17 Международный Региональный Симпозиум по реологии

Тезисы докладов

Саратов, 27 июня-1 июля 1994 г

Дорогой коллега!

Перед Вашими глазами Программа и Тезисы докладов 17 Симпозиума Реологического Общества им. Г.В.Виноградова по реологии. Как сопредседатель Оргкомитета я был рад узнать, что около 200 реологов бывшего СССР намерены участвовать в Симпозиуме. Традиционно широко представлена реология полимеров, несколько слабее, чем в предыдущие годы, реология дисперсных систем и гораздо сильнее - реология биосистем (главным образом, реология крови). В этом большая заслуга членов Оргкомитета из Саратовского Медицинского Университета активно рекламировавших данный Симпозиум.

Несмотря на нелучшие времена для науки в независимых странах, научный уровень докладов представляется достаточно высоким. Существует разумный компромисс между фундаментальными и прикладными докладами, что свидетельствует о жизнеспособности нашей науки даже в весьма сложных условиях. Конечно жаль, что ряд ведущих ученых СНГ по разным причинам не смог принять участие в Симпозиуме, однако это ни в коей мере не умаляет значение данного научного события, а с другой стороны дает дорогу молодым.

Существует и иной аспект нашей встречи, а именно сохранение и укрепление дружеских связей между учеными не только разных независимых государств, но даже и одной и той же страны. Из-за коммуникационных трудностей я давно не видел в Москве ученых из Новосибирска, Хабаровска, Свердловска и даже из Ярославля. Надеюсь, что встречи и дискуссии в Саратове, на берегу прекрасной Волги оживят наши отношения.

Успехов всем нам !

Президент Реологического Общества
им.Г.В.Виноградова, В.Г.Куличихин

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7 МЕЖДУНАРОДНЫЙ РЕГИОНАЛЬНЫЙ СИМПОЗИУМ ПО РЕОЛОГИИ

ТЕЗИСЫ ДОКЛАДОВ

САРАТОВ

27 июня - 1 июля, 1994 г.

В сборнике помещены тезисы докладов XVII Симпозиума по реологии. Тематика докладов охватывает широкий круг проблем реологии полимеров, реологии дисперсных систем и реологии биосистем.

Сборник представляет интерес как для специалистов и научных работников, так и специалистов, связанных с переработкой полимерны материалов, пищевых продуктов и врачей-практиков.
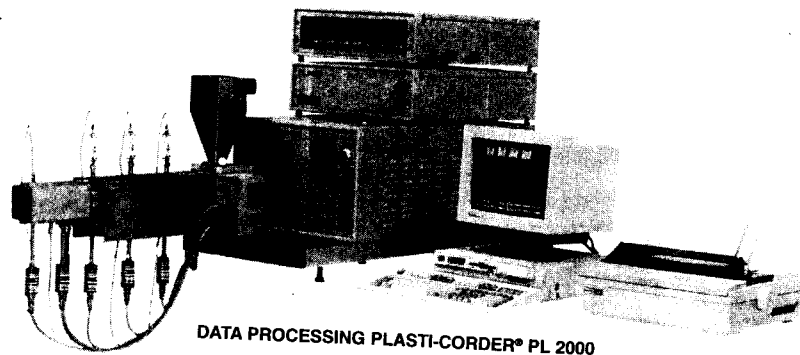
СЕКЦИЯ I. РЕОЛОГИЯ ПОЛИМЕРОВ

THE EFFECT OF DRAWING ON STRUCTURE AND RHEOLOGIC BEHAVIOUR OF POLY-4-METHYLPENTENE-1

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Using X-ray method and mechanical tests the regime of molding of PMP (poly-4-methylpentene-1) cylindrical fibers (equal form) on their structure and mechanical properties has been studied. The samples were molded by melt extrusion at temperatures (T_m) 279. (sample 1), 286 (sample 2) and 302°C (sample 3); the extension diagram $\sigma(\varepsilon)$ was done at 23°C and drawing speed $4,1\cdot10^{-4}$ m/s; at the same time with extension the pictures of SAXS and WAXS were studied.

Mechanical investigations showed that during the transition from sample 1 to 2 and 3 the values of modulus of elasticity E, stresses-at-break σ and stretches of break ε, determined from different parts of the deformation curves, differ greatly. If for samples 1 and 2 it is typical that E have equal height values at low σ and ε, it in vice versa for sample 3-high σ and ε at low E. This differences probably are closely connected with pecularities of structural transformations of the polymer during extension.

For clearing out the characteristics of structural transformations in the samples were carried out structural investigations. The most common traits of changes in X-ray patterns of the investigated samples during the extension in ε = 0-360% are the following: 1) intensity of reflections in WAXS in equatorial and meridional directions diminish, while ε increases and their radial half-width increase gradually; 2) at small deformations ($\varepsilon \approx$ 80%) the degree of orientation of crystallites increases, then in the interval $\varepsilon \approx$ 80-360% decreases; 3) lowering of the intensity scattering is accompanied by their redistribution in the reflections till their complete disappearance and increase of intensity of amorphous halo. It is necessary to note that the observed changes clearly display on the pictures of scattering of samples 1 and 2 at $\varepsilon \approx$ 80%, and in sample 3 at $\varepsilon \approx$ 220%.

Comparison of results of structural-mechanic investigations showed that initial structures of samples have different mechanical firmness and it is defined by the temperature of molding; the increase of T_m lead to decrease of mechanical firmness of elements of structure, increase of their pliability and improvement of macromechanical parameters of the system accordingly as a whole.

Analysis of the results allow to suppose that tension of samples is followed by structural changes and they take place by destruction (melting) of the initial structure and its recrystallization into a new one.

4.

ANISOTROPY OF MOBILITY IN EQUATIONS OF DYNAMICS OF A POLYMER CHAIN

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The detailed description of dynamics of polymer system which is based on the microstructure approach needs the formulating of equations of macromolecule dynamics. For the case of concentrated system topological restrictions define dynamics of macromolecules substantially. These restrictions are considered in the equations with the using of tensor coefficient friction which can be considered in different ways.

There was hold the comparison of the different methods of the consideration anisotropy of mobility macromolecules with the modelling of the flow polymer fluids in the conditions of the simple shearing flow. There is marked the qualitative coinsidence of the results which have been got by the different authors and also the difficulty of the quantative assessment of microparameter of anisotropy on the basis of experimental data for shear flows.

The dependence of steady-state elongational viscosities as a function elongational stress whic' have been got in the work is defined with two scalar functions - the coefficient of slippage and the coefficient of flow anisotropy. The found dependences are theoretical basis of the quantitative assessments of microanisotropy parameter which considers shape and orientation of macromolecular coils in the equations of dynamics of macromolecules and which is the parameter of non-linear theory of linear polymer.

5.

УДК 541.64:532.135

ВЯЗКОСТЬ И КОЛЛОИДНО-ХИМИЧЕСКИЕ СВОЙСТВА КОНЦЕНТРИРОВАННЫХ ЭМУЛЬСИЙ АКРИЛОВЫХ МОНОМЕРОВ И ЛАТЕКСОВ НА ИХ ОСНОВЕ

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Агрегативная устойчивость и необходимый комплекс коллоидно-химических свойств концентрированных эмульсий акриловых мономеров и латексов на их основе обеспечивается применением смеси неионогенного эмульгатора и высокомолекулярного защитного коллоида. Определяющим фактором стабилизации при этом выступают структурно-механические характеристики адсорбционных слоёв микрокапель мономеров, где происходит процесс сополимеризации в данных условиях.

Исследовано влияние концентрации дисперсной фазы и состава смеси стабилизаторов на свойства сополимеризующихся систем. Сополимеризация трибутилоловометакрилата с алкилметакрилатами и акриловой кислотой проводилась в присутствии ОП-10 и поливинилового спирта (ПВС) в водных эмульсиях с концентрацией мономерной фазы от 20 до 85 %. Установлено, что устойчивые эмульсии типа "масло в воде" получаются при концентрации мономеров до 75 %, причём эта эмульсия является предельной. При дальнейшем увеличении концентрации мономеров до 85 % наблюдается обращение фаз и получение эмульсий типа "вода в масле", характеризующихся неустойчивостью.

Показано, что коллоидно-химические и вязкостные характеристики исходных эмульсий мономеров коррелируют с аналогичными свойствами латексов. Для латексов и эмульсий с концентрацией мономеров менее 55 % выявлен ньютоновский характер течения. При концентрации мономерной фазы > 55 % наблюдается структурирование системы и возникновение аномалии вязкости-резкое уменьшение вязкости при увеличении сдвига. Вязкость концентрированных (до 55%) латексов сохраняется постоянной в течение 4-х лет. Высококонцентрированные латексы (до 75%) при длительном хранении желатинизируются и переходят из структурно-вязкого в высоко-эластическое состояние.

Сделан вывод о том, что присутствие ПВС существенно увеличивает стабильность эмульсионных систем за счёт образования механически прочных слоёв на поверхности частиц мономера, что препятствует их коалесценции даже при очень плотной упаковке в концентрированных эмульсиях и отражается на вязкостных свойствах систем.

Влияние температуры на структуру и механические свойства
свежесформованного волокна термотропного ЖК сополиэфира

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Методами динамической механической релаксации, дифференци-
альной сканирующей калориметрии и рентгеноструктурного анализа
исследованы в широком температурном интервале фазовые и релакса-
ционные переходы трехкомпонентного термотропного ЖК сополиэфира,
содержащего звенья терефталевой кислоты (ТФК), фенилгидрохинона
(ФГХ) и п-гидроксибензойной кислоты (ГБК) (45/45/10). Исходная
структура свежесформованного волокна определена как ЖК мезофаза
типа смектик В, в которой роль мезогенных групп, необходимых для
создания слоевой упаковки, выполняют два из трех возможных остат-
ков ФГХ, ТФК и ГБК, имеющих одинаковый продольный размер. Повыше-
ние температуры ведет к постепенному размораживанию структурных
единиц сополиэфира, приводящему при 180°С к кооперативному движе-
нию фрагментов цепи, что и определяет температуру стеклования.
Вследствие этого в области температур от 180 до 250°С происходит
фазовый переход смектической мезофазы в ЖК нематическое состоя-
ние. Установлено, что модуль упругости монотонно убывает с темпе-
ратурой и, начиная с 250°С, сополиэфир приобретает способность
течь. При отжиге выше температуры стеклования начинается кристал
лизация сополиэфира, приводящая к образованию двух термодинами-
чески стабильных кристаллических фаз ромбического типа, равновес-
но сосуществующих с ЖК нематической мезофазой, которые плавятся
при температуре выше 300°С, превращаясь в ориентированный немати
ческий расплав. Изотропизация наступает около 400°С.

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Effect of Temperature on the Structure and Mechanical Properties
of As-spun Fibers of Thermotropic Liquid Crystalline Copolyester

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Phase and relaxation transitions on heating of as-spun fi-
bers of three-component thermotropic liquid crystalline (LC) co-
polyester were studied by X-ray analysis, differential scanning
calorimetry and dynamic mechanical tests within a wide temperatu-
re range. The copolyester under investigation was synthesized
from terephthalic acid, phenylhydroquinone and p-hydroxybenzoic
acid (molar ratio 45/45/10, respectively). It is found that the
initial structure of as-spun fibers is LC smectic B phase where
any two of three copolyester's monomeric units (which lengths are
equal) are involved in so-called conformational mesogenic group
responsible for formation of layer smectic structure. An increase
of temperature leads step by step to arising of local mobility of
monomeric units. Cooperative mobility of chain segments begins at
180°C, which is glass transition temperature for this copolyes-
ter. Above this temperature up to 250°C the phase transformation
of the initial LC smectic structure to LC nematic mesophase takes
place. An elasticity modulus decrease permanently on heating and
starting from 250°C leads to development of two thermodynamically
stable crystalline phases each of them is orthorhombic but with
slightly different unit-cell parameters. Crystalline phases co-
exist with LC nematic phase up to their melting points following
by a transition to the LC nematic melt. Isotropisation process
coincides with the temperature degradation of copolymer about
400°C.

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Особенности вязкостного поведения высокомолекулярного
полиэлектролита в водно-органическом растворителе

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Для высокомолекулярного полиэлектролита ПДМАЭМА (полиди-
метиламиноэтилметакрилата) (MB = $28*10^6$, $20*10^6$, $15*10^6$)
исследована зависимость приведенной вязкости $\eta_{уд}/c$= f(c) от сос-
тава растворителя вода-ацетон "γ" (γ - доля ацетона в смеси) и
градиента "в" в интервале концентраций от $6*10^{-2}$ до $5*10^{-4}$ (%).

При в ≈ 1000 c^{-1} и γ < 0.50 $\eta_{уд}/c$ = f(c) имеет линейный ха-
рактер, а при γ > 0.50 ниже концентраций, соответствующих кри-
терию $c*[\eta]$ = 1, наблюдается резкое падение $\eta_{уд}/c$ и отклонение
этой зависимости от прямолинейной. Наблюдаемое явление можно
связать с резким изменением балланса сил внутри- и межмолеку-
лярных взаимодействий при достижении концентрации, когда число
межмолекулярных контактов заметно уменьшается. При "в" от 1.0
до 0.1 (c^{-1}) влияние межмолекулярных взаимодействия сказывается
в области "с" на порядок меньших, чем при в ≈ 1000 c^{-1}, и прояв-
ляется в сильной зависимости $\eta_{уд}/c$ = f(c) и отсутствии линейного
участка.

Для малых "в" зависимость относительной вязкости " η_r" от
"в" наиболее выражена при γ = 0.50 и постепенно уменьшается по
мере увеличения "γ". По достижении γ = 0.76 исследуемый по-
лиэлектролит претерпевает переход клубок-глобула и величина
характеристической вязкости [η] перестает зависеть от градиен-
та.

Параметр Хаггинса "к'" в глобулярном состоянии больше,
чем в клубкообразном, поскольку переход клубок-глобула связан
с ухудшением термодинамического качества растворителя. Однако
второй вириальный коэффициент "A_2" не становится отрицатель-
ным.

С привлечением данных светорассеяния и двойного лучепре-
ломления в потоке этих растворов предложена гипотетическая мо-
дель полиэлектролита в глобулярном состоянии.

Viscous Behavior of a Macromolecular Polyelectrolyte in an Aqueous-Organic Solvent

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The dependence of reduced viscosity η_{sp}/c= f(c) on the
composition of water-acetone solvent "γ" (γ - is the acetone
fraction in the mixture) and gradient "G" in the concentrati-
on (c) range from $6\cdot10^{-2}$ to $5\cdot10^{-4}$ dl/g was investigated for
high-molecular-weight polyelectrolyte poly(dimethylaminoethyl
methacrylate) PDMAEMA, with M = $28\cdot10^6$, $20\cdot10^6$, $15\cdot10^6$.

At G ≈ 1000 c^{-1} and γ < 0.50 the equation η_{sp}/c = f(c) is
linear, whereas at γ ≥ 0.50 and "c" lower then the concentra-
tions corresponding to the criterion $c\cdot[\eta]$ = 1 a drastic de-
crease in η_{sp}/c and the deviation in this dependence from li-
near are observed.

This phenomenon may by associated with a sharp change in
the force balance of intra- and inter interactions after that
concentration is attained at which the number of intermolecu-
lar contacts markedly decreases. At G from 1.0 to 0.1 c^{-1} the
effect of intermolecular interactions is manifested in the co-
ncentration range by one order of magnitude lower then that at
G ≈ 1000 c^{-1} and is revealed by a strong dependence of η_{sp}/c on
"c" and the absence of the linear part.

For small "G" values the dependence of relative viscosity
η_r = f(G) is most pronounced at γ =0.50 and gradually decreases
with increasing "γ". When "γ" value attains γ = 0.76, the po-
lyelectrolyte undergoes a random coil-globule transition, and
intrinsic viscosity [η] no longer depends on gradient.

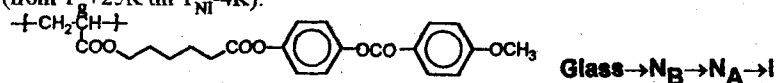The Huggins parameter "k'" in the globular state is hi-
gher then that in the random-coil state because the coil-
globule transition is associated with interior solvent quali-
ty. However the second virial coefficient A_2 does not become
negative.

Using in addition the date on light scattering and flow
birefringence of these solutions a hypothetical model for a
polyelectrolyte in the globular state is proposed.

1(

Dynamics Rotation of LC Director of Comb-Shaped Liquid Crystal Polymer in Magnetic Field.

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LC director rotation of comb-shaped LC polymer in magnetic field has been investigated. Rotational viscosity γ_1 has been calculated based on the values of characteristic reorientation times τ. Sample of LC polymer has been studied in the corresponding range of polymerization degrees (P_n=12-45) and temperatures (from T_g+25K till T_{NI}-4K).

$$\text{+CH}_2\text{-CH-+}$$
$$\underset{COO}{|}\wedge\wedge\wedge COO-\bigcirc-OCO-\bigcirc-OCH_3$$

Glass→N_B→N_A→I

I-isotropic phase;

N_A-nematic phase;

N_B-the new type of nematic mesophase [1], distinguished from the classical N_A-phase by peculiar type of the ordering of the side chains.

The LC director reorientation in the magnetic field was studied by of ^{1}H NMR spectroscopy method based on the study of kinetic dependence of line shape of ^{1}H NMR spectra during of LC director reorientation [2].

The principal regularities of the LC director reorientation process have been revealed:

(1) LC director in the N_B-phase was shown not to be reoriented in the magnetic field.

(2) The full LC director reorientation in N_A-phase is demonstrated. Dynamics of the LC director reorientation was interpreted in terms of the monodomain model [2].

(3) The temperature dependence of the rotational viscosity coefficient were described satisfactorily by the Arrhenius equation. The temperature dependence of the rotational viscosity coefficient has a bend in the region of N_A→N_B-phase transition towards increasing of γ_1, interpreted as the appearance of the nucleis of the N_B-phase.

(4) The dependence of rotational viscosity coefficient γ_1 on the polymer chain length follows an exponential law $\gamma_1 \propto M^\alpha$; values of α increase with decreasing temperature from 0.75 to 1.74.

1. Ya.S.Freidzon, N.I.Boiko, V.P.Shibaev, N.A.Plate, *Dokl. Akad. Nauk SSSR.* V.282, N.4, (1985) 934.
2. L.B.Stroganov, A.N.Prokhorov, R.A.Galiullin, E.V.Kireev, V.P.Shibaev and N.A. Plate. *Polymer Science* V.34 N1. (1992) 89.

SMALL-SCALE HYDRODYNAMICS OF DILUTED FLEXIBLE POLYMER SOLUTIONS.

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Molecular-based derivation of continuum constitutive equations starts from the definition of the space regions much larger than the particle sizes which however can be considered as points in continuum theories. In many rheological experiments with polymeric systems one can not neglect the flow gradients on the scales of macromolecules. From this it follows that the common hydrodynamic equations (the Navier-Stokes equations) are inapplicable in the rheology of dilute polymer solutions.

In this work the new set of the state variables are proposed which assume averaging over distances much larger than monomer sizes but smaller than overall macromolecular dimensions. The minimal set of such variables includes the monomer density in a polymer coil and the velocity fields of monomers and solvent. Simply speaking we depict a macromolecular coil as a drop of monomer solution. This model is of radically different kind from existing ones, namely, of a rigid porous sphere or a sequence of frictional centres.

Firstly the proposed hydrodynamic equations were used for calculation of the translational diffusivity at infinite dilution and the zero-shear intrinsic viscosity. This two simplest problems show the minimal set of the proposed hydrodynamic equations describes the freely draining - non-draining crossover at least qualitative./. It must be stressed that proposed approach does not use the Oseen hydrodynamic interaction tensor.

The further extension of the minimal hydrodynamic equations and their possible use in the polymer rheology is discussed.

ДИНАМИКА МАКРОМОЛЕКУЛ В ЭЛОНГАЦИОННЫХ ПОЛЯХ.

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Происходящие в элонгационных гидродинамических полях большие деформации макромолекул вызывают интерес многих исследователей. Это связано с необходимостью решения фундаментальных вопросов динамики макромолекул и прикладных проблем волокнообразования, гашения турбулентности малыми полимерными добавками, использования полимеров в нефтедобыче и др.

В докладе представлен обзор экспериментальных и теоретических работ, выполненных в Институте высокомолекулярных соединений РАН по проблеме влияния элонгационного гидродинамического поля на полимерные цепи большой массы в разбавленных и полуразбавленных растворах. Эксперименты проводили с линейными гибкоцепными полимерами (полистирол, полиэтиленоксид), полужесткоцепными (целлюлоза и ее эфиры) и полиэлектролитами (поливинилпиридин в подкисленном водном растворе).Элонгационные гидродинамические поля (осесимметричные и плоские) генерировали в зазорах между соосными капиллярами или щелями. О достигнутой в гидродинамическом поле степени развернутости макромолекул судили по величине отношения измеренного двулучепреломления к предельно возможному. Изучено влияние молекулярного веса полимера, температуры, вязкости и концентрации раствора, качества раствор геля, а в случае полиэлектролита – влияние ионной силы раствора на критические условия перехода макромолекул в практически полностью развернутое состояние. Теория динамики макромолекул в элонгационных полях развита на основе гантельной модели с учетом как изменений гидродинамического взаимодействия сегментов цепи при разворачивании, так и ее конечной растяжимости.Использование подхода неравновесной термодинамики позволило установить, что разворачивание гибких цепей в элонгационном поле происходит по механизму динамического (неравновесного) фазового перехода первого рода, а полужестких цепей – по механизму динамического перехода второго рода. Показано, что структура текущего раствора с развернутыми цепями может быть отнесена к классу диссипативных.

DYNAMICS OF MACROMOLECULES IN ELONGATIONAL HYDRODYNAMIC FIELDS.

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Uncoiling of macromolecules which occurs in elongational hydrodynamic fields is attracting the attention of many scientists This interest is, on one hand, related to fundamental problems of macromolecular non-linear dynamics, and, on the other hand, to many applications, e.g. fiber production, hindering of turbulence by small polymeric additives, polymer flooding in oil-extracting industry, etc.

A review is given of experimental and theoretical studies, which were carried out in the Institute of Macromolecular Compounds of RAS and connected with the problem of the influence of elongational hydrodynamic field on high molecular weight polymers in dilute and semi-dilute solutions. Experiments have been made with linear flexible chain polymers (polystyrene, polyoxyethylene), semirigid polymers (cellulose and its ethers), polyelectrolytes (polyvinilpyridine in acidic aqueous solutions). Elongational hydrodynamic fields (axisymmetric and planar) were generated in gaps between two opposed coaxial capillaries or between two opposed slots. The attained level of uncoiling was evaluated using the ratio of the measured streaming birefringence to its limiting value. The influence of molecular weight, temperature, viscosity and concentration of solutions, thermodynamic quality of the solvent, and ionic strength for polyelectrolytic solutions on crytical conditions of practically whole uncoiling was studied in detail.

A theory of dynamics of macromolecules in a high-intensity elongational hydrodynamic fields was developed on basis of W.Kuhn's dambbell model. This theory accounts for the changes in hydrodynamic interactions of the segments accurring with the uncoiling of the polymeric chain as well as the finite extensibility of the chain. The use of principles of non-equilibrium thermodynamics permits to state that the uncoiling of flexible macromolecules in a elongational field is a dynamic (non-equilibrium) first order phase transition, and the uncoiling of semirigid chain is a second order dynamic phase transition.

It has been shown that the nature of the flowing solution containing uncoiling chaines corresponds to dissipative structures

Реологические особенности смесей олигомеров в однофазном и двухфазном состояниях

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Исследованы реологические свойства совместимых и несовместимых смесей высоковязких олигобутадиенуретанакрилата (ОБУА) и олигобутадиенуретанметакрилата (ОБУМ) с олигоэфиракрилатами (ОЭА) двух гомологических рядов: n-метилендиметакрилатов (n-ДМЭ),где n=1-5, и n-оксиэтилендиметакрилатов (n-ДМОЭ), где n=2-4,- в интервале температур Т=20-70 °С при изменении скорости сдвига γ на 3 десятичных порядка.

Исходные олигомеры - неньютоновские жидкости.

Смесям с неограниченной совместимостью компонентов в общем случае также присущ неньютоновский характер течения. Однако, для растворов ОБУМ в n-ДМЭ при n≤2 в сравнительно узком интервале концентраций ОЭА (C<20%) и при Т<30° обнаружена независимость вязкости η от γ. Увеличение С и Т переводит эти системы в режим течения неньютоновских жидкостей, при этом наблюдается закономерное уменьшение η при росте γ. Существенно, что в указанном диапазоне С и Т для растворов всех других олигомеров в эксперименте регистрируется линейный рост η как функции γ, то есть имеет место эффект дилатансии. В любых иных режимах испытания все однофазные смеси текут как обычные тиксотропные системы.

Концентрационная зависимость η при γ=Const характеризуется нелинейным уменьшением η при росте С, причем до С <50% значения η ниже, а при С>50% выше аддитивных. На кривых зависимости эффективной энергии активации от состава смеси вблизи С=50% имеет место перегиб.

Для систем с ограниченой совместимостью на кривых η(С) выделено три области, в которых функциональные зависимости различны. Перегибы на кривых совпадают с точками бинодали, то есть фазовые переходы определяют характер течения. Слева от бнодали η раствора аддитивно уменьшается с ростом С (~ на 1,5 порядка при С= 0-40%). Справа от бинодали падение η подчиняется степенному закону (на 3 десятичных порядка в интервале С= 98-100%). В области двухфазного состояния η как функция С меняется сравнительно мало (не боле, чем в 5 раз).

Выявленные различия в реологическом поведении однофазных и двухфазных смесей есть естественное следствие различия фундаментальных законов вязкого течения гомогенных и дисперсных систем. Особенности же течения однофазных смесей обусловлены сложными концентрационно-температурными зависимостями их термодинамических параметров. Последние определяют степень структурной регулярности смесей, от которой, в свою очередь, зависят вязкостные свойства. Комплекс найденных закономерностей находит удовлетворительное объяснение в рамках сиботаксической модели жидкости.

THEORETICAL PROBLEMS IN RHEOLOGY OF POLYMERIC LIQUID CRYSTALS

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During the past decade, the rheology of liquid crystal (LC) polymers has become a subject of central importance in polymer science and technology. This review is a critical treatment with descriptions and analysis of both theory and experiment, providing a comprehensive account of the field as it stands today.

The new developments of invariant constitutive equations of anisotropic liquids used for describing the rheologigal properties of low-molecular liquid crystals and LC polymers are presented. Rheologigal properties of LC polymers are analyzed on the basis of nonlinear viscoelastic model of anisotropic fluid. Simple shear and elongational flows of transversely isotropic viscoelastic fluid which used as the elementary model of nematic polymers were examined. The longitudinal and transversal (with respect to director) viscosities and relaxation times are considered. The features of the linear anisotropic viscoelasticity of LC polymers with different degree of anisotropy were discussed. Oscillatory normal stress difference and oscillatory shear stress are determined in a shear strain region where LC polymers behave linearly. The existence of the normal stress (normal viscosity) in a linear viscoelasticity region is the main feature of these anisotropic fluids.

ОСОБЕННОСТИ РЕОЛОГИЧЕСКОГО ПОВЕДЕНИЯ РАСПЛАВОВ ТРОЙНЫХ СМЕСЕЙ ТЕРМОПЛАСТОВ .

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Использование малых добавок третьего компонента является одним из наиболее рациональных путей модификации свойств бинарных смесей полимеров. Влияние небольших (до 10%) добавок полипропилена (ПП) на реологические свойства расплавов промышленных термопластов - полиметилметакрилата (ПММА) и полистирола (ПС), а также их бинарной смеси ПММА/ПС 45/55 изучено методом малоамплитудных гармонических колебаний. Значения компонент комплексного динамического модуля сдвига (G*) - модуля упругости (G') и модуля потерь (G") определяли на приборе ВИСКОЭЛ-1 (частота колебаний индентора 50 Гц) в диапазоне температур 180 -210 С. Морфологию смесей анализировали с помощью электронного трансмиссионного микроскопа "Tesla BS-242E".

Проведенные исследования показали, что зависимости вязкоупругих свойств тройных смесей ПП/ПММА/ПС от содержания полимера-добавки (ПП) имеют более сложный характер, чем аналогичные зависимости для соответствующих полимерных пар ПП/ПММА и ПП/ПС. Обнаружено наличие статистически значимых максимумов G' и G" при введении в исходную бинарную смесь ПММА/ПС 7% ПП. Увеличение температуры от 180 до 210 С приводило к смещению экстремальных точек в сторону меньших дозировок третьего компонента. Особенности реологического поведения расплавов трехкомпонентных смесей обсуждаются с точки зрения изменения взаимной растворимости полимерных фаз, термодинамически несовместимых в статических условиях, в поле сдвиговых напряжений.

Высказано предположение о возможности аналогичных изменений взаимной растворимости основной дисперсной фазы (ПММА) и дисперсионной среды (ПС) в присутствии малых добавок третьего компонента (ПП) при смешении расплавов полимеров на вальцах. Это может служить одной из причин наблюдавшегося существенного (до 6 раз) увеличения степени дисперсности смесей , содержащих малые добавки третьего компонента, по сравнению с исходной бинарной системой.

RHEOLOGICAL BEHAVIOR OF THREE-COMPONENT THERMOPLAST BLENDS IN MELT.
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The influence of small quantities (to 10%) polypropylene (PP) on the rheological properties of binary blends of industrial thermoplasts - poly(methyl methacrylate) and polystyrene, are studied. For determination loss and storage module are used instrument "Viskoel-1" (frequency 50 Hz). Themperature range 180-210 . Morfology of blends are analysed on mycroscop "Tesla BS-242E".

Our investigations demonstrated complicated sharp of viscoelastic properties dependences on the content polypropylene. Maxima G' and G" at the 7% PP content are observed. Temperature increasing shifts maxima to lower contens of third component - PP. Rheological behavior of the three-component blends are discussed from point of wiev change of compatibility under shearing. It is possible reason increasing of dispersion in the three-component blends in comparison with initial binary svstem.

УДК 678.02;678.01;541.54

КИНЕТИКА ПРОЦЕССА ОТВЕРЖДЕНИЯ КФС В ОБЛАСТИ СТЕКЛОВАНИЯ

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Исследовали кинетику процесса отверждения водных суспензий карбамидоформальдегидной смолы (КФС) марки КФ-МТ-15 ниже температуры стеклования. В качестве отверждающего агента использовали водный раствор хлористого аммония, которы" добавляли в расчете 1-5 вес.% по отношению к массе абсолютно сухой смолы. Изучение кинетики проводили на крутильном маятнике МК-3 и дифференциальном сканирующем калориметре, работающем в изотермическом режиме.

Кривые изменения тангенса угла механических потерь для всех изученных композиций характеризуются наличием двух максимумов. Первый максимум отвечает релаксационному переходу из вязкотекучего в высокоэластическое состояние. Второй соответствует переходу системы в стеклообразное состояние.

Изменение температуры стеклования T_c отверждающихся композиций от реологической степени превращения аппроксимируется единой кривой. Для полностью отвержденных образцов T_c составила 75°.

При переходе системы в стеклообразное состояние происходит уменьшение сегментальной подвижности в реакционной системе, что приводит к существенному торможению реакции образования поперечных связей и резкому уменьшению количества выделившегося тепла за счет реакции сеткообразования. При этом, этот тепловой поток столь мал, что калориметрия становится нечувствительной к процессам, протекающим в застеклованном материале.

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KINETICS OF UREA-FORMALDEHYDE OLIGOMER CURING PROCESS

IN THE GLASS AREA

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Kinetics of curing process urea-formaldehyde aqueous syspersions were studied below glass transition temperature. Ammonia chloride aqueous solution was used as a catalyst in quantity of 1-5 mass-% conserning to absolute dried resin. Kinetics were investigated by torsion pendulum MK-3 and differential scain calorimeter woring in isothermal regime.

For all studied compositions the curves of loss angle tangent changes have two maximums. The first one correponds to relaxation transition from a viscous state to a rubbery state. The seconde maximum correlates with transition of system to a vitreous state.

Glass transition temperature T_g v-iations of cured compositions are approximated united curve. For fully cured samples T_g is 75°.

In the case of a transition to glassy state, the segmental mobility of reactive system decreases and as the result of this the essential inhibition of network formation reaction and the abrupt decrease of evolve heat quantity on account of reaction of network formation take place. In this case the heat flow is so small that a calorimetry becomes unsesitive to processes runing in vitrified material.

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МОДЕЛИРОВАНИЕ ПРОЦЕССА РАСТЯЖЕНИЯ ОРИЕНТИРОВАННОГО ПОЛИМЕРНОГО ВОЛОКНА.

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Предложена модель для теоретического описания процесса растяжения ориентированного полимерного волокна, имеющего микрофибриллярную структуру. Эта модель является дальнейшим развитием кинетической модели растяжения микрофибриллы, в которой учитывается вклад в деформационное поведение процессов проскальзываний и обрывов напряженных проходных цепей, а также перераспределения полимерного материала между аморфными областями. В волокне в силу структурной неоднородности микрофибриллы нагружены неравномерно. Предполагается, что размеры аморфных областей одинаковы, поэтому неравномерность нагружения микрофибрилл связана с различием размеров кристаллитов. Деформация микрофибрилл, расположенных в поперечном сечении волокна определяется соответствующим распределением продольных размеров кристаллических областей материала.

Переход к описанию процесса растяжения волокна, представляющего в данной модели совокупность разнонагруженных невзаимодействующих микрофибрилл осуществляется усреднением кривой растяжения отдельной микрофибриллы по распределению деформаций. Дополнительно учитывается возможность потери устойчивости отдельными микрофибриллами вследствие достижения доли дефектов в кристаллите критической величины. Полагается, что при этом происходит лишь уменьшение энергетических барьеров указанных выше молекулярных процессов.

С помощью модели рассчитаны кривые растяжения полиэтиленового волокна при различных скоростях деформирования, которые качественно описывают аналогичные кривые растяжения, наблюдаемые экспериментально на полиэтиленовых волокнах и нитях. Скоростные зависимости прочности ПЭ гель-нитей на разных стадиях ориентационного вытягивания также подтверждаются расчетами в рамках модели. Изучено влияние параметров распределения деформаций микрофибрилл на форму кривой растяжения.

ИНХС РАН, МПГУ

SIMULATION OF EXTENSION PROCESS OF ORIENTED POLYMER FIBER.

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A computer model was proposed describing extension of oriented polymer fiber of microfibrilla structure. This model is further advancement of kinetic model of microfibrilla extension wherein influence of the concurrent and interrelated process of polymer chains slippage, redistribution of the polymer units between the amorphous regions and chains scission on the deformation behavior are considered. From structural irregularity in fiber the microfibrillae load unevenly. It is suggested that the sizes of amorphous regions is equal and as a consequence the irregularity of microfibrillae load is connected with distinctions of the crystallities sizes. Microfibrillae deformation is determined by the corresponding distribution of the longitudinal dimensions of crystallities.

In this model the fiber is totality of vary loading uninteracting microfibrillae. Going from description of the extension microfibrilla to description of the extension fiber process is achieved by averaging stress-strain curve of the individual microfibrilla over the deformation distribution. In addition, a possibilities for the loss of tolerance in consequence achievement of the critical defect degree of crystallinity. It is assumed that this phenomenon must occur with a decrease of the energy barriers to previously indicated molecular process.

Stress-strain polyethylene curves at various rates of deformation was calculated. These theoretical results are in good qualitative agreement with the experimental data for polyethylene samples obtained by different means. The velocity dependencies of the strength PE gel-spinning yarns, obtained on varies stage of the orientation process are supported by the model calculations also. The influence of the microfibrillae deformation distribution parameters on the form stress-strain fiber curves was investigated.

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RHEOLOGICAL EQUATION FOR TURBULENT FLOWS OF VISCOELASTIC FLUIDS AND ABNORMAL TURBULENCE ENERGY ABSORPTION

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Rheology of turbulent flows of viscoelastic fluids is considered. It i suggested that fluid under consideration is an upper convected Maxwel one.

A rheological equation for averaged local stress tensor is derived b using Maxwell-Oldroyd rheological equation and its exact solutions. Thi equation describes averaged visco-elastic stress tensor dependence o fields of averaged local velocity gradient, kinetic turbulence energy and rat of its dissipation.

Analysis of the equation shows that under certain conditions rate o transformation kinetic energy of turbulence into energy of elastic deformations may rise steeply. This phenomenon of abnormal turbulenc energy absorption in viscoelastic fluid is characterised by a threshold as in case of parametric resonance in the flows of viscoelastic fluids an expressions for these thresholds appear to be closely allied structurally Parametric resonance and abnormal turbulence energy absorption ma complement each other nicely: whereas the parametric resonance give rise to Toms phenomenon near the walls, the abnormal turbulence energy absorption make its contribution to Toms phenomenon far from the walls in area of well-developed turbulence.

This equation may attempt to use for modelling turbulent flows o viscoelastic fluids not only at high Reynolds numbers, but at low Reynolds numbers (in case of elastic turbulence) as well.

k,ε,Π-MODEL FOR TURBULENT FLOWS OF VISCOELASTIC FLUIDS

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A simple mathematical model of turbulent flows of viscoelastic fluids is presented. It is assumed that stress tensor of the fluid is a sum of Newtonian stress tensor and tensor of viscoelastic stresses; the latter is governing by Maxwell-Oldroyd rheological equation. The model determines the fields of averaged local velocity, turbulence energy (k), rate of turbulence energy dissipation (ε) and averaged local viscoelastic stress tensor (Π). This model is based on k,ε-model of turbulence, includes all its equations and equation for averaged local viscoelastic stress tensor. In this k,ε,Π-model Reynolds equation and k-equation includes terms which take into consideration interactions of averaged local velocity and pulsating flow velocity fields with the field of viscoelastic stress tensor. Π-equation describes dependence of averaged local viscoelastic stress tensor on fields of average local velocity gradient, turbulence energy and rate of its dissipation.

Numerical simulation of turbulent flow of viscoelastic fluid through straight duct based on this k,ε,Π-model has been done. Results of the simulation reinforce that the model may describe turbulent flows of viscoelastic fluids. In such flows abnormal turbulence energy absorption, that is characterised by certain threshold, may take place. In case of dilute polymer solution flows at high Reynolds number model predicts that under certain conditions hydraulic drag coefficient and turbulence energy may be far less than in the case of pure Newtonian fluid. It testifies that the abnormal turbulence energy absorption may be responsible for Toms phenomenon.

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ПОЛЗУЧЕСТЬ КОМПОЗИТОВ НА ЭЛАСТОМЕРНОЙ ОСНОВЕ
И МЕЖФАЗНОЕ ВЗАИМОДЕЙСТВИЕ

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Кривые ползучести ненаполненных и наполненных вулканизованных композитов на эластомерной основе хорошо описываются эмпирическим уравнением Наттинга. При этом коэффциенты уравнения $E(t) = KGt^n$ по смыслу характеризуют: K - начальную упругую податливость и n - интенсивность ползучести. Анализ изменения этих коэффициентов в зависимости от состава композитов позволил выявить следующие основные закономерности:

- коэффициент K уменьшается с ростом концентрации наполнителя, степени анизодиаметричности частиц, их ориентации и величины межфазного взаимодействия между эластомерной матрицей и наполнителем;

- коэффициент n растет с увеличением межфазной поверхности между наполнителем и эластомером в единице объема композита и слабо зависит от объемной доли наполнителя и ориентации анизодиаметричных частиц. Ненаполненная эластомерная матрица показывает минимальное значение коэффициента n, который растет после введения наполнителя. Добавление в композит химических модификаторов, увеличивая адгезионное взаимодействие эластомера и наполнителя, уменьшает влияние последнего на увеличение коэффициента n. На примере композита, армированного короткими полиамидными волокнами, показано влияние роста адгезионного взаимодействия на уменьшение коэффициента .

Таким образом, интенсивность ползучести характеризует величину межфазного взаимодействия между эластомерной матрицей и наполнителем. Этот показатель можно использовать для оценки эффективности химических модификаторов межфазного взаимодействия.

CREEP OF COMPOSITES ON ELASTOMERIC BASIS AND
INTERPHASE INTERACTION

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Creep curve of unfilled and filled cured composites on elastomeric basis are well described by empirical Nutting's equation. Here the equation coefficients $E(t) = KGt^n$ characterize: K - initial elasticity compliance and n - creep intensity. The analyses of these coefficients changing depending on composites ingredients allowed to reveal the following basic conformities to the law:

- coefficient K reduces with the filler concentration increase, degree of anisodiametricity of particles and value of interphase interaction between elastomeric matrix and the filler;

- coefficient n increases with increasing of interphase surface between filler and elastomer in the unit of composite volume and depends slightly on filler volume part and anisodiametric particles orientation. Unfilled elastomeric matrix shows minimum coefficient n value, which increases after filler introduction. Chemical modifiers' adding into composite while improving adhesion between elastomer and filler reduces the influence of the filler on coefficient n improving. On example of the composite, reinforced with short polyamide fibres the adhesion improving effect on coefficient reduction is shown.

Thus, creep intensity characterizes the value of interphase interaction between elastomeric matrix and the filler. This index can be used for estimation of efficiency of chemical modifiers of interphase interaction.

ПРИБОР С МАГНИТНЫМ ПОДВЕСОМ ДЛЯ ИССЛЕДОВАНИЙ РЕОЛОГИЧЕСКИХ СВОЙСТВ ПОЛИМЕРОВ

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Предлагаемый прибор предназначен для экспериментальных исследований реологический, реоптических и диэлектрических свойств жидких сред. Для пространственной ориентации чувствительного элемента использована схема с активным магнитным подвесом на постоянном токе и электродинамической системой регулирования, являющейся системой стабилизации по обобщенным координатам сенсора и следящей по силовым факторам, действующим на чувствительный элемент. Сенсор оснащен набором рабочих узлов типа коаксиальных цилиндров и конус-плоскостей и обладает измерительным элементом в виде электрической пружины с функциями прецизионной следящей системы по возмущению. Использование магнитного подвеса и электрической пружины позволяет определить полный вектор состояния сенсора с 6-ю степенями свободы. Полный вектор состояния чувствительного элемента с продольной осью AB (рис.1) включает: линейные перемещения и силы по осям O_1X_1, O_1Y_1, O_2X_2, O_2Y_2, O_1O_2, а также момент вокруг оси O_1O_2. Так, в управляемом эксперименте принципиально возможно получение всех компонент тензора напряжения анизотропной жидкости.

В состав функциональной схемы прибора также входит модуль ротации и микровозмущений на основе широкодиапазонного безредукторного привода для вращения рабочего узла с испытуемым полимером и системы управляемых микровозмущений в виде микроротаций вокруг общей оси ротации, либо линейных перемещений вдоль радиуса ротации.

Для исследования жидкостей с широким диапазоном упруго-вязких свойств найден способ изменения чувствительности прибора путем варьирования в больших пределах жесткости силовой части подвеса.

Данное измерительное устройство может быть использовано для получения информации об анизотропии протекающих в ЖК полимерах тензорных релаксационных процессов и в настоящее время не имеет аналогов.
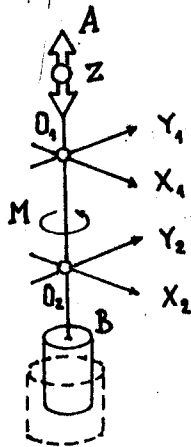

Рис. 1

The Device with the Magnetic Bearing for the Investigations of Rheological Properties of Polymers.

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The device suggested is intended for the expiremental investigations of rheological, rheoptical and dielectrical properties of liquid media. The scheme with an active magnetic bearing on direct current and with electrodynamic control, which is the system of stabilization on the generalized sensor coordinates and tracking due to the force factors affecting the sensible element has been used for space orientation of the sensitive element.

The sensor is equipped with a set of operating components (coaxial cylinders and cone-plate) and has a measuring element as an electric spring with the precision tracking system functions on disturbance.

The use of the magnetic bearing and the electric spring allow us to determine the full vector of the sensor state with six degrees of freedom. Full vector of state for the sensitive element with the longitudinal axis AB (Fig. 1) includes: the linear transfers and the forces along the axis O_1X_1, O_1Y_1, O_2X_2, O_2Y_2, O_1O_2 and also the moment about the axis O_1O_2.

Thus in the controlled experiment it is possible to obtain all the components of the tensor of stresses of the anisotropic liquid.

The modulus of rotation and microdisturbances on the basis of wide-band gearless drive for the operating component rotation with polymer tested and the system of the controlled microdisturbances as micro rotations around the common rotation axis or linear transfers along the rotation radius is also the part of the operating device scheme.

The method of changing the device sensitivity by variating in wide limits of rigidity for the bearing force part has been found to study liquids with wide range of viscoelastic properties.

The measuring device given can be applied to obtain the information about anisotropy occuring in LC polymers of tensor relaxation processes and at present this device has no analog at all.
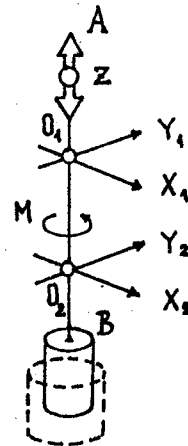
Fig. 1

DEPENDENCE OF ADHESIVE STRENGTH OF POLYMER-FIBER SYSTEMS ON LOADING RATE.

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The study of the response of polymer-fiber interface to the rate of external force application is one of the important aspects of composite rheology. However research of this problem is not as abundant. The available data, as a rule, were obtained only at room temperature.

The objective of this work was to investigate the effect of loading rate on shear adhesive strength (τ) of polymer-fiber systems at temperatures (T) higher and lower than room temperature (-195 - 200°C).

The joints of epoxy, Butwar-phenolic and thermostable (N-containing) polymers with steel wire of diameter 150μm were investigated. The values of τ were obtained by pull-out technique at various loading rates differing by 3,5 orders of magnitude.

It was shown that for all systems under investigation and all temperatures the adhesive strength is linear function of logarithm of stress growth rate $\dot{\tau}$: $\tau = C_1 + C_2 \log \dot{\tau}$, where C_2 is a constant that characterizes the relaxation behaviour of the interface. This equation allows one also to presume that the time dependence of strength for these joints may be described by the Zhurkov equation and to determine the constants of this equation: U_0 and γ (U_0 is the apparent activation energy of the fracture process and γ is a coefficient associated with stress concentration). The values of C_2, U_0 and γ were found to be dependent on T increasing as T increases. The most appreciable changes were observed within the glass transition region of polymers.

The adhesive strength behaviour are considered together with those of block polymer cohesive strength.

CURING RHEOCINETICS OF EPOXY-AMINE SYSTEMS ABOVE AND BELOW GLASS TRANSITION TEMPERATURE.

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Curing rheocinetics of epoxy-amine systems was studied with the help of viscosimetry, dynamic mechanical analysis (DMA) and differential scanning calorimetry and IR-spectroscopy. The reaction was investigated in the range of temperatures above and below the glass transition temperature of cured system. Isothermal curing has been performed at curing temperatures between 25 and 80 C. The dependence between the degree of conversion and the reaction time, obtained by DMA and DSC, was adequately described with the self-acceleration equation, and the rate constants, evaluated by both methods, coincided. It was shown, that the relationship between Tg and the degree of conversion could be calculated with the aid of Di Benedetto equation.

The conversion degree tended to have a limiting value after vitrification, but the modulus increased mostly after it. Tg increased from 0 up to 40 C at curing temperature 25 C.

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НЕЛИНЕЙНАЯ РЕОДИНАМИКА И МАССОПЕРЕНОС
ПРИ РОСТЕ ПАРОВЫХ ПУЗЫРЬКОВ В КИПЯЩИХ РАСТВОРАХ ПОЛИМЕРОВ

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Поведение индивидуальных паровых пузырьков в кипящей жидкости определяет, в конечном итоге, интегральную теплоотдачу и поэтому имеет принципиальное значение для теории кипения. При кипении полимерных растворов проявляются два специфических фактора: реологические особенности несущей фазы и ее двухкомпонентный состав; при этом в фазовых переходах участвует только низкомолекулярный растворитель. В докладе анализируется роль этих факторов при нелинейной эволюции паровых пузырьков в перегретом растворе полимера. При записи обобщенного уравнения Релея реологические эффекты учитываются лишь вблизи межфазной границы, где реализуются максимальные градиенты скоростей деформаций [1]:

$$J + \Delta p + 2\sigma R^{-1} = S, \qquad J = \varrho_{20}(R\dot{R} + \tfrac{3}{2}\dot{R}^2) \qquad (1)$$

$$S = -4\eta_s \dot{R} R^{-1} + \tau_{22}(R), \qquad \Delta p = p_\infty - \varrho_s(T_R, k_R)$$

Радиальная компонента тензора напряжений τ_{rr} определяется из реологического уравнения обобщенной максвелловской жидкости с коэффициентами, зависящими от инвариантов тензора напряжений [2]. Задача замыкается уравнениями теплопроводности и диффузии в жидкой фазе и уравнением состояния насыщенного пара в пузырьке. На границе записывается условие для теплового потока и уравнение Флори-Хаггинса. Полученная система решена численно, предварительно проведен анализ роли реологических эффектов в рамках безынерционного приближения. Результаты указывают на возможность существенной задержки перехода к тепловой стадии роста пузырька, по сравнению с ньютоновской жидкостью, из-за проявления эффектов реологической нелинейности.

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PECULIARITIES OF STRUCTURING IN AQUEOUS SOLUTIONS OF METHYLCELLULOSE

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The processes of structuring in aqueous solutions of methylcellulose have been investigated using the reological method ($T = 180$, $[\eta]$ is 5.5 dl/g in aqueous solution at 25^0C, solutions concentration j of 5 - 70 g/l). The measurements have been carried out with rotation viscosimeter and Hoeppler viscosimeter at shear tension (τ) from 0.5 up to 300 Pa and rate gradients ($\dot{\gamma}$) from 5 up to 3000 s^{-1} within the temperature range of 5 - 75^0C.

An experimental hysteresis curve η - T has been obtained. The viscosity of methylcellullose solutions at low temperatures (5 - 40^0C) is essentially independent of rate gradient and its order of applying (i.e. from lesser to greater and from greater to lesser), that is a feature of homogeneous, weakly associated solutions and is confirmed by small values of both activation energy (ΔH_{η}) and activation entropy (ΔS_{η}) of viscous flow.

The temperature rise leads to a gelation in the system. A temperature of gelation decreases with the increase of a polymer concentration. Gel formation takes place within a narrow temperature range at a sufficiently high rate. The process could be described as a co-operative one analogous with these proceeding in albuminous systems.

Characteristic for the system is poor stability of a rapidly forming gel net. The energy of a bond unit for gel net calculated with the Eldridge-Ferry equation is of 49.8 kJ/mol. Thus at 50^0C a net formed is destroyed even at low values of $\dot{\gamma}$ = 10 - 15 s^{-1}. The hysteresis phenomenon is revealed under viscosity changes from greater shear tensions towards lesser ones. The viscosity values fall down to these close to the initial ones. The feature of the methylcellulose - water system is a viscosity increase after gel melting under temperature decrease, which indicates the formation of secondary structures destroyed in the process of a further temperature decrease.

The mechanism of gelation and secondary structures formation has been suggested.

Wave and regular regimes of compaction of viscous porous media.

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Analytical and numerical solutions of the problem of one-sided compression of porous material are found that made it possible to establish new regularities of the process, which expand the physical knowledge of it, and to reveal qualitatively different regimes of compaction - the regular regime and the wave one. Theoretical description for each of these regimes is given.

At the regular regime the compaction rate does not depend explicitly on the mass coordinate and is presented in the form of the product of functions, one of which is depended on time, and the other - on density. Compaction of any separated individua. volume of material for a nonuniform density distribution occurs in the same manner as for uniform one with the same initial density.

At the wave regime a disturbance from the plunger will not propagate throughout the bulk of the material instantaneously, thus creating prerequisites for forming a compaction wave in the porous medium. The inertial factor as distinct from the regular case becomes important and the compaction is localized in a narrow zone.

Analysis of results of numerical experiments made it possible to find criterial conditions for realizing various regimes of compaction of hot porous mass, depending on the generalized Reynolds number. The regular and wave regimes are realized at small and large values Re correspondingly. The intermediate values of the Reynolds number are consistent with transient regimes of compaction. These regimes combine with the wave and regular properties depending on the specific value of Re display t..em to a greater or lesser extent.

RHEOLOGICAL PROPERTIES AND MISCIBILITY OF THERMOPLASTICS WITH SOME OLIGOESTERS.

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During recent years there has been an increased interest in modification of structure and proper ies of industrial polymers with small amounts of oligomers. However, the mechanism of modifiers action depends on th molecular structure of polymer and additive and their compatibility. In this work inverse gas chromatography (IGC) has been extended to the investigation of polyethylene-oligoesters blends.

Rheological properties were studied with the help of flow melt indexer. Viscosity and activation energy decrease with the oligoesters content increasing. No direct correlation between rheological properties and interaction parameter was found.

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Тезисы

доклада Кинельблата В.И., Вольфсона С.И., Чеботаревой И.Г.
"Реологический подход к исследованию полиэтилена"

Базовые экструзионные марки ПНД обладают очень широким молекулярно-массовым распределением и значительной молекулярной массой. Композиции ПНД, как правило, содержат технический углерод. Эти особенности делают их весьма неудобными объектами для исследования зависимости эксплуатационных свойств от молекулярных характеристик. Между тем, такие исследования актуальны, поскольку объемы выпуска ПНД и изделий из него наращиваются, причем изделия, в частности трубы из ПНД, все шире применяются в таких ответственных областях, как газопроводы и технологические трубопроводы.

Исследование серийных и экспериментальных марок и партий отечественного и импортного ПНД позволили выявить ряд высокоэластических характеристик расплава ПНД, чувствительных к вариациям молекулярной массы, ММР и разветвленности. В результате статистической обработки результатов испытаний получена система уравнений вида:

$$y_1 > f(x_1, \Delta y_1)$$

$$y_2 < f(x_1, x_2, \Delta y_2).$$

где x_1 — вязкость расплава при заданной скорости сдвига,
x_2 — разбухание экструдата,
y_1 — скорость высокоэластического срыва,
y_2 — максимальная амплитуда автоколебаний напряжения сдвига,
Δy_1 и Δy_2 — допустимые отклонения экспериментальных значений y_1 и y_2 от расчетных.

Несоответствие результатов испытаний и расчетов системе уравнений свидетельствуют о появлении длинноцепной разветвленности или гелеобразовании в результате деструкционных процессов.

Реологический подход к исследованию экструзионных марок ПНД позволяет решить ряд практических задач:
— оценка качества базовой марки ПНД и композиции;
— оценка эффективности стабилизирующей системы;
— прогнозирование надежности изделий из ПНД;
— выявление причин аварий полиэтиленовых трубопроводов.

Представляется перспективным использование реологического подхода для каучуков и резиновых смесей.

RHEOLOGY AND DYNAMICS OF PHASE SEPARATION IN MISCIBLE POLYMER BLENDS

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During phase separation in miscible polymer blends the constituent polymer phases move relative to each other, and peculiarities of these microflows can be analysed from the rheological behaviour. The rate of phase separation near the critical temperature of mixing is very slow and the most important rheological characteristic in this case is zero-shear viscosities of constituent phases. We have studied the kinetics of phase separation for two polymer blends; bisphenol A polycarbonate (PC) - poly(methylmethacrylate) (PMMA) and poly(vinylmethylether) - polystyrene, having various molecular weights (and correspondingly different viscosities). The kinetics of phase separation at temperatures above the LCST was studied by small-angle light scattering and with help of an original spectroscopic method, developed by authors. It was shown that the phase viscosity determines both the kinetics of phase separation and morphology of the system after separation. For blends PC with PMMA-72 (MW 72 kg/mol, in this case the viscosity of PMMA is one third that of PC) the fast process of phase separation seems to proceed by spinodal decomposition when the content of PC is less than 50 % ww but at the content of PC more than 50% the kinetics and morphology more likely corresponds to a slow nucleation and growth mechanism.

For polymer blends with high molecular weight PMMA (MW 330 kg/mol, for which the viscosity is 3-5 times higher than that for PC), the rate of phase separation is considerably lower than in case with PMMA-72 and the morphology of the phase-separated system is very fine and uniform for a variety of compositions.

ИНВЕРСИЯ РЕЛАКСАЦИИ НАПРЯЖЕНИЙ В ПОЛИПРОПИЛЕНЕ
ПРИ КОМБИНИРОВАННОЙ ВЫТЯЖКЕ ПЛЕНОК В ЖИДКОСТИ

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Соотношение скоростей деформирования и релаксации напряжения при вытяжке пленок изотактического полипропилена определяет пористую структуру, вероятность обрыва и, соответственно производительность процесса получения полимерных сорбентов методом "разрыхляющей ориентации в жидкой среде /1/. Стабильную структуру сорбента с максимальным объемом и узким распределением пор по размерам получают путем растяжения пленок в жидкостях, проявляющих физическую активность по отношению к полипропилену, сокращением(усадки) пленки под натяжением до определенной величины остаточного натяжения и изометрической термофиксацией в инертной среде. Контроль релаксационных процессов, протекающих в полипропилене на каждой стадии позволяет оптимизировать режим комбинированной вытяжки по критериям качества пористого материала.

Установлено, что релаксация напряжения в полипропилене после цикла "растяжение-сокращение" в жидкой среде и на воздухе меняет направление в зависимости от величины остаточного натяжения пленки после сокращения. Напряжение, при котором в полимерах происходит инверсия релаксационных процессов - "структурная"точка"β",/2/соответствует оптимальным условиям термофиксации пористых пленок.

Точка β" при деформации на воздухе и в инертной жидкой среде составляет 1/3 предела вынужденной эластичности полипропилена, практически не зависит от величины деформации растяжения, но существенно снижается под действием бутанола и нонана. При этом время контакта полипропилена с пластифицирующими и адсорбционноактивными жидкостями не влияет на положение точки "β". При предварительном насыщении полимера спиртом и нонаном до предельной степени набухания величина напряжения в точке "β" не изменяется, что свидетельствует об определяющем влиянии макроскопической структуры/1/ полимера на ее положение и надмолекулярном механизме структурных перестроек при деформации в жидкости.

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THE INVERSION OF RELAXATION OF STRESSES IN POLYPROPYLENE
UNDER THE COMBINED ELONGATION OF FILMS IN FLUID.

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The relationship of the speeds of deformation and relaxation of the stress under the elongation of the films of isotactic polypropylene defines a porous structure, a propability of breakage and the capacity of the process of production of polymer sorbents by the method of "loosening" orientation in fluid medium /1/. A stable structure of the sorbent with a maximal volume and narrow distribution of pores according to the dimensions can be produced by the tension of films in fluids, which show a physical activity towards polypropylene, by the cancellation of the film under the tension till the definite quantity of permanent tension and by the isometric thermofixation in an inert medium. The control of ralaxation processes, which follow in polypropylene at the each stage, allows to optimize the regime of the combined elongation according to the criterias of quality of the porous material.

It is established, that the relaxation of the stress in polypropylene after the cycle " tension-cancellation " in fluid medium and in the air changes the direction, depending on the quantity of permanent tension of the film after cancellation. The stress, with the help of which the inversion of relaxation process is occured in polymers — so-called "structural" point "β" /2/, corresponds to the optimal conditions of thermofixation of porous films.

The point "β" at the deformation in the air and in inert fluid medium accounts for 1/3 of the limit of the forced elasticity of polypropylene, does not depend on the quantity of deformation of tension, but it is substantialy reduced under the influence of butanol and nonan. In accordance with this fact, the time of the contact of polypropylene with plasticized and adsorbtive active fluids does not have the influence on the position of point "β". The quantity of the stress in point "β" does not change under the preliminary saturation of the polymer with spirit and nonan till the limiting stage of the swell, this fact shows a great influence of macroscope structure /1/ of polymer on its state and the overmolecular mechanism of structural changes under the deformation in fluid.

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ЧИСЛЕННОЕ МОДЕЛИРОВАНИЕ ТЕЧЕНИЯ ВЯЗКОУПРУГОЙ ЖИДКОСТИ

В КАНАЛЕ СЛОЖНОЙ ФОРМЫ

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Работа посвящена изучению осесимметричных течений расплавов и растворов полимеров в каналах формующих инструментов. Большинство полимерных материалов являются вязкоупругими жидкостями. Многие уравнения состояния качественно описывают поведение вязкоупругих жидкостей. Среди хорошо известных моделей уравнение Уайта-Метцнера отличается простотой определения реологических постоянных и возможностью описания процессов течения в широком диапазоне скоростей деформаций.

Для анализа движения полимеров отлично проявили себя математические модели, основанные на фундаментальных принципах сохранения массы, момента количества движения и энергии. Эта система нелинейных дифференциальных уравнений в частных производных, описывающих нестационарное течение жидкости, должна удовлетворять граничным условиям. В настоящей работе система дифференциальных уравнений решалась методом конечных разностей по неявной схеме. В качестве искомых переменных были выбраны функции вихря и тока, с использованием которых вычислялись поля скоростей и напряжений. Исследовано влияние угла входа и реологических постоянных на характер течения.

NUMERICAL SIMULATION OF VISCOELASTIC LIQUID FLOW IN CHANNEL OF COMPLEX SHAPE

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This paper is concerned with numerical studies of axisymmetric polymer melt and solution flows in the channels of the forming instruments. Most of the polymer materials are viscoelastic fluids.

The majority the constitutive equations describe viscoelastic fluids behavior qualitatively. Among the well-known constitutive equations the model of Wnite-Metzner is distinguished by its relative simplicity of determining the rheological constants and by the possibility of describing the flow processes in the wide range of strain rates.

Mathematical models based on the fundamental principles of the mass, momentum and energy conservation have excellently proved themselves for the analysis of the motions of polymer melts and solutions. This system of the nonlinear partial differential equations describing unsteady flow of viscoelastic fluids has to satisfy boundary conditions. Numerical calculation of the system is made on the basis of finite difference method using the implicit scheme. In the present study the vorticity and stream functions are used.

The analysis of the polymer flows in the axisymmetric cylindrical, cone - cylindrical and abrupt narrowing channels has been made. The influence of rheological and heat physical constants on the characteristics of the flows has been examined. The velocity and stress fields in channels have been obtained. The influence of the inlet angle and rheological characteristics on the flow rate of viscoelastic liquids is demonstrated.

РЕОЛОГИЧЕСКИЙ ФАКТОР ПРИ НАПОРНОМ ТЕЧЕНИИ ВЫСОКОВЯЗКИХ СРЕД В ЦИЛИНДРИЧЕСКИХ КАНАЛАХ

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Реологические свойства играют, как известно, определяющую роль при переработке материалов в химической, фармацевтической, пищевой отраслях, производстве керамики, целлюлозы и т.д.. В данной работе выполнены расчетно-экспериментальные исследования, конечной целью которых являлась разработка устройства для контроля реокинетических характеристик полимерной смеси в технологическом процессе ее приготовления по зависимостям "напор-расход".

Для описания кривых течения использована модель Балкли-Гершеля:

$$\tau = \tau_0 + k|\dot{\gamma}|^{1/m-1}\dot{\gamma} .$$

содержащая, как структурную (предел текучести) τ_0, так и вязкую составляющие. Выполнены численные расчеты профилей скоростей и напор-расходных характеристик для выбранной модели и степенной зависимости $\tau = k|\dot{\gamma}|^N\dot{\gamma}$, наиболее часто используемой в инженерных приложениях. Показано, что аппроксимация течения нелинейно-вязкопластичной жидкости степенным законом становится возможной при малых значениях параметра N, или достаточно высоких скоростях сдвига.

Выполнена также визуализация течения высоковязких полимерных композиций в цилиндрической трубе. По полученным профилям деформации проведены оценки предельного напряжения сдвига.

С использованием реологической модели нелинейно- вязкопластичной среды и обобщенного преобразования Муни для круглого цилиндрического канала получено интегральное соотношение с консистентными переменными, которое необходимо для технологических зависимостей типа "расход-напор". На их основе разработано разработано устройство для контроля реологических свойств среды в техпологическом процессе с автоматизированной системой обработки информации. Проведены его опытные испытания на модельных средах, в качестве которых использованы высококонцентрированные глинистые суспензии с эффективной вязкостью порядка $(2-7)\,10^5$ Пас.

RHEOLOGICAL EFFECTS AT FLOWS OF HIGHLY VISCOUS FLUIDS IN CYLINDRIC CHANNELS

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As is known, the rheological properties play a decisive role in processing of various materials in the chemical, pharmaceutical, and food industries, in manufacturing of ceramics, cellulose, etc. In the present work the theoretical and experimental investigation are carried out, which are aimed at the development of a unit for controlling the rheokinetic characteristics of a polymeric mixture during the processing of the latter. The volume rate versus pressure drop dependence is used as input data.

To describe the flow curve, the Balkly-Gershel model

$$\tau = \tau_o + k|\dot{\gamma}|^{1/(m-1)}\dot{\gamma}$$

is used, which involves both the structural (vis. yield stress, τ_o) and viscous components. Numerical calculations of the velocity profile and the dependence of the volume rate on the pressure drop have been performed using both this model and the power-law relationship $\tau = k|\dot{\gamma}|^N\dot{\gamma}$, which is every so often used in applications. It has been shown that the power-law approximation, as applied to the flows of non-linear viscoplastic liquids, is valid at low N values either at sufficiently high shear rates.

The visualization of flows of highly viscous polymeric compositions in a cylindric tube was performed. The obtained deformation profiles were used for estimating the ultimate shear stress.

Using the rheological model for a non-linear viscoplastic medium and the generalized Mooney transformation, an integral relationship with consistent variables has been obtained for a circular cylindric channel, which is necessary for obtaining the technological dependencies "volume rate versus pressure drop". On the basis of these dependencies a device has been developed for controlling rheological properties of a medium during the technological process, which includes an automatic data processing system. The device has been tested with the use of high concentrated clay suspensions with the effective viscosity of about $(2-7)\,10^5$ Pa·s.

Межфазные слои и деформационные свойства смесей
эластомеров и их вулканизатов.

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Расчетным путем, по теории Гелфанда определена толщина слоя сегментальной растворимости на границе раздела бутадиен - этилстирольный - бутадиеннитрильный эластомеры. Рост толщины слоя СР сопровождается ростом работы адгезии на межфазной границе.

Экспериментально, методом РТЛ и методом крутильных колебаний определены температуры стеклования межфазных слоев /МФС/, непосредственно примыкающих к слою СР. Температура стеклования МФС в целом понижена по сравнению с T_c в объеме данной фазы, что указывает на разрыхление упаковки сегментов на большом удалении от слоя СР.

Методом набухания тонких срезов, показано увеличение концентрации поперечных связей в МФС, возникающих в процессе серной вулканизации. В то же время вулканизация фенол-формальдегидной смолой обеспечивает создание сетки, плотность узлов которой не зависит от расстояния от межфазной границы.

Найденные закономерности структурообразования в эластомер-эластомерных МФС качественно коррелируют со следующими механическими характеристиками двухфазной смеси: концентрацией напряжений в каучуковой матрице вблизи дисперсных частиц, деформируемость дисперсных частиц при растяжении эластомерной матрицы, прочность и усталостную выносливость смесей каучуков.

АНОМАЛЬНАЯ ВЫСОКОЭЛАСТИЧНОСТЬ СМЕСЕЙ
МОНОДИСПЕРСНЫХ И / ИЛИ НАПОЛНЕННЫХ ПОЛИМЕРОВ

М.П. Забугина

Анализ экспериментальных данных о реологических свойствах смесей монодисперсных полибутадиенов (ПБ) с дисперсными наполнителями друг с другом позволяет предложить объяснение экстремальной зависимости модуля высокоэластичности ($e_в$), определенного по упругому отскоку от содержания наполнителя или высокомолекулярной фракции. Полагаем, что единицей течения служат некие упругие образования значительно более крупных размеров, чем принято считать (как, например сегмент), причем величина их зависит как от ММ полимера, так и от природы и формы частиц наполнителя. В процессе течения в первую очередь действующие напряжения (τ) воспринимаются частицами больших размеров, следовательно истинное τ, действующее на них, оказывается значительно больше задаваемых и, как следствие упругий отскок оказывается большим. Мы же для расчета $e_в$ используем задаваемое τ и потому получаем заниженное значение $e_в$. Таково, на наш взгляд, объяснение наличия минимума на зависимости $e_в$ от концентрации наполнителя независимо от природы наполнителя (сажа, волокно, полимерная фракция с большим ММ).

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ТЕПЛОФИЗИЧЕСКИЕ, СТРУКТУРНЫЕ И РЕОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ МЕЗОФАЗНОГО ПОЛИ-БИС-ТРИФЕОРЭТОКСИФОСФАЗЕНА

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Поли-бис-трифторэтоксифосфазен (ПФ) - важный и сравнительно новый полимер медицинского назначения. Он представляет и значительный научный интерес как полимер с гибкой цепью, образующий мезофазу в широком интервале температур(~0 - $\sim 250^{\circ}$С). В работе исследован синтезированный в растворе ПФ с узким ММР и $M_n \approx 10^6$. Рентгенострук-турные исследования показали, что этот полимер в кристаллическом состоянии обладает орторомбической элемементарной ячейкой и имеет высокую степень кристалличности. В мезофазном состоянии для него характерны разворачивание цепей, нарушенная орторомбическая упаковка с образованием слоистой структуры. Результаты дилатометрических исследований под давлением показывают, что приложенное давление сдвигает переход из кристаллического в мезофазное состояние в область более высоких температур и значительно расширяет область существования мезофазы. Найдено, что переход из кристаллического в мезо-фазное состояние сопровождается резким увеличением теплового расши-рения и сжимаемости ПФ, причем плотность его молекулярной упаковки приближается к значению этой величины для изотропных расплавов полиэтилена. Однако приложение высоких давлений приводит к резкому снижению теплового расширения и сжимаемости мезофазы по сравнению с кристаллическим ПФ. Исследование энтальпии и энтропии перехода из кристаллического в мезофазное состояние свидетельствует об упорядо-чении мезофазы при высоких давлениях. Реологические исследования показывают, что в кристаллическом состоянии ПФ обнаруживает вторич-ный релаксационный переход, связанный, возможно, с локальной подвиж-ностью боковых заместителей полимера.В мезофазном состоянии ПФ ведет себя как неньютоновская жидкость, обладающая пределом текучести, которой линейно убывает с ростом температуры, из-за снижения степени структурирования мезофазы. Течение полимера происходит, по-видимому, на уровне перемещения и разрушения его доменов. Следствием доменной структуры мезофазы ПФ является его фибриллизация в потоке. При этом в экструдате образуются волокна с диаметром в несколько мкм.

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Роль метрологии при измерениях реологического поведения материалов.

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Единство и правильность измерений вязкости ньютоновских материалов обеспечиваются у нас в стране и ещё 17 странах - членах МОЗМ в соответствии с Международным Документом № 19 "Международная поверочная схема для средств измерений вязкости". Согласно этого документа шкала вязкости строится на основе измеренного рядом авторов 1,2,3 и принятого ИСО ТК 28 в 1966году значения вязкости воды, равного 1,002 мПа.с. Это значение применяется для калибровки I группы эталон-ных капиллярных вискозиметров. Для передачи размера единицы вязкости приборам, имеющим диапазон от 1.10^{-3} до 1.10^2 Па.с применяется набор стандартных образцов вязкости, приготовленных на основе смесей мине-ральных масел и чистых органических веществ.

Реометры, имеющие диапазон вязкости более 1.10^2 Па.с, метрологи-чески не обеспечены. Это связано с тем, что во-первых, до сих пор не найден материал- стабильный носитель вязкости в диапазоне более 1.10^2 Па.с, а во-вторых, не разработан метод измерений вязкости.

Исследование некоторых свойств полидиметил силметилена, получен-ного методом магнийорганического синтеза из хлрметилдиметилхлорсилана показало, что этот материал, при условии тщательной очистки, может рассматриваться в качестве основы для создания мер вязкости в диапа-зоне от 10^2 до 1.10^7 Па.с.

Свойства полидиметилсилметилена исследедуются.

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RHEOLOGICAL PROPERTIES OF AQUEOUS SOLUTIONS OF POLYVINYL ALCOHOL AND ITS COMPOSITES

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S U M M A R Y

Aqueous solutions of polyvinyl alcohol (PVA) and its composites find wide application for forming the films used as light-, electro-, magnetosensitive materials, in information storage technologies, in printing, pulp and paper industries. The structure and properties of a polymer solution govern the properties of film materials.

A rheological technique has been employed to determine a structure of aqueous PVA solutions and sodium-carboxylmethyl cellulose (Na-CMC) of different types as well as PVA and Na-CMC composites of different concentration. Measurements have been conducted in a rotational viscosimeter "REOTEST-2" in dependence on a shear rate (a rotational speed of the inner cylinder) within the temperature range 20 to 90 C at concentrations ranged from 1 to 12 wt.% for PVA and from 1 to 7 wt. for Na-CMC. The composites have been prepared by using different-concentration PVA and Na-CMC with their weight ratio as follows: 24:1; 15:1; 1,5:1; 5:1; 1,5:1.

The concentration, temperature ranges are revealed at which the structures of the tested polymer solutions undergo change. An influence of a mechanical factor (the rotational speed f the inner cylinder of the measuring cell) on a structure forming process of the investigated media is established.

MAGNETOSENSITIVE FILM-FORMING MAGNETITE-BASED COMPOSITES

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S U M M A R Y

Magnetite Fe_3O_4 and γ-iron oxide Fe_2O_3 are the most extensively studied and the most commonly encountered oxy compounds of iron possessing ferromagnetic properties. They find different application in different materials, e.g. magnetic tapes, paints, etc. that are formed from fluid composites. A specific feature of fluids with a disperse ferromagnetic filler is the possibility of forming, n their base, the film materials with a filler structure being oriented owing to an applied magnetic field.

We have evaluated the magnetic field effect on the film-forming magnetite-based fluid composites through evaluation of their magnetic and magnetorheological properties. As binders, use has been made of a transformer oil, aqueous solutions of polymers (polyvinyl alcohol, sodium-carboxylmethyl cellulose, methyl-, ethyl-, oxypropylcellulose) as well as different lacquers based on glyptal, pen erythritol-modified phthalic resins, epoxy acryl resin and colophony. The optimal magnetosensitive composites are worked out in dependence on a filler concentration as well as a type and concentration of a binder.

ВЛИЯНИЕ УСЛОВИЙ СИНТЕЗА НА ВЯЗКОСТНЫЕ СВОЙСТВА И АГРЕГАТИВНУЮ УСТОЙЧИВОСТЬ ПОЛИАКРИЛАТНЫХ ДИСПЕРСИЙ.

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Получение концентрированных органодисперсий полимера с регулируемым азмером частиц дисперсной фазы, агрегативной и кинетической устойчивостью важно при создании ла окрасочных материалов с заданными реологическими свойствами.

Другими факторами, влияющими на реологические свойства таких ди персий являются: полярность органической среды, природа и концентра ция дифильного стабилизатора.

Изучен процесс сополимеризации акриловых мономеров в осадительн органических средах различной полярности (диэлектрическая проницае мость ε =2.6-7.6) в присутствии привитых и блок-сополимеров на осн ве олигоуретанов и полибутадиена в присутствии инициатора перекиси бензоила.

Получены органодисперсии с содержанием твердой фазы до 40% и ра мером частиц 90-560 нм. Установлено, что размеры частиц уменьшаютс с ростом полярности органической среды и повышением концентрации с билизатора.

Определена оптимальная толщина адсорбционного слоя стабилизатор на дисперсных частицах, обеспечивающая долговременную агрегативну устойчивость систем.

Установлена зависимость толщины адсорбционного слоя от природ содержания стабилизатора.

Детально изучены вязкостные свойства органодисперсий и установ но, что снижение концентрации стабилизатора при постоянной концен ции инициатора в среде с ε = 5.5 приводит к агрегации дисперсии.

В то же время с повышением полярности среды даже при использо оптимального количества стабилизатора дисперсии при длительном хр нии способны структурироваться (происходит повышение вязкости до ной желатинизации).

Установлено, что природа дифильного стабилизатора также влияет интенсивность роста вязкости в ходе синтеза посредством воздейств на степень структурирования систем.

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ЭЛЕКТРОГИДРОДИНАМИЧЕСКОЕ ОПИСАНИЕ ПРОЦЕССОВ В РЕОЭЛЕКТРИЧЕСКОМ ДВИГАТЕЛЕ

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Рассматривается реоэлектрический двигатель цилиндрической конструкции. Ротор представляет собой металлический цилиндр в цилиндрической диэлектрической оболочке. Цилиндрический статор на внутренней поверхности имеет электроды постоянного высокого электрического напряжения чередующейся полярности.

Получена замкнутая система дифференциальных уравнений, которая описывает как стационарные, так и нестационарные вращения ротора и жидкости. Электрогидродинамическая модель учитывает эффекты объемной и поверхностной проводимости ротора, инерции ротора, жидкости, электрического поля, эффект вязкой жидкости, влияние эквипотенциальной поверхности внутри ротора и числа электродов ротора, размеров ротора и статора на характеристики вращения ротора.

Найдены необходимые и достаточные условия существования стационарного режима работы двигателя [I]. Получены аналитические формулы для расчет угловой скорости стационарного вращения ротора и критического значения электрического потенциала электродов.

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ELECTROHYDRODYNAMIC DESCRIPTION OF PROCESS INSIDE REOELECTRICAL MOTOR. ABSTRACT

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Reoelectrical motor cylindrical construction has been ir estigated. Stationary and non-stationary rotations of the rotor have been discussed. Rot r and stator dimensions, the mber of electrodes, presence of equipotential surface inside the rotor, rotor inertia, liquid and electrical field were taken into account. Analytic formulas for angular velocity of the rotor rotation and for critical value of the electric field were obtained.

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ДЕФОРМИРОВАНИЕ ПЛАСТИНЫ ИЗ ВЯЗКО-ПЛАСТИЧЕСКОГО МАТЕРИАЛА

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Рассматривается жестко защемленная круглая пластина, нагруженная равномерным давлением. Материал пластины считается несжимаемым жестко-вязко-пластическим. За начальное условие пластичности принимается условие максимального приведенного напряжения, которое в плоскости безразмерных изгибающих моментов $m_r = M_r/M_o$, $m_\theta = M_\theta/M_o$ изображается шестиугольником текучести, описываемым шестью функциями пластичности

$$\mathcal{L}_1 = m_r + m_\theta - 2, \quad \mathcal{L}_2 = -m_r + 2m_\theta - 2, \quad \mathcal{L}_3 = -2m_r + m_\theta - 2,$$

$$\mathcal{L}_4 = -m_r - m_\theta - 2, \quad \mathcal{L}_5 = m_r - 2m_\theta - 2, \quad \mathcal{L}_6 = 2m_r - m_\theta - 2$$

Здесь $M_o = \sigma_o h^2/4$, σ_o — предел текучести материала при растяжении, h — толщина пластины.

Исследования показывают, что вязко-пластические деформации возникают при нагрузке $p > p^* = 1_{\sim},3\, Mo/R^2$, где R — радиус пластины. Величина p^* является предельной нагрузкой для пластины из жестко-пластического материала. Для описания вязко-пластических деформаций используются линейные соотношения между изгибающими моментами и скоростями кривизны срединной поверхности пластины

$$\lambda \varkappa_j = M_o \sum_{i=1}^{6} \frac{\partial \mathcal{L}_i}{\partial m_j}, \quad j = r, \theta,$$

где при суммировании учитываются $\mathcal{L}_i > 0$.

В пластине реализуются шесть пластических зон. Использование зависимостей между величинами $\varkappa_r$, $\varkappa_\theta$, m_r, m_θ и соотношений для $\mathcal{L}_i$ приводит к системе шести дифференциальных уравнений относительно m_r, m_θ. Интегрирование этих уравнений совместно с уравнением равновесия позволяет получить распределение изгибающих моментов, скорости прогиба пластины и систему пяти трансцендентных уравнений для пяти радиусов раздела пластических зон. Численная реализация полученных соотношений отражена в графиках.

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VISCO-PLASTIC PLATE DEFORMATION

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Rigidly restrained round plate under uniform pressure is discussed. The material of the plate is considered to be incompressible, rigid-visco-plastic. The state of maximally reduced stress is taken as the initial plastic condition, which in the plane of non-dimensional bending moments $m_r = \mathcal{M}_r/\mathcal{M}_o$, $m_\theta = \mathcal{M}_\theta/\mathcal{M}_o$ is represented by yield hexagon described by six functions of plasticity

$$\mathcal{L}_1 = m_r + m_\theta - 2, \quad \mathcal{L}_2 = -m_r + 2m_\theta - 2, \quad \mathcal{L}_3 = -2m_r + m_\theta - 2,$$

$$\mathcal{L}_4 = -m_r - m_\theta - 2, \quad \mathcal{L}_5 = m_r - 2m_\theta - 2, \quad \mathcal{L}_6 = 2m_r - m_\theta - 2$$

Here $\mathcal{M}_o = \sigma_o h^2/4$, σ_o - is the material yield point in tension, h - is a plate thickness.

Investigations show that visco-plastic deformations appear when the load $p > p^* = 11,3\ \mathcal{M}_o/R^2$, where R - is the radius of the plate. The value of p^* is the ultimate load for rigid-plastic plate material. Linear relations between bending moment and curvature rates of the middle surface of the plate are used for describing visco-plastic deformations

$$\lambda \varkappa_j = \mathcal{M}_o \sum_{i=1}^{6} \frac{\partial \mathcal{L}_i}{\partial m_j}, \quad j = r, \theta,$$

where $\mathcal{L}_i > 0$ is taken into account in summation.

Six plastic zones are realized in a plate. Dependence between the values of $\varkappa_r$, $\varkappa_\theta$, m_r, m_θ and relations for $\mathcal{L}_i$ leads to the system of six differential equations with respect to m_r, m_θ. Integration of these equations alongside with the equilibrium equation allows to obtain the distribution of bending moments, the rate of the plane bending and a system of five transcendental equations for five radii of plastic zones. Numerical realization of the relations obtained is illustrated graphically.

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ИССЛЕДОВАНИЕ РЕОЛОГИЧЕСКОГО ПОВЕДЕНИЯ ЭЛАСТОМЕРОВ С ЦЕЛЬЮ ОПТИМИЗАЦИИ ИХ ЭКСТРУЗИИ

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Изучено реологическое поведение эластомерных материалов, преимущественно резиновых смесей в условиях продавливания через различные насадки в условиях свободного истечения и с использованием специальных гидродинамических сопротивлений, устанавливаемых перед профилирующим отверстием.

Произведен анализ напряженного состояния экструдатов методом наблюдения за их эластическим восстановлением и последующей фиксацией, а также с помощью визуализации потока поляризационно-оптическим способом. Произведены измерения распределения скоростей истечения материалов и энергосиловых затрат при деформировании в различных условиях.

Показано, что используя различные типы гидродинамических сопротивлений, можно активно влиять на реологическое поведение материалов, добиваясь оптимизации экструзионных процессов.

На основе проведенных исследований предложены перспективные конструкции экструзионных головок для производства профильных изделий из эластомерных материалов.

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Реологические свойства и электропроводность саженаполненных смесей термопластов

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Исследованы реологические свойства и удельная объемная электропроводность 6 композиций на основе смесей полиэтилена низкой плотности (ПЭ) и полипропилена (ПП) в зависимости от объемного содержания φ сажи. Композиции с различным содержанием сажи получали двумя способами - готовили концентрат ПЭ, включающий 0,18 об. долей сажи, который затем разбавляли полипропиленом, в другом случае концентрат ПП с 0,18 об. долями сажи разбавляли полиэтиленом.

Кривые течения расплавов наполненных смесей показывают появление предела текучести τ_T (величина которого рассчитывалась из уравнения Кэссона) при $\varphi > 0,02$ независимо от способа получения композиций. В то же время концентрационные зависимости вязкости существенно различаются при разных способах введения сажи: в случае использования концентрата ПП-сажа зависимость η от φ имеет обычный вид, тогда как для композиций, полученных из концентрата ПЭ-сажа, эта зависимость аномальна.

Исследование электропроводности δ как функции φ в саженаполненных смесях, а также в саженаполненных индивидуальных ПЭ и ПП показало, что величина порога перколяции φ_c и коэффициент плотности упаковки наполнителя F для композиций на основе концентрата ПП-сажа и для саженаполненного ПП совпадают (φ_c - 0,05, F - 0,24) тогда как для композиций на основе концентрата ПЭ-сажа φ_c - 0,03 F - 0,21, а для саженаполненного ПЭ φ_c - 0,09, F - 0,28.

Полученные данные позволяют заключить, что в случае формирования композиций из концентрата ПП-сажа, наполнитель распределяется по всему объему композиции. Если же концентрат ПЭ-сажа разбавляется полипропиленом, то наполнитель остается преимущественно локализованным в полиэтилене. В этом случае фаза ПЭ-сажа образует проводящую каркасную структуру, что оказывает влияние на величину порога перколяции, коэффициент плотности упаковки сажи и реологические характеристики композиций. Эти выводы подтверждаются результатами электронномикроскопических исследований.

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ГЕЛЕОБРАЗОВАНИЕ, КАК РЕЗУЛЬТАТ ВЗАИМОДЕЙСТВИЯ ИОНОВ ХРОМА С МАКРОМОЛЕКУЛАМИ НАТРИЙ-КАРБОКСИМЕТИЛЦЕЛЛЮЛОЗЫ

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Оценена возможность гелеобразования растворов натрий-карбоксиметилцеллюлозы.

Установлено, что структурирование растворов натрий-карбоксиметилцеллюлозы происходит в присутствии ионов хрома, железа, алюминия, циркония. Независимо от типа комплексообразователя, формирование геля происходит с нерегулируемой скоростью. Качество геля и его кинетическая устойчивость зависят от массового соотношения полимера и структурирующего агента.

Поэтому, для экспериментального определения области гелеобразования систем: натрий-карбоксиметилцеллюлоза- ион хрома были получены изотермические диаграммы фазового состояния в координатах: концентрация полимера- концентрация ионов хрома к весу полимера. С помощью диаграмм определены концентрационные области фазовых переходов: раствор- гель- гетерогенная система, а также предельная концентрация полимера, ниже которой гелеобразование не происходит независимо от концентрации структурирующего агента (критическая концентрация гелеобразования ККГ).

Установлено, что с увеличением молекулярной массы полимера уменьшается ККГ, а также улучшается кинетическая устойчивость геля.

GEL FORMATION AS A RESULT OF INTERACTION OF CHROMIUM IONS
WITH MACROMOLECULES OF SODIUM CARBOXYMETHYLCELLULOSE

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The possibility of gelation of sodium carboxymethylcellulose solutions was evaluated.

It was established that the structurization of sodium carboxymethylcellulose solutions occurs in the presence of chromium, iron, aluminium and zirconium ions. Irrespective of the type of a complexing agent, the gel formation proceeds with an uncontrolled rate. The gel quality and its kinetic stability depend on the mass ratio of the polymer and the structurizing agent.

Therefore, to determine the regions of the gel formation of sodium carboxymethylcellulose - chromium ions systems the isothermal phase-state diagrams were plotted on the coordinates of the polymer concentration against the chromium-ion concentration (of the polymer weight). These diagrams allowed to determine concentration regions of the phase transitions (solution-gel-heterogeneous system) as well as the limiting concentration below which no gel formation takes place regardless of the structurizing agent concentration (the critical concentration of the gel formation (CCGF)).

It was revealed that with increasing the molecular weight of the polymer the value of CCGF decreases and the kinetic stability is enhanced.

РАЗРАБОТКА ОСНОВ МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ ДВИЖЕНИЯ СМЕСЕЙ ПОЛИМЕРОВ В УЗЛАХ ПЕРЕРАБАТЫВАЮЩЕГО ОБОРУДОВАНИЯ

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Режимы переработки смесей полимеров не могут быть такими же, что и режимы переработки "чистых" полимеров. Поэтому механический перенос зависимостей, определяющих состояние "чистого" полимера в характерных каналах полимерного оборудования на поведение смеси полимеров, составленной на базе "основы", в подобных узлах является неправомерным. Это связано с тем, что еще недостаточно полно исследованы закономерности, объясняющие поведение смесей полимеров во взаимосвязи увеличения, либо уменьшения вводимой добавки и интенсивности поля напряжений и скоростей воздействия. Не анализируется влияние количества введения модифицирующей добавки на степень проявления аномалии вязкости смеси.

В предлагаемой работе предпринята попытка представления полуэмпирической реологической модели систем полимер-полимер на основе модельных обощенных составов в интервале температурно-силовых воздействий, присущих таким методам переработки как экструзия, литье под давлением. Причем весь концентрационный интервал от нулевой концентрации одного полимера до нулевой концентрации другого условно разбивался на интервалы, внутри которых реологические свойства объединены общими закономерностями.

В работе показано, что реологическое уравнение состояния может быть получено использованием механических аналогий предопределенных природой материала.

DEVELOPMENT OF FOUNDATION FOR MATHEMATICAL MODELLING OF POLYMER MIXTURE MOVEMENT IN THE PROCESSING EQUIPMENT UNITS

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Regimes for polymer mixtures processing cannot be the same as for "pure" polymer processing. Therefore mechanical application of the relationships, determining the state of "pure" polymer in specific channels of polymer processing equipment, to the behaviour of compozite polymer mixture in similar units is unjustified. This is due to the fact that regularities explaining the reaction of polymer mixtures to either increasing or reducing the amount of injected admixture, and to the intensity of stress field and the velocity of action have not been sufficiently studied .

The relation between the amount of modifying admixture and the degree of mixture viscosity anomaly is not analysed as well.

In the present report, an attempt is made to offer, to a large extent emperic, reological model of "polymer-polymer" system based on model summarized compositions in the interval of temperature-power actions inherent to such modes of processing as extrusion and injection moulding. The entire concentration range from zero concentration of one polymer to that of another is conventionally divided into intervals within which reological properties are similar.

The report shows that a reological equation of state can be obtained through application of mechanical analogies predetermined by the nature of the material.

ИССЛЕДОВАНИЕ ПРОЦЕССА ЭКСТРУЗИОННОГО ДИСПЕРГИРОВАНИЯ ГЕТЕРОГЕННЫХ РАСТВОРОВ ПОЛИМЕРОВ

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Производственная и исследовательская практика использует процесс экструзии в качестве процесса, обеспечивающего получение профильно-погонажных изделий как из расплавов полимеров, так и из композиционных полимерных систем на их основе.

Значительное число исследовательских работ связано с математическим описанием процесса экструзии с учетом фазового состояния полимера и некоторых конструктивных решений сложного канала червяка экструдера.

В представленной работе рассматривается возможность использования экструдера в качестве аппарата для диспергирования гетерогенных растворов полимеров, нашедших некоторое применение в практике ряда химических производств.

В качестве рабочего органа такого экструдера используется червяк типа Майллефера.

В предлагаемой сфере использования подобных червяков, экструдер рассматривается состоящим из трех зон - зоны транспортирования, зоны нагнетания и зоны диспергирования.

Гидродинамика первых двух зон может быть реализована с известными математическими моделями движения для расплавов полимеров, внося коррекцию в уравнение реологического состояния гетерогенной системы.

Описание зоны диспергирования предусматривает использование гидродинамических уравнений и уравнений реологического состояния компонентов гетерогенной системы с учетом специфики Майллеферовского червяка.

В работе приводятся постановка задачи расчета вышеуказанных зон и алгоритм их решения.

A STUDY OF THE PROCESS OF HETEROGENEOUS POLYMER SOLUTIONS DISPERSION IN THE COURSE OF EXTRUSION

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In research and production, the process of extrusion is used as the process ensuring manufacture of profile-extruded items, both from polymer melt and melt-based composite polymer systems.

Quite a number of research papers deal with mathematical description of extrusion process, considering polymer phase state and some constructive solutions of a complex screw channel problem.

The present report considers a possibility of utilizing extruder as a device for the dispersion of heterogeneous polymer solutions which are used in several ways in chemical production. A Maillefer type screw is suggested to be employed as a working unit of such an extruder.

For the suggested sphere of this type of a screw utilization, an extruder should be made up of three zones: transportation, injection and dispersion zones.

Hydrodynamics of the first two zones can be realized with the help of certain mathematical models for polymer melt motion with due adjustments made in the equations of reological state of a heterogeneous system.

The description of the dispersion zone provides for the application of hydrodynamics equations and those of reological state of the heterogeneous system components, with due account of specific features of a Maillefer's screw.

The present report sets the problem of calculating the above mentioned zones, and offers an algorythm for its solution.

ВЛИЯНИЕ ПРИРОДЫ ТЕХНИЧЕСКИХ ЛИГНИНОВ НА РЕОЛОГИЧЕСКИЕ И ФИЗИКО-МЕХАНИЧЕСКИЕ СВОЙСТВА ЖЁСТКИХ ПВХ-КОМПОЗИЦИЙ

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Введение наполнителей в ПВХ-композиции позволяет, наряду с модификацией их свойств, значительно снизить и экономические затраты при производстве материалов на их основе. В этой связи представляется перспективным использование в качестве наполнителей технических лигнинов (отходов целлюлозно-бумажного и гидролизного производств), так как одновременно решается и экологическая задача- утилизация многотоннажных отходов.

Приведены результаты по изучению влияния природы и содержания технических лигнинов (лигносульфоната и гидролизного лигнина) на текучесть, прочность и стабильность жёстких ПВХ-композиций. Текучесть композиций при температуре 18°C оценивали методом капиллярной вискозиметрии.

Установлено, что зависимость эффективной вязкости расплавов ПВХ от количества введённых технических лигнинов носит экстремальный характер. При значительном содержании наполнителя (более 30 м.ч.) существенное влияние на эффективную вязкость расплавов ПВХ-композиций оказывает природа технических лигнинов.

Прочностные характеристики ПВХ-композиций увеличиваются в присутствии технических лигнинов.

Кроме того, показано, что независимо от своего строения технические лигнины даже при небольших содержаниях (до 2 м.ч.) оказывают стабилизирующее действие на ПВХ-композиции- вязкость их остаётся постоянной во всём промежутке времени исследования (0,5 часа).

INFLUENCE OF TECHNICAL LIGNIN NATURE ON RHEOLOGICAL AND

PHYSICOMECHANICAL PROPERTIES OF RIGID PVC-COMPOSITIONS

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The introduction f fillers into PVC compositions allows, along with the modification of their properties, to decrease considerably expenses of the production of based-on-them materials. In this connection, the application of technical lignins (waste of pulp and paper industry, hydrolysis production processes) is promising since, at the same time, the ecological goal - the recovery of multi-tonnage waste - was solved.

The study results of the effect of technical lignin nature and content, e.g. lignosulphonate, hydrolysis lignin, on the fluidity, strength and stability of rigid PVC compositions were discussed. The composition fluidity at 180°C was estimated by the method of capillary viscosimetry.

It was established that the dependence of effective viscosity of PVC melts on the quantity of technical lignins added has an extremal character. With a considerable content of the filler (more than 30 wt. parts) the effective viscosity of PVC-composition melts is effected much by the technical lignin nature.

The strength characteristics of PVC compositions increase in the presence of technical lig ins.

Moreover, it was shown that regardless of their structure, the technical lignins even in small quantities (upto 20 wt. parts) have a stabilizing action on PVC compositions, i.e. their viscosity is constant in the whole period of investigation (0.5 h).

АНОМАЛЬНЫЙ ХАРАКТЕР ТЕЧЕНИЯ РАСТВОРОВ КОМПОЗИЦИОННО-ОДНОРОДНЫХ
СОПОЛИМЕРОВ МЕТАКРИЛОВОЙ КИСЛОТЫ

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Для разработки перспективных технологии получения полимерных материалов широкого спектра назначения важное значение приобретают исследования реологии растворов сополимеров, в том числе содержащие полярные группы (-COOH, -NH₂ и др.), которые оказывают сильное влияние на конформацию макромолекулы.

Предложен технологичный (лаковый) способ получения композиционно-однородных сополимеров бутилметакрилата с метакриловой кислотой глубокой конверсии и рассмотрено влияние жесткости цепи сополимеров на вязкостные свойства их спиртовых растворов.

В данной работе методом ротационной вискозиметрии на микрореометре ИДР-92А изучено течение растворов композиционно-однородных и композиционно-неоднородных сополимеров бутилметакрилата с метакриловой кислотой в области малых напряжении сдвига (τ =0÷1 Па). Обнаружено влияние степени композиционной однородности сополимеров на вязкостные свойства растворов. Показано, что увеличение жесткости цепи сополимеров (за счет увеличения содержания звеньев метакриловой кислоты) приводит к росту вязкости растворов при равных молекулярных массах сополимеров. Для всех исследованных растворов характерно аномально-вязкое дилатантно-тиксотропное течение. Дилатантный характер течения ослабевает с ростом концентрации растворов, независимо от молекулярной массы сополимеров.

ANOMALOUS CHARACTER OF FLOW OF COMPOSITION-HOMOGENEOUS
METHACRYLIC ACID COPOLYMER SOLUTIONS

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In the development of production processes with good prospect
of polymer materials used in various fields, the studies of rheo-
logy of copolymer solutions including polymers with polar group
(-COOH,-NH$_2$ etc.) which effect strongly on the macromolecule
conformation are of a great importance.

A technological (lacquer) method of preparation of composi-
tion-homogeneous butylmethacrylate - methacrylic acid copolymer
of deep conversion was proposed, and the effect of the rigidity
of the copolymer chain on the viscosity properties of their al-
cohol solutions was considered.

By the rotation viscosimetry with using a MDR-92A micro-
meter the flow of solutions of composition-homogeneous and
composition-non-homogeneous butylmethacrylate - methacrylic acid
copolymers was studied in the range of small shear stresses
(τ =0-1 Pa). The influence of the   degree of composition
copolymer homogeneity on the viscosity solution properties was
revealed. It was shown that the increase in the copolymer chain
rigidity (due to the increase in the content of methacrylic acid
units) leads to the rise in the solution viscosity with the same
molecular masses of the copolymers. All the solutions under in-
vestigation are characterized by an anomalous viscous dilatant-
thixotropic flow.The dilatant character of the flow becomes less
pronounced with increasing the solution concentration irrespec-
tive of the copolymer molecular mass.

VISCOSITY PROPERTIES OF MELTS OF POLYMETHYLMETHACRYLATE-
VINYL POLYMER BLENDS

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The modification of commercial polymers is one of methods
for the design of new materials with the predetermined combi-
nation of properties. The goal was to investigate thermomecha-
nical, viscosity and strength properties of blends of polymethyl-
methacrylate (PMMA) with modifiers such as polybutylacrylate (PBA)
or (meth)acrylic copolymers. The blends contain 0-20 mass % of PBA
or 0-10 mass % of the copolymer based on methylmethacrylate, butyl-
acrylate (BA) or butylmethacrylate (BMA). The change in the blend
composition allows to examine the alteration of their properties
on going from limitely compatible to incompatible components.

The investigation of viscosity properties of blends of PMMA
with (meth)acrylic modifiers were carried out in a temperature
range of 190 to 230° C and at strain rates of $10^{-1}-10^4$ s^{-1}. In
the strain rate range studied the systems are characterized by the
anomaly of the melt viscosity (η). The expression generalizing
the dependence of viscosity properties of PMMA-PBA system was
proposed: $\frac{\eta}{\eta_{H.0}} \approx 1-10^{-4} \left(\gamma \cdot \eta_{K5} \right)^{0.8}$

The extremal character of the dependence of the η value of
the composition melt on the modifier content was revealed. The
introduction of the modifier affects the activation energy value
of a viscous flow (E$_a$) of PMMA melt that is associated, probably,
with the peculiarity of the modifier particle distribution in
the matrix of PMMA. The range of shear stress values corresponding
to "creeping" (a plateau in the curve of flow) was discovered.
This phenomenon is characteristic of polymers which are composition
materials and possess high impact strength.

APPEARANCE OF HIGH-ELASTICITY IN METHACRYLIC POLYMERIZING MASSES AND ITS EFFECT ON THERMODYNAMIC PROPERTIES OF FINISHED POLYMER

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It is known that the properties of the finished polymer depend to a considerable extent upon the prehistory of its production, i.e. they are acquired directly in the course of its synthesis. In homophase radical polymerization of methacrylic monomers the high elasticity appears in reaction masses at a certain critical conversion P_{cr2}. The region of high elastic state extends from P_{cr2} to the conversion P_{cr3}. corresponding to the polymerizate vitrification. The concentration extension of the high elasticity region is characterized by $\Delta P = P_{cr3} - P_{cr2}$. The increase in the polymer molecular mass, not affecting P_{cr3}, shifts P_{cr2} into the region of smaller conversions. At the same time the high-elasticity region is extended.

We compared the extension of high elasticity region originated in the process of polymer synthesis and determined by the rheological method with a thermomechanical plateau of high elasticity of the finished polymers. On the base of thermomechanical measurements of molecular masses (10^4-10^6) the extension of the high elasticity plateau was determined from the difference of temperatures of flow (T_{fl}) and glass transition (T_g) i.e. $\Delta T = T_{fl} - T_g$. The dependence of ΔT upon the polymerization degree N is described well by the equation of Kargin-Slonimsky:

$$\lg N = \lg N_c + \frac{B \cdot \Delta T}{C + \Delta T},$$

where N_c is the polymerization degree of a kinetic segment; B and C are empirical constants for the given polymer.

The comparison of relationships $\Delta T(N)$ and $\Delta P(N)$ showed the correlation between them. The quantitative relation between the high-elasticity plateau of the polymers and the concentration extension of the high-elasticity originated in the polymer synthesis process was established.

ТЕХНОЛОГИЯ УПРАВЛЕНИЯ СВОЙСТВАМИ ЭЛЕМЕНТОВ ИЗДЕЛИЯ ИЗ АНИЗОТРОПНОГО ПОЛИМЕРНОГО КОМПОЗИЦИОННОГО МАТЕРИАЛА.

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Многочисленные теоретические и экспериментальные исследования однозначно указывают на определяющее значение ориентирования армирующих дисперсных и волокнистых наполнителей на комплекс деформационно-прочностных свойств анизотропных полимерных композиционных материалов (ПКМ). Реализовать уникальные потенциальные возможности ПКМ на эластомерной основе в элементах изделий, обусловленные способностью к варьированию свойств в пределах порядка, позволяет системное исследование закономерностей ориентирования армирующих анизотропных наполнителей.

В качестве оценочного критерия эффективности ориентирования армирующих наполнителей установлен показатель анизотропии (А), определяемый как отношение значений условного модуля упругости в двух взаимно перпендикулярных направлениях.

Экспериментально определен и эмпирически описан характер изменения показателя анизотропии (А) в зависимости от геометрических параметров наполнителей, профилирующего зазора и прессующего индентора.

Установлена идентичность характера изменения во времени деформационно-прочностных свойств ПКМ в элементах изделия вне зависимости от показателя анизотропии (А).

На основании найденных зависимостей сформирована технология управления свойствами (ТУС) элементов изделия из анизотропного ПКМ, содержащая процессы получения смеси компонента, профилирования детали, формирования заготовки, формования изделия. Предложенная ТУС апробирована в приложении к процессу производства массивных высокоэластичных шин и позволяет при помощи технологических приемов получать различные деформационно-прочностные свойства в зависимости от функционального назначения конструкционных элементов, выполненных из единого анизотропного ПКМ на эластомерной основе.

TECHNOLOGY OF PROPERTIES' CONTROL OF ARTICLE
ELEMENTS FROM ANISOTROPIC POLYMER COMPOSITIONAL
MATERIAL

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Numerous theoretical and experimental investigations point out defining significance of orientation of reinforcing dispersive and fibrous fillers on the complex of strain-tensile properties of anisotropic polymer compositional materials (PCM). System investigation of conformity to natural laws of aniso-diametrical fillers during PCM flow on the elastomeric basis reveals potential opportunities of their properties' varying within the order

As an estimating criterion of reinforcing fillers' orientation efficiency, anisotropy index (A) is fixed, it being defined as the ratio of relative tension modulus values in two mutually perpendicular directions.

Character of anisotropy index (A) changing is experimentally fixed and empirically described depending on geometrical parameters of the fillers, profilling gap and the mould design

Identity of character of changes in time of PCM strain-tensile properties in article elements beyond of dependence on anisotropy index (A) is fixed.

On the basis of revealed dependencies the technology of properties' control (TPC) of article elements of anisotropic PCM is formed, this technology including the processes of mixture preparing, half-finished product profiling and the article moulding. Suggested TPC is approved in an applicarion to the process of solid highly elastic tyres production and allows with the help of technological methods to achieve different strain-tensile properties depending on functional application of design elements, made from anisotropic PCM on elastomeric basis.

RHEOLOGY OF POLYELECTROLYTE SOLUTIONS IN SHEAR AND
CONVERGENT HYDRODYNAMIC FIELDS.

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Rheological behaviour of dilute and semi-delute aqueous solutions of polyacrylic acid (PAA) of different molecular weights ($M = 1,2.10^5$ and 1.10^6) and degree of dissociation (DD) (H-PAA and Na-PAA), and also of a copolymer of acrylic acid with acrylamide ($M = 15.10^6$, NaPAA – 15%) were investigated in conditions of shear and convergent flow.

It was shown, that increasing of DD of polyelectrolyte (PE) macromolecules leads to a corresponding increase of viscosity just as if M was essentially increased. In the most diluted solutions of high molecular weight PE a fluctuation network was observed destroyed by the hydrodynamic fields. In shear fields it is manifested in an abrupt decrease of iscosity with shear rate increasing. The character of concentration dependences of viscosity essentially differs from those one for other polymers and is in accord with the model of crossover of strongly swollen PE coils at high dilutions.

Quite different are dependences of effective viscosity on rate of strain in case of convergent flow. Now a competition of two opposite processes occurs, namely the destruction of the fluctuation network (decrease of η_{eff}) and the uncoiling of macromolecules due to the longitudinal gradient. The contribution of the latter increases with the general increase of intensity of the convergent flow.

УД: 539.3

NUMERICAL SOLUTION OF PROBLEMS ON VIBRATIONAL BENDING OF POLIMERIC PLATE.

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When vibrational deformation of some parts of polymeric material construction takes place it is necessary to take into considiration their reological properties of the material do not depend on temperature then we may have two problems. In the process of the first problem solution stress-strain state is defined and the power of volumetric heat sources can be determined according to them. The solution of second problem gives us opportunity to define temperature distribution.

It is from this point of view that the problem of vibrational bend of rectangular polymeric plate two supported sides of which lie one hinges and two other sides can be fixed arbitrary is considered. Both of the two problems are solved by numerical methods The first two-dimensional problem solved by the division of variables comes to boundary problem for the system of ordinary differential equations of the first order. The former is solved by S.K.Godunov stable numerical method of discrete orthogona'isation. For the determination of the plate field temprature (the second problem) the numerical-analytical method worked out by the authors is used.

The calculations are made 'or three polymeric materials. Different ways of plate sides' fixing are considered.

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ВЯЗКОСТНАЯ ОЦЕНКА СТЕПЕНИ СШИВКИ АКРИЛОВЫХ СОПОЛИМЕРОВ ПРИ НАБУХАНИИ ИХ В ОРГАНОДИСПЕРСИЯХ

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Процесс взаимодействия сетчатых сополимеров с молекулами низкомолекулярного растворителя завершается ограниченным набуханием и зависит от количества поперечных связей в сополимере. В данной работе степень сшивки сополимеров оценена по вязкости их органодисперсий.

Синтезированы методом эмульсионной сополимеризации и выделены низкотемпературной коагуляцией сополимеры трибутилоловометакрилата с метилметакрилатом с различным содержанием сшивающего агента – диметакрилатэтиленгликоля (ДМЭГ) в составе сополимера. Получены 30%-ные органодисперсии сополимеров в изопропиловом спирте.

Течение дисперсий сополимеров, содержащих ДМЭГ от 0 до 4 мол.%, является аномально-вязким – вязкость зависит от режимов деформирования. Так как в данном случае количество поперечных связей в сополимере невелико, молекулы растворителя проникают в фазу полимера, раздвигая отрезки цепей макромолекул. Это способствует набуханию и слипанию частиц органодисперсий.

С возрастанием содержания ДМЭГ в составе сополимера вязкость дисперсий уменьшается. 30%-ные дисперсии с содержанием ДМЭГ от 6 до 10 мол.% приближаются к ньютоновским жидкостям – течение не вызывает изменения структуры. Данные сополимеры имеют высокую степень сшивки, ограничивающую набухание полимера в растворителе.

Исследования вязкостных свойств органодисперсий акриловых сополимеров могут подтверждать и оценивать образование их сетчатой структуры.

ОСОБЕННОСТИ РЕОЛОГИЧЕСКОГО ПОВЕДЕНИЯ РАСПЛАВОВ ГИДРОКСИ_
ЭТИЛЦИАНЭТИЛЦЕЛЛЮЛОЗЫ – ТЕРМОТРОПНО-МЕЗОГЕННОГО ПОЛИМЕРА

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Согласно данным ДСК, рентгеноструктурного анализа и поляризационной оптической микроскопии смешанный эфир целлюлозы – гидроксиэтилцианэтилцеллюлоза (ГЭЦЭЦ, 9,8% азота, 23% гидроксильных групп) обнаруживает в расплаве термотропно-мезогенный жидкокристаллический порядок (ЖКП), который сохраняется в застеклованном состоянии.

Реологическое поведение расплавов (120-220°С) проявляет черты присущие расплавам других жидкокристаллических полимеров. Так, кривые течения характеризуются пределом текучести, значение которого немонотонно снижается с повышением температуры. Но постоянство величины предела текучести в некотором интервале температур (150-170°С) у других систем с ЖКП не наблюдалось. Кроме того, расплавы ГЭЦЭЦ имеют очень высокие значения времен восстановления структуры после прекращения установившегося течения.

Существование выраженного ЖКП у расплавов ГЭЦЭЦ при сравнительно низких степенях этерификации окисью этилена может быть объяснено тем, что введение в макромолекулу цианэтильных групп придает ей повышенную жесткость и способствует усилению межцепных взаимодействий.

PECULIARITY OF RHEOLOGICAL BEHAVIOR OF MELTS OF HYDROXY-
ETHYL CYANETHYL CELLULOSE - THERMOTROPIC MESOGENIC
POLYMER

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The mixed ether of cellulose with low extent of etherification - hydroxyethyl cyanethyl cellulose (HECEC) displays in melts a thermotropic mesogenic order (data of DSC, X-ray diffraction and polarizational optical microscopy). This oder freezes at the temperatures below T_g.

The rheological behavior of melts of HECEC (120-220°C) display traints of thermotropic systems. They posess a yield stress, which value decreases with temperature up to 0 in the isotropic state (190°C). And more over the melts of HECEC in anisotropic state possess a vary high retardation time of renewal of structure.

The liquid crystal order of HECEC can be explained in terms of increasing in figidity of chains and increasing in interchain interaction accoding to introdusing of cyanethyl groups.

Light Scattering from Shear-Induced Defects of Liquid Crystalline Polymers. Experiment and Theory.

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Light scattering and optical microscopy experiment performed during shear flow of liquid crystalline hydroxypropylcellulose and polypeptide solutions are reviewed. A simplified model of the defects created by a weak shear flow is proposed. It consists as disclination loops with a director rotation along the flow direction and given some angle towards a disclination core axis. The corresponding light scattering patterns are theoretically calculated. A good qualitative agreement is found between experiment and theory.

INSTABILITIES AND PATTERN FORMATION IN SIDE-CHAIN POLYMER NEMATIC SOLUTIONS

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Rotation of the director in nematic liquid crystals (for example, at the twist Freederiks transition in the magnetic field) induces a flow of liquid which causes the appearance of convective instabilities. There is a critical value of the field $h_c = H_c/H_F$ corresponding to the appearance of instabilities (where H_F is the Freederiks threshold field). For $h > h_c$, transient periodic patterns are observed because of the formation of oppositely rotating domains. These patterns may be analyzed with polarizing technique due to the periodic director modulation in the direction perpendicular to the field. The periodicity is characterized by the wavelength λ. This paper is focused on the experimental study of pattern formation and measurements of effective twist viscosity for $1 < h < 13$ in dilute solutions of polyacrylate with side mesogenic groups in a low molecular mass nematic liquid crystal (LMLC). The value of λ was found to obey a scaling law $\lambda \propto (h - h_c)^{-\beta}$ with a critical exponent $\beta \approx 1/2$ for LMLC and for all solutions under study. The critical field h_c^2 being determined in such a way was strongly depended on the polymer concentration C within a concentration range $0 < C < 0.01$:

$$h_c^2 \approx 1 + \frac{\eta_2^{solution}}{\gamma_1^{solution}} \propto \frac{\eta_2^{LMLC}(1 + \delta\eta_2/\eta_2^{LMLC})}{\gamma_1^{LMLC}(1 + \delta\gamma_1/\gamma_1^{LMLC})} \propto 1355 \cdot C$$

Obtained data showed that the value of h_c^2 was mainly controlled by the contribution of macromolecules to the shear viscosity $\delta\eta_2$, whereas the contribution to the twist viscosity was negligible, $\delta\gamma_1/\gamma_1^{LMLC} \ll \delta\eta_2/\eta_2^{LMLC}$.

Strong Damping of the Backflow in Nematic Solutions Containing Comb-Like Polymer Molecules

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Rotational viscosity of nematic liquid crystals γ_1 is connected with the rotation of the director without hydrodynamic motion of molecules. However, the director rotation (for example, at the Bend Freederiks transition in the magnetic field) may induce a flow of liquid (backflow). In this case the value of γ_1 is replaced by an effective field-dependent value $\gamma_1^*(h)$ which involves the shear Miesowich viscosity coefficient η_1. The decrease in $\gamma_1^*(h)$ may be very large at the director reorientation in the strong magnetic field $h = H/H_F \gg 1$, where H_F is the Freederiks threshold. For $h \to \infty$, the effective twist viscosity reaches its limiting value $\gamma_1^*(\infty) = \gamma_1(1 - A)$, where $A \approx \gamma_1/\eta_1$.

This paper is focused on damping of the backflow for nematic solutions containing polymethacrylates with side mesogenic groups in a low molecular weight nematic liquid crystal (LMLC). In our experiments, the ratio of $\gamma_1^*(h)/\gamma_1$ was measured as a function of h. It has been shown that no viscosity reduction occurs for polymer solutions ($\gamma_1^*(h)/\gamma_1 \approx 1$), whereas for LMLC $\gamma_1^*(h)/\gamma_1$ is normally $\ll 1$.

This result was explained by the decrease in the parameter A, i.e. the shear viscosity coefficient η_1 of solutions was more sensitive to the presence of polymer molecules than the twist viscosity coefficient γ_1.

ABSTRACT

Paper for the 17th International Regional Symposium on Rheology "The interrelationship between the kinetic characteristics, structure and properties of rubber compounds filled with a silica filler".

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Using a Monsanto type rheometer, kinetic characteristics of the curing process (scorching beginning time – $\mathcal{C}_s$, time of achieving the cure optimum – $\mathcal{C}_{90}$ and cure rate – V) have been determined for rubber compounds based on styrene-butadiene rubbers modified by functional groups and NR (ENR-25), filled with silica fillers (SF) differing in dispersity and surface chemistry.

It is shown that at a certain combination of functional groups (amide, carboxyl, epoxide) with a different SF type there is improvement in curing characteristics of rubber compounds, which offers an opportunity to solve a complicated technical task, i.e. "to lower scorching in rubber compounds based on modified rubbers", e.g. SKS-30 Am (with amide groups) – SF of the Zeosil grade; ENR-25 – Zeosil; ENR-25 – SF of the BS-120 grade.

The effect of molecular chains modification by functional groups on interfacial interaction (IFI) "rubber-SF" has been studied.

It is established that as IFI increases, improvement in elastic-strength and hysteresis properties of cured rubbers is observed.

Rheological Characteristics Required for Thermoforming of Hihg-Impact Polystyrene

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We have researched experimentally shear and elongation deformation of various hihg-impact polystyrene (HIPS) trade marks and thermoelastoplastic modified HIPS, used for refrigerator details thermomoulding. Shear deformation was investigated on the Gettfert capillary viscosimeter at 190 C at the capillary with length/diameter ratio 40/2.

Elongation deformation was researched under the constant force at 150 C in a silicon oil bath under the initial elongation stress of 84 g/sm . All the studied materials had the same shear curves and different behavior under elongation deformation. We used the following characteristics for analyzing materials behavior under elongation deformation:

elongation index - elongation time, for which the sample achieved the certain value of deformation E (in our case E=5) under above mentioned conditions;

melt durability and fracture deformation E under the initial elongation force is 100 g/square sm.

The obtained results are shown in the table:

Materials \ Characteristics	Styron 457 Dow Chemical	HIMP-703E	HIMP-803E	modified HIPS-703E 1	2
Elongation Index, s	68	70	75	108	82
g/sm	180	174	126.5	190.5	160
	7.3	7.1	5.4	7.9	6.6

It is seen that HIMP-803E elongation behavior is practically identical to the Dow Chemical analog, and HIMP-803E has durability and deformation at fracture oment of about 30% higher than the values of HIMP-703E. Modified HIPS-703E has durability values hi er than the values of HIMP-703E virgin polymer at about 26-46%.

So we have observed that elongation behavior of the researched HIPS differ for various trade marks, modified HIPS and Styron-457, Dow Chemical, while the sam es strain-strengh properties in solid state and shear behavior are similiar. We can consider HIPS-803E to be an analog of Styron-457, used for refrigerator details manufacturing. Thermoelastoplastic modification improves strain-strengh properties of HIPS-703E trade mark. We consider that melt index, elongation index, melt durability and fracture deformation can be criteria of a polymer ability to deep extension at refregerator details thermomoulding.

ПЕРЕХОДНЫЕ СДВИГОВЫЕ ТЕЧЕНИЯ РАСПЛАВОВ ЖИДКОКРИСТАЛЛИЧЕСКИХ ПОЛИМЕРОВ

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Изучены особенности деформирования термотропного полиэфира с мезогенными группами в основной цепи в условиях предстационарного режима течения. В качестве объекта исследования был выбран полностью ароматический сополиэфир - терефталоил-бис-окси-бензоат резорцина и фенилгидрохинона. Измерения касательных напряжений (τ) и первой разности нормальных напряжений (N₁) проводили на ротационном вискозиметре ПИРСП-2 с рабочим узлом "конус-плоскость"в режиме постоянных скоростей сдвига (γ̇). Вискозиметр снабжен электромагнитной муфтой для обеспечения практически мгновенного перехода от состояния покоя к процессу деформирования.

После начала деформирования значения τ и N₁ изменяются не монотонно, а проходят через максимум, а N₁ - через минимум, при этом величины деформаций, отвечающие τ_{max} и N_{1min}, практически не зависят от γ̇ и температуры, а глубина минимума N₁ не зависит от γ̇.

В работе сделана попытка объяснить особенности развития τ и N₁ влиянием механической предыстории ЖК-расплава. Моделируя последнюю изменением (увеличением или уменьшением) расстояния между конусом и плоскостью, получили характерные пары зависимостей τ(γ̇) и N₁(γ̇). Было установлено, что минимум N₁ возникает только при уменьшении рабочего зазора перед началом деформирования, а его глубина прямо зависит от степени этого уменьшения. Величина минимума возрастает со снижением жесткости измерителя нормальной силы и увеличением уровня N₁ в предшествующем сдвиге. Полученные результаты позволяют предположить , что особенности развития τ и N₁ обусловлены начальной ориентацией жестких макромолекул и их доменов в расплаве.

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ЭФФЕКТЫ УПРУГИХ ДЕФОРМАЦИЙ ПРИ ФИЛЬТРАЦИОННОМ
ТЕЧЕНИИ РАСТВОРОВ ПОЛИМЕРОВ

Л.А. Погребняк, В.Г. Погребняк

Среди попыток объяснить природу эффекта, заключающегося в "аномальном" сопротивлении пористой среды течению растворов полимеров, особое место занимает подход, основанный на деформационном воздействии гидродинамического поля на макромолекулы /1-3/. Однако результаты, полученные для растворов полиэлектролита в слабо минерализованной воде, свидетельствующие о более высокой, чем у растворов неионогенных полимеров их нефтевытесняющей способности из пористой среды, ставят под сомнение определяющую роль эффектов упругих деформаций в механизме полимерного нефтевытеснения. Высокая нефтевытесняющая способность растворов полиэлектролита /в отличие от растворов неионогенных полимеров/ проявляется в широком диапазоне расходных скоростей, включая и самые малые, когда заведомо деформация макромолекулярных клубков мала. Всё это и обусловливает скептицизм в отношении сильного деформационного воздействия гидродинамического поля фильтрационного течения на макромолекулы.

Фильтрационное течение, также как и турбулентное, несмотря их сложность, можно свести к суперпозиции двух видов течений - со сдвигом и растяжением /2/. Поэтому, изучив проявление деформационных эффектов в условиях преимущественно продольного и сдвигового течений, т.е. разделив вклады в сопротивление пористой среды продольного и сдвигового течений, можно прояснить вопрос о роли эффектов упругих деформаций в явлении нелинейной фильтрации растворов полимеров и, естественно, в механизме полимерного нефтевытеснения.

Полученные экспериментальные данные позволили сделать вывод, что понимание и описание нелинейной фильтрации растворов полимеров лежит через изучение больших обратимых /а также необратимых/ упругих деформаций макромолекул в потоках с растяжением. Прояснен вопрос о механизме "аномального" сопротивления пористой среды и выравнивания фронта вытесняющей полимерной жидкости при нефтедобыче.

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ДЕГРАДАЦИЯ ВОДНЫХ РАСТВОРОВ ПОЛИЭТИЛЕНОКСИДА
И ПОЛИАКРИЛАМИДА В РАСТЯГИВАЮЩЕМ ГИДРОДИНАМИЧЕСКОМ ПОЛЕ

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Выяснение причин, вызывающих деградацию полимера при гидродинамическом воздействии, необходимое для разработки методов борьбы с отрицательным её влиянием на эффективность практического их использования, требует исследований в двух направлениях. Первое направлено собственно на выяснение механизма изменений структуры раствора полимера на молекулярном и надмолекулярном уровнях, который может иметь как физическую, так и химическую природу, и второе - на расшифровку структуры полимерных молекул, побывавших в гидродинамическом поле. Эти два направления взаимно связаны: зная механизм изменения структуры полимерной системы, можно предполагать конечную структуру макромолекул, и наоборот, установив строение видоизмененной в гидродинамическом поле молекулы полимера, можно представить путь, который привел к такой трансформации структуры. Эти подходы и реализованы в работе, использовав для этого большое число физико-химических методов, что позволило изучить особенности влияния гидродинамических полей на молекулярные и межмолекулярные взаимодействия в растворах, структуру и конформацию макромолекул.

Полученные результаты позволили предложить схему деградации растворов ПЭО и ПАА под действием растягивающего гидродинамического поля. Необходимым условием для деградации полимерного раствора в гидродинамическом поле является сильное деформационное воздействие поля на макромолекулярные клубки. Несмотря на то, что усилия, реализуемые в потоке с продольным градиентом скорости при скоростях, когда наблюдается деградация, вполне достаточные для механического разрыва полимерной цепи, разрыву подвергается лишь небольшая часть макромолекул. Последнее согласуется с полученными нами ранее данными о неполном разворачивании макромолекул в сходящемся потоке, степень разворачивания которых не превышает 60%. Доказано, что преимущественный вклад в деградацию полимерных растворов вносят образующиеся радикалы, вступающие в реакции рекомбинации, в результате которых образуются полимерные сшивки между участками одной и той же цепи или разных цепей макромолекул.

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ABOUT REASONS FOR INFRINGEMENT OF THE TIME-TEMPERATURE REDUCTION PRINCIPLE FOR FILLED RUBBERS

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According to the data available in literature the principle of time-temperature reduction is observed for dynamic properties of filled rubbers. Nevertheless, the shifts ($\log a_T$) along the $\log \omega$ axis (ω - frequency) which are necessary to bring into coincidence the curves obtained at different temperatures are different for dynamic modulus $E'(\omega)$ and loss modulus $E''(\omega)$ which contradicts the basis of this principle.

Such situation cannot be explained by nonlinearity of viscoelastic properties of filled rubbers as the calculations made show that in this case $E'(\omega)$ and $E''(\omega)$ depend on ω only through the product of ω into τ (τ is relaxation time) and, consequently, $\log a_T$ must be the same for both viscoelastic functions.

The reason for such behavior of filled rubbers is connected with the following circumstance. On reduction before the shift along the frequency axis the measured values are multiplied by kinetic factor T_0/T , where T_0 and T are absolute temperatures of reduction and experiment accordingly. This is correct only in the case when equilibrium and nonequilibrium moduli are proportional to absolute temperature. For unfilled elastomers it is really so. But for filled rubbers, as the measurements taken by us show, the equilibrium modulus that makes a considerable part of $E''(\omega)$, changes with temperature by the law $E_\infty = a + b \cdot T$ where a is positive and depends on the level and type of the filler. Owing to this, $E'(\omega)$ frequency dependences obtained at different temperatures, after mutiplication by T_0/T, are moved apart along the Y-axis in a greater degree than it is necessary in the physical sense. This results in higher value of $\log a_T$ for $E'(\omega)$ as compared with $E''(\omega)$ which doesn't comprise E_∞ .

УДК 532.135

РЕОЛОГИЧЕСКИЕ СВОЙСТВА ОПТИЧЕСКИХ ПОЛИМЕРОВ ДЛЯ СВЕТОПРОВОДЯЩИХ ВОЛОКОН

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Полимерные биокомпонентные оптические волокна (ПОВ) находят широкое применение в измерительной технике, медицине и автомобилестроение. В настоящее время наиболее перспективными являются ПОВ с ядром из полиметилметакрилата (ПММА) и оболочкой из полифторакрилатов и фторопластов. При соэкструзии ПОВ важное значение имеют реологические свойства их расплавов. Объектами исследования были ПММА с $\bar{M}_N = 1 \cdot 10^5$, 2,2,3,3-тетрафторпропилметакрилат (ПМН-1) с $\bar{M}_N$ 2,45·10^5 и фторопласт марки Ф-400. Исследования проводили методами ротационной и капиллярной вискозиметрии. Установлено, что при использовании полимера Ф-400 в качестве оболочки вязкость его расплава в аномальной области примерно в 4 раза выше, чем у полимера ядра (ПММА). При этом различие вязкостей в ньютоновской области возрастает до 10 раз. Для пары ПММА-ПМН-1 вязкость расплава полимера оболочки (ПМН-1) в аномальной области ниже вязкости полимера ядра примерно в 3 раза. Но при скоростях сдвига, близких к ньютоновским, это разница уменьшается до 1,2. Исходя из необходимого соотношения вязкостей расплавов (вязкость полимера ядра должна быть выше либо в крайнем случае равна вязкости полимера оболочки), полученные данные позволяют выбирать при формовании ПОВ оптимальный скоростной режим экструдирования. При касательных напряжениях менее 3·10^5 Па высокоэластичность расплавов рассматриваемых полимеров, оцениваемая по раздутию струи, примерно равна. Но с увеличением напряжения высокоэластичность ПМН-1 резко возрастает. Это необходимо учитывать при конструировании коаксиальной фильеры и выборе температурно-скоростных параметров соэкструзии ПОВ во избежание отслоения оболочки от ядра волокна.

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СТЕРИЧЕСКИЙ ФАКТОР ПРИ САМОПРОИЗВОЛЬНОМ УДЛИНЕНИИ ПЭТФ ПОД ДЕЙСТВИЕМ ЖИДКОЙ СРЕДЫ

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Пористая структура аморфно-кристаллических полимеров, образующаяся при одноосном растяжении плёнок в активной среде чрезвычайно лабильна, изменяется при сушке, термообработке, контакте с жидкостью или паром /1/. Важной специфической проблемой реологии и технологии переработки полимеров является стабилизация структуры пористых плёнок и волокон, запасающих при деформации значительные внутренние напряжения, способных к большим обратимым деформациям и самопроизвольному удлинению /2/.

Измеряли линейные размеры (x,y,z) образцов аморфного неориентированного ПЭТФ в исходном состоянии, во время вытяжки, после термообработки в воде. Установлено, что приращению объёма полимера при вытяжке строго соответствует количество поглощенной плёнкой адсорбционно-активной среды. Объем образцов сокращается при вытяжке более 250%.

Стабилизация пористой структуры достигается термообработкой вытянутого полимера в воде, сопровождающейся самопроизвольным удлинением (СПУ) на десятки процентов, уменьшением линейных размеров на 10-15% по толщине и 15-20% по ширине. Показана существенная зависимость процесса СПУ от начальных линейных размеров образца ПЭТФ, отражающая решающую роль стерического фактора в эффекте СПУ ПЭТФ. Исходя из величины СПУ и начальных линейных размеров образца, установлена возможность расчета количества микротрещин на единицу длины образца как функции степени вытяжки и средней ширины крейзов.

Структурный механизм самопроизвольного удлинения включает: 1) коагуляцию фибрилл, 2) кристаллизацию ориентированной и неориентированной части полимера и продольно-поперечный перенос структурных элементов полимера, проявляющийся при повышенных температурах обработки. Предложена модель стерических изменений в структуре микротрещин при термообработке в жидкой среде.

Изложенные особенности реологического поведения аморфно-кристаллического полимера должны учитываться при стабилизации пористой структуры и могут быть использованы для разработки технологии новых сорбентов органических и неорганических веществ.

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THE STERIC FACTOR UNDER THE SPONTANEOUS EXTENSION OF THE PATF AT THE ACTION OF FLUID MEDIUM

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A porous structure of the amorphous-crystal polymers, which is formed by a single-axis tension of the films in active medium, is rather labile, it changes under drying, heat-treating and making a contact with a fluid or vapor /1/. One of the most important and specific problems of the rheology and technology of the polymers processing is the stabilization of the structure of porous films and fibers, storing a great internal stress under deformation and having the ability to great reversible deformation and spontaneous extension /2/.

The linear dimentions (x,y,z) of the samples of amorphous inoriented PATF were measured in a starting state, during the elongation and after water heat treatment. It is established that increment of the polimer's volume under elongation corresponds rigorously to the quantity of adsorptive-active medium, absorbed by the film. The volume of the samples is reduced under the elongation more than 250 %.

The stabilization of porous structure is reached by water heat treatment of the elongated polimer, which is accompanied by the spontaneous extension (SPE) tens per cent and the decrease of linear dimensions of thickness 10-15 % and width 15-20 %. A substantial dependence of the process of SPE on the starting linear dimensions of the sample of PATF is shown, and reflects a great role of the steric factor in the effect of SPE of PATF. Taking the quantity of SPE and starting linear dimensions of the sample, the opportunity to calculate the quantity of microcrtacks per unit of length of the sample is established, as the function of the degree of elongation and average width of crazes.

A structural mechanism of the spontaneous elongations includes: 1) the coagulation of fibrils, 2) the crystallization of the oriented and inoriented part of the polymer and longitudinal-lateral transfer of structural elements of the polymer, which is exhibited under the high temperatures of treatment. The model of steric changes in the structure of crazes under the heat treatment in fluid medium is suggested.

The presented peculiarities of rheological behavior of the amorphous-crystal polymer must be taken into account under the stabilization of porus structure and can be used for the development of the technology of new sorbents of organic and inorganic substances.

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Formation and rheological behavior of thermoplastic elastomers based on carboxil containing poly(dimethylsiloxanes) in the absence and with the presence of metal ions.

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Reversible physical networks of thermoplastic elastomers can be formed in polymers with flexible backbone and functional side or end groups either without phase separation, through hydrogen bonding and electrostatic interactions between these groups, or through domain formation at microphase separation. The particular case of domain formation occurs in ionomers (the polymers with non-polar backbone and small amount of polar side groups) due to their neutralization with metal ions.

In the present work the reversible network formation preceded by the association was studied in poly(dimethylsiloxane) containing small amount of side or end carboxyl (COOH) groups (PDMS-C) by means of the measurement of its rheological properties.This study was carried out both in the absence and on the introduction of metal ions.

The specific feature of physical structure formation in PDMS-C via interaction between COOH-groups themselves (networks 1) consists in the viscosity increase and arising of rubber-like elasticity upon temperature rise. The G', G''- ω plots measured at different times and temperatures characterize the transitions from viscous to elasto-viscous, viscoelastic and rubber-like bodies. The physical nature of the networks formed is confirmed by the decrease of their elasticity modulus upon subsequent temperature increase, as well as by the irreversible creep of the networks at high temperatures. The decrease of elasticity modulus is less intensive in the high frequencies region.

Cooling to ambient temperature leads to the stable rubber-like network formation whose elasticity modulus is the greater the higher was the temperature and the duration of previous heating.

Heating is necessary also for the network formation through the interactions of PDMS-C with metal ions. Depending on the nature of the metal ion both ionic and coordination bonds are formed, that manifests itself sharply in the rheological properties of thermoplastic elastomers (network 2). The elasticity moduli of networks 1 and 2 are close to each other but networks 2 are considerably more stable against heating and in the case of Ni^{2+} their behavior approaches to that of covalent networks.

The complex of the rheological properties of the networks studied is analyzed from the standpoint of our suggestion about formation of intramolecular bonds between COOH groups during polymer synthesis in solution and their rearrangement into intermolecular bonds during heating.

REOLOGICAL PROPERTIES OF GAS-CONTAINING HETEROPHASE THERMOPLASTICS BLENDS

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Rheological properties of LDPE-PS and gas-containing blends have been studied. Asodicarbonamide (ChHZ-21) was used as a foamer. The investigations with capillary viscometer "Rheograph 1000" ("Göttfert",Germany) in shear rates range of $1.4 \div 724\ s^{-1}$ were carried out. Some experiments with microviscometer "MB-3M" (R Ac Sci) used as a dilatometer were made to compare the data obtained for static conditions with ones obtained under shear deformation.

The apparent viscosity ,swelling ratio and density of the extruded samples were determined. For the foamed extrudates the foaming coefficient (the ratio of whole foamed sample volume to the pure polymer volume) and the quality of the cellular structure also were determined. The critical pressures (P_{cr}) below which discharge of gas in free phase occurs were obtained.

It was ascertained that none of the above values were the additive dependences on the blends components content. The flow curves of the investigated samples with and without porofor were practically the same for pressures $P > P_{cr}$. But for $P < P_{cr}$ the apparent viscosity of gas-containing blends was higher. P_{cr} dependences on the components content in the blends, obtained at static and dynamic experiments, are higher than calculated additive dependences. It should be noted that P_{cr} values obtained under shear deformation in all the cases were higher than the values obtained for static conditions.

At shear rates increasing the character of the apparent viscosity dependences on the components content vary from the curves with minimum and maximum to the curves with the only minimum. The above maximum (for approximately 10% content of PS in the blend) is seen essentially well on the obtained swelling ratio dependences on components content . The later dependences characterize the elastic properties of the investigated blends melts. For PS contents of about 10% the foamed samples are of the best quality (have uniform fine-cellular structure) however the foaming coefficient is slightly less (approximately on 7%) than that for pure PE. Foaming coefficient decreases sharply when PS content increses till 50% and changes very little at further PS content increasing.

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INVESTIGATION OF ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE DEFORMATIONAL PROPER IES DURING THE PROCESSING AT TEMPERATURE ELOW MELTING POINT.

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Deformational properties of ultra high molecular weight polyethylene (UHMWPE) have been studied in connection with the production articles from this polymer by forging at temperature 10-30 K below melting point. Forging process have been modeled by compression of UHMWPE samples. The investigated samples have the best deformational properties at temperature 403 K.

The specific form of forging samples makes their testing under different methods of loading difficult. The correlation between the structure and microhardness of samples was investigated and the perspective of estimating properties of forging articles according to their microhardness was shown.

The microhardness of the UHMWPE samples deformed in the process of forging was measured in the tangential and radial directions (MHt and MHr accordingly) on the sample surface. Analysing the results of measurements for the microhardness of the UHMWPE forged samples it should be noted that the microhardness v. ue, depending on the degree of orientation and strengthening of the samples, is higher in the tangential direction, compared with the radial one. The latter testifies to the formation "c-axial" texture in the tangential direction where the axis "b" is located radially but the axis "a" - is directed perpendicularly to the compressed surface. While measuring the values of microhardness along the radius of the deformed UHMWPE samples, the values MHt and MHr correspondingly were found to be increased as far as they moved off from the centre of the sample, the value MHt having the higher meaning than MHr one.

Strengthening of the articles in the most loaded parts can be achieved in the forging by the proper billet and construction.

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THE NUMERICAL PREDICTIONS of the FEATURES of DEFORMATION PROCESSES UNDER COMPACTING and EXTRUSION of VISCOUS . M . BLE MATERIALS

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For studying the processes of deformation of powder materials under SHS compaction and analyzing nonisothermal flow of compressible media in various zones of equipment nonisothermal rheodynamic models are used, whose basic parameters are temperature, macroscopic density, velocity and stresses in material.

In the region of high-temperature ($T \approx 2000-3000^\circ K$) the powder materials behave as high-viscous liquids (viscous coefficient are from 1 MPa*s to 100 GPa*s). The high initial porosity is unique to such materials (up to 50%). The characteristic property of these materials is the existence of two viscosity coefficients - volumetric and shear ones, wich depend on porosity, temperature and deformation conditions. The stress-strain state of such materials under SHS-compaction and extrusion with consideration for the initial porosity and temperature distributions of the volume is investigated in the work.

Analytical solutions of the problem of one-sided compression and extrusion of powder materials are found wich enable us at a qualitative level to establish different regimes of compaction and extrusion and to find criterial conditions for their realization. A numerical analysis of the influence of the nonuniformity of the thermal regime and the conditions of heat transfer on the regularities of compaction and extrusion of material is performed.

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The URGENT PROBLEMS of HIGH-TEMPERATURE RHEODYNAMICS
in TECHNOLOGY of POWER SHS-COMPACTING of POWDER MATERIALS

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The variants of technology of self-propagating high-temperature synthesis (SHS), combining combustion and mechanical action upon the heated product - SHS-compaction - are finding ever application for producing of materials and articles of different purposes from refractory inorganic compounds. The characteristic temperature range of forming the materials is rather wide: ranging from the combustion temperature to the recrystallization temperature.

In the temperature region of our concern SHS-materials are specific rheological objects, the behaviour of that has been scantily known so far.

The results of experimental investigations of forming the structure and properties of materials and products are presented in the paper, and possibilities of controlling the structural variations at the synthesis and shaping phases are investigated. The problems are being considered to develop the measurement methods for the main rheological characteristics of the SHS-materials and their dependence on the porosity, temperature and deformation conditions.

The types of viscosimetric flows wich admit a simple experimental realization, allow to obtain information on dilatational and shear viscosities, are described by relatively simple and readily solved equations have been proposed. The math of mathematical modeling of the heat and deformation processes of SHS-compacting are considered. It is shown how the models developed facilitate solution of practical problems of producing the concrete items.

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ОСОБЕННОСТИ РЕОЛОГИЧЕСКОГО ПОВЕДЕНИЯ СМЕСЕЙ ПОЛИЭТИЛЕНТЕРЕФТАЛАТА С ЖК-ПОЛИЭФИРОМ.

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Исследовано реологическое поведение смесей полиэтилентерефталата(ПЭТФ) с жидкокристаллическим полиэфиром - сополимером этилентерефталата с п-оксибензойной кислотой (ПЭФ-I) в области температур,соответствующих полностью нематическому расплаву ПЭФ-I. Содержание ЖК-полимера в смесях составляло от 5 до 90% масс.

По характеру реологического поведения смесей можно выделить две области концентрации ПЭФ-I. Первая - ниже 10% ЖК-полимера. В этой области существенный вклад в течение смеси вности ПЭТФ. Во второй области (концентрация ПЭФ-I больше 10%) резко возрастает аномалия вязкости смесей.При этом в широком диапазоне напряжений сдвига ПЭФ-I оказывает основное влияние на характер течения смесей.

Концентрационная зависимость вязкости смесей ности экстремальный характер с максимумом , соответствующим 70%-ному содержанию ЖК-полимера. Во всем диапазоне концентраций ПЭФ-I вязкость смесей оказывается выше аддитивных значений.

Оптическим интерференционным микроскопическим методом установлена высокая совместимость ПЭФ-I с ПЭТФ в смеси.Растворимость ЖК-полимера в ПЭТФ составляет почти 10%. Методом ИК-спектроскопии обнаружены структурные и конформационные изменения в цепях макромолекул компонентов смеси по сравнению с исходными материалами. Таким образом установленные особенности реологического поведения смесей ПЭТФ с ПЭФ-I могут быть объяснены диффузионными процессами, а также реакциями межцепного обмена,протекающими в межфазном слое и приводящими к образованию блок-сополимеров с повышенной совместимостью.

PECULIARITIES OF RHEOLOGICAL BEHAVIOUR OF BLENDS CONTAINING POLY(ETHYLENE TEREFTALATE) AND A LIQUID CRISTALLINE COPOLYESTER

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Rheological properties of blend containing poly(ethylene tereftalate) and a liquid crystalline copolyester-copolymer of ethylene tereftalate and p-hydroxybenzoate (PET/PHB) have been investigated in the temperature region corresponding to fully nematic melt of PET/PHB. The PET/PHB content was varied from 5% to 90% by mass.

Two region of the PET/PHB concentrations may be distinguished by rheological behaviour of blends. Flow of blends containing less than 10% PET/PHB is significantly affected by PET. Whereas flow of blends containing more than 10%PET/PHB mainly contributed by the liquid crystalline component

It has been established that the concentration dependance of blend melt viscosity has a maximum around the 70% PET/PHB content, i.e. positive deviation from additivity over the whole range of the PET/PHB concentrations takes plase

It was found by optic interference microscopic method that limits compatability occurs in this system. Solubility of PET/PHB in PE constitutes bout 10%.

By IR spectroscopy it was detected that changes in conformation and structure of macromolecules take place in blends in comparison with pure polymers.

From results obtained one may suggests that peculiarities of rheological behaviour of PET-PET/PHB blends are explained by diffusion processes and transesterification reactions going interphase layer and resulting in formation of copolymers posessing by improved compatability.

RHEOLOGICAL PROPERTIES OF METHYLCELLULOSE SOLUTIONS IN BENZYL ALCOHOL

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It is well known that in production of vacuum fluorescent displays in electronic industry ethylcellulose solution in terpineol is widely used. Due to a number of existing shortcominds (bad solubility of ethylcellulose, polymer unfall burning out, unstability of solutions rheological properties time) there is a necessity of an alternative system based on other polymers and solvents.

From a big class of studied systems based on simple and complex cellulose ethers a new structure on the basis of methylcellulose and bensyl alcohol was used. This system meets all the requirements submitted to polymeric binders in electronic industry.

The complex of physics chemical method of investigation resulted in foundation of the composition concentrations methylcellulose – benzyl alcohol. It was found out that in their rheological properties the system was identical to the traditional system.

The studies system possesses necessary values of viscosity. Solution flow curves are realized in a wide range of viscosity integrals ($\lg Dr=-0.4 - +2.4 (s^{-1})$)) and in their character are similar to the Newton ones. However it is observed a definite increase of viscosity in small deformations field caused by existence in there composition structures having small fluidity limits. This fact can be regarded as most significant because polymeric binders being coated on the plate surface should posses some form stability. Methylcellulose solutions in benzyl alcohol are homogeneous easily solutable and stable within longterm storage. We should point it out that the concentration necessary for pastes rheological parameters is 1.5 - 2.0 times less than in case of ethylcellulose.

The decrease of polymer concentration in composition leads accordingly to the reduction of zol remainders after pastes urning out. We also observe decrease of thermal decomposition temperature in case of this system.

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Определение критического давления при вынужденном течении газогранульных композиций.

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Независимое движение гранул, возникающее вследствие трения их о поверхность сердечника червяка, друг о друга и о стенки винтового канала можно рассматривать как вынужденное сдвиговое течение газогранульной смеси, подчиняющееся закономерностям теории движения смесей газов с твердыми частицами [1,2,3].

Макроскопическое поведение такой системы описывается дифференциальными уравнениями сохранения энергии, массы и момента количества движения.

Действующие в газогранульной смеси нормальные напряжения возникают вследствие суммирования кинетической энергии гранул, ударяющихся о стенки канала, с кинетической энергией соударения гранул между собой. Обе эти величины являются следствием существования флуктуационной составляющей скорости, рассчитываемой как произведение частоты соударений на величину среднего расстояния между частицами, зависящего от объемной концентрации гранул.

Такой подход позволяет рассчитать давление, развивающееся в момент формирования твердой пробки, когда достигается критическая объемная концентрация, при которой относительное движение гранул невозможно, а также определить необходимую длину винтового канала.

Зависимость критического давления на начальной стадии формирования пробки, имеет вид:

$$Po = Kc * [3,14 * (1 - h/D)] * D * N * g$$

Здесь D и h соответственно наружный диаметр и глубина винтового канала, м; g-плотность гранул, кг/м ; N-частота вращения, 1/с.
Kc = 49,9-цилиндрические гранулы; Kc = 36.8-сферические гранулы.

Проверку полученных зависимостей производили на экструдерах с диаметрами червяков 19 и 63.5 мм. В экспериментах использовали цилиндрические гранулы ПЭВД и ПВХ размером 3*4 мм, а также порошкообразный ПЭВП со сферическими частицами 0.15-0.3 мм.

Сопоставление экспериментальных и расчетных данных показывает, что предложенная модель удовлетворительно описывает зависимость критического давления и длины участка формирования пробки от параметров процесса и конструктивных характеристик червяка.

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The Influence of Small Doses of Trifluoroacetic Acid on the Structure and Rheological Properties of Acetate Cellulose Concentrated Solutions.

Fedusenko I. V., Shipovskaya A. B., Timofeyeva G. N.

Previously it was found out that the presence of trifluoroacetic acid in acetate cellulose solutions exerts significant influence on the structure of dissolved and concentrated solutions. Taking into consideration the intensity of trifluoroacetic acid influence on the polymer structure as well as its aggressive character we have performed studied aimed at studying microqualities (0.006 - 0.8 % polymer weight) influence of the above mentioned solvent on the structure and rheological properties of acetate cellulose.

The Study of acetate cellulose rheological properties revealed that the viscosity of 27 % concentrated solutions in case of addition of trifluoroacetic acid in in the amount of 0.2 mg/eV and higher, up to 2 mg/eV, sharply decrease from 2100-2300 poise /20°C/. Flow characters maintain their ordinary form peculiar to polymeric concentrated solutions. Such significant decrease of viscosity accomponied by trifluoroacetic acid additions has allowed to increase by 2% the concentration of acetate cellulose spinning solutions for thread forming. The thread formed from acetate cellulose solutions with trifluoroacetic acid microadditions reveals physics and mechanic indices much better than in case of control acetate threads. Concurrently with 20-25% increase of breaking strength variation coefficientof breaking strength and breaking elongation decrease over 2 times.

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EFFECT OF DECREASING VISCOSITY OF DILUTED SOLUTIONS OF NITROGEN-CONTAINING POLYELECTROLYTES IN COURSE OF TIME

V. I. Fomina and V. I. Klenin

Viscosity of aqueous and aqueous/salt (1M KCl) solutions of dimethylamino ethyl methacrylate hydrochloride and acrylamide (DMAEMA·HC + AA) copolymers of different compositions at temperature ~25° C in course of time has been studied. It has been shown that viscosity number decreases when keeping solutions in air, nitrogen, in the presence of an antimicrobe additive (sodium azide) and when preparing solutions on the base of water purified from diluted gases (O_2 and CO_2) and microorganisms by boiling.

It has been established that viscosity number of aqueous solutions of DMAEMA·HC + AA decreases significantly for samples containing high number of acrylamide links. It has been shown that η_{spec} /C (where spec = specific) of aqueous and aqueous/salt solutions of a DMAEMA·HC homopolymer doesn't change in course of time.

It has been found that increasing the copolymer concentration, introducing an acid (1 M HCl) to pH = 2-3 for aqueous solutions and to pH = 4.0-4.5 for aqueous/salt solutions and decreasing the temperature of solution keeping (to 6°C) result in stabilization of solution viscosity in course of time.

Using the methods of potentiometry and viscosimetry (η_{spec} /C - pH) it has been found that the solutions of copolymers given show properties specific of polyampholytes depending on time of solution keeping. Decreasing solution viscosity while keeping solutions over a long period of time (to ten days and more) is explained with hydrolysis of DMAEMA·HC + AA acrylamide links that apparently leads to formation of complexes between copolymer carboxylate and cation groups.

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СРАВНИТЕЛЬНОЕ ИССЛЕДОВАНИЕ ТЕЧЕНИЯ ЖИДКОКРИСТАЛЛИЧЕСКИХ ПОЛИМЕРОВ ЧЕРЕЗ ЦИЛИНДРИЧЕСКИЕ КАПИЛЛЯРЫ И ВОЛОКНИСТЫЕ МАТЕРИАЛЫ

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Жидкокристаллические (ЖК) полимеры и их смеси с термопластами применяются для получения изделий литьем под давлением, экструзией и в качестве связующих в армированных пластиках. Поэтому важно знать закономерности их течения через цилиндрические каналы и волокнистые пористые среды. Этому вопросу посвящена настоящая работа.

В качестве ЖК-полимеров использовали сополиэфиры п-оксибензойной кислоты и полиэтилентерефталата с разным соотношением компонентов и их смесей с поли-4-метилпентен-I (ПМП). Изучали течение полимеров на капиллярном вискозиметре через капилляры разной длины или нетканый материал, состоящий из перепутанных волокон марки терлон.

Найдено, что для ЖК-полимеров характерно неньютоновское течение, а также наличие предела текучести, который снижается с увеличением температуры. Их энергии активации вязкого течения убывают с ростом температуры и напряжения сдвига.

Показано, что, небольшие добавки ЖК- полимера снижают вязкость ПМП за счет миграции менее вязкого ЖК-компонента к стенкам капилляре. Кроме того, ЖК-компонент образует волокна в матрице ПМП.

Течение ЖК-полимеров через волокнистые среды (пропитка) изучены при разных температурах (250-280°С) и давлениях (0,I-2,5МПа). Показано, что существует предельное давление, ниже которого течение через среду не происходит. Установлена количественная связь этого давления с пределом текучести ЖК-полимера. Найден способ описания температурной зависимости скорости пропитки по данным течения через цилиндрические каналы. Найдено, что добавлении ЖК-полимера к ПМП увеличивает скорость пропитки.

Из анализа всего материала следует, что течение изученных полимеров через волокнистые материала может быть рассмотрено и количественно описано в рамках модели, по которой течение полимера через пористую среду моделируется ее течением через набор эквивалентных капилляров равной длины и диаметра.

Электронно-микроскопические исследования сколов и срезов полученных при пропитке композитов показали достаточно полное проникновение ЖК-полимеров между волокнами нетканого материала.

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Зависимость структуры полиалкиленфумароил-бис-4-оксибензоатов

от реологической и термической предистории.

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Исследованы структурно-реологические свойства полигекса- полидекаметиленфумароил-бис-4-оксибензоатов и статистического сополиэфира на их основе в широком интервале температур. При высоких напряжениях сдвига макромолекулы жидкокристаллических полимеров преимущественно ориентируются вдоль потока с расположением смектических слоев перпендикулярно направлению течения. Уменьшение напряжения сдвига приводит к изменению характера течения: смектические слои располагаются под углом к оси экструзии, тогда как макромолекулы внутри слоя сохраняют ориентацию вдоль направления течения. Обнаружено и необычное поведение сополимера в области плавления: выдержка при температурах на 5-20°С выше температуры перехода в ЖК фазу ведет к коренной перестройке структуры сополиэфира, сопровождающейся возрастанием вязкости во времени [I]. Прослежена температурная эволюция структуры исследуемых полимеров, определен их фазовый состав и проведена иде.тификация различных фазовых состояний.

I. В.Е.Древаль, В.В.Зуев, Е.В.Котова, П.И.Хохлов, И.А.Волегов, Е.М.Антипов, Ю.К.Годовский, С.С.Скороходов, В.Г.Куличихин "Реологические и структурные особенности жидкокристаллических полиалкиленфумароил-бис-4-оксибензоатов", Высокомол.соед., 199 т.А33, N2, с 369-379.

RHEOLOGICAL ASPECTS OF RESISTANCE AND FRACTURE OF LIQUID STREAMS IN POLYMER MIXTURES

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As a result of carried out theoretical and experimental investigations the features of the fracture of liquid streams in polymer mixtures mel s have been determinated. It was shown that the fracture of a liquid cylinder (fiber) for viscoelastic polymer systems differs from the known theoretical predictions concerning Newtonian fluids. The discrepancies are expressed by the following facts.

- The wavelength of the destructive disturbance and the size of the resulting drops for polymer systems are greater than for Newtonian fluids.
- The growth of amplitude of the destructive wave slows down at the final stages of the fracture.
- Theoretical and experimental values of the lifetime of a polymer stream differ by 2 - 3 orders.

The enumerated discrepancies are due to non-Newtonian effects caused by the elasticity of polymer melts.

- For the first time it was established that during flowing of polymer mixture melt with specific interaction macromolecules of components in the interface layer polymer f the disperse phase are forcedly deformed and accumulated large elastic deformation. A clear example of such system are mixtures of ethylene and vinyl acetate copolymer - copolyamide (EVAC/CPA). The microfibers of EVAC produced during the flow of mixtures of polymer melts do not fracture on drops accordingly to wave mechanism Rayleigh-Weber-Tomotika even at the temperatures wich are considerably greater EVAC melting point. In these liquid streams the relaxation of accumulated elastic deformations predominates that prevents to fracture. As a result the lifetime of the EVAC liquid streams sharply increases, fracture becomes possible only for $T \geqslant 160^{\circ}C$ though EVAC melting point microfibers is $80^{\circ}C$.

Interrelation of Rheological Properties with Acetate Cellulose Structure Modified with Various Solvent Vapour

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Established by us the mechanism of active influence of solvents vapour forming lyotropic LC-phase on the initial polymer structure provided widening the field of investigation of other vapour influence on the structure of cellulose acetates used for films and membranes formation.

For modification of cellulose acetates we used vapour of technological solvents widely applicable in di-and triacetate thread formation: the mixture of acetone with water and methylenechloride with ethanol. The treatment was performed with vapour of a solvent nontraditional for this ether cellulose, in other words cellulose diacetate was treated by vapour on the mixture of methylene-chloride with ethanol while cellulose triacetate by the mixture of acetone with water.

Such modification of initial samples was due to the fact that there solvents differ in the character of interaction with polymer functional groups.

It was found out that such treatment of a dry polymer before dissolution lead to the change of physical and chemical properties of materials obtained on the base of modified polymers.

Rheological properties of solutions based on the polymer that has saturated definite amount of vapour of the solvent not traditional for it and dissolved in an ordinary mixture of solvents differ from the control one in character of flow cur.es. For example, in the area of low shift voltages we observ firstly increase and then sharp decrease of viscosity what may be connected with the change of polymeric matrix structure and with appearance of orientation phenomena in the system. It is necessary to point out that the distinctive feature of similar solutions beyond the above mentioned mechanisms is a tendency to decrease activation energy of viscous flow and to increase the degree of crystallinity in polymer.

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Влияние волокнистого наполнителя на реологические и физико-механические свойства смесей ЖК-сополиэфира с полипропил ном

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Исследованы реологические и физико-механические свойства полипропилена (ПП) и жидкокристаллического сополиэфира (СПЭ) полиэтилентерефталата и оксибензойной кислоты (соотношение 4/6), наполненных короткорубленным стекловолокном (СВ), при температурах 190 и 220°С. Было показано, что специфическое волокнообразование дисперсной фазы СПЭ в матрице ПП (область концентраций 5-50 мас.%) при капиллярном течении имеет место при $T \geq 220°С$, тогда как при. более низких температурах такое явление отсутствует. При этом было установлено, что развитое волокнообразование ЖК-фазы наблюдается при концентрациях выше 20%. Это приводит к следующим последствиям: а) при температуре 190°С (волокнообразование дисперсной ЖК-фазы отсутствует) вязкость ПП при увеличении содержания СПЭ во всей области концентраций монотонно возрастает; б) при 220°С вязкость ПП при концентрациях СПЭ > 20% заметно снижается. Введение в ПП стекловолокна приводит к увеличению механических характеристик (прочности и модуля упругости) твердых экструдатов. Однако этот эффект более существенный при добавлении в ПП стекловолокна и СПЭ. Так, например, для композиций ПП + 5% СВ прочность возрастает на 14%, а модуль упругости на 34%; для композиций ПП/СПЭ = 7/3 + 5% СВ прочность возрастает на 140%, а модуль упругости – на 80%. В обоих случаях относительное удлинение экструдатов снижается. Механические характеристики и их изменение при изменении концентрации СПЭ и СВ сопоставлены и обсуждены на основании данных по адгезионной прочности на границе раздела ПП – СПЭ, ПП/СПЭ – стекло, ПП – стекло и СПЭ – стекло.

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РЕОКИНЕТИКА ФОРМИРОВАНИЯ СЕТЧАТЫХ СТРУКТУР В СМЕСЯХ цис-1,4-ПОЛИИЗОПРЕНА С ПОЛИБУТАДИЕНАМИ.

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Изучен процесс формирования сетки поперечных связей в диеновых эластомерах - полиизопрен / ПИ / и полибутадиен -1,4 -цис /ПБ/ и полибутадиен ,содержащий 58% 1 2- структур /СКДл , и их смесях помощью реокинетического метода.

На начальных стадиях сшивания до гель-точки оценивали изменение вязкости системы с помощью прибора "Rheomat-30". Изменение составляющих комплексного модуля во время гелеобразования изучали с помощью крутильного маятника при частоте 1 Гц.

Изменение вязкоэластических свойств ПИ ,ПБ и их смесей связано с кинетикой формирования гель-фракции и зависит от типа сшивающих систем (величины индукционного периода, времени прогрева до гель-точки, ИП).

Для смесей из индивидуальных эластомеров наблюдается хорошая корреляция между изменениями вязкости, tg &, G'. Максимум на зависимости tg & -время соответствует времени гелеобразования, фиксируемом реометрическим методом по данным " Монсанто" и моменту обращения вязкости в бесконечность /1/.

В композициях полиизопрена с полибутадиеновыми каучуками разной структуры ,в случае применения сшивающих систем,обеспечивающих различие в длительности индукционного периода сшивания каждой из фаз ,реокинетические методы позволяют зафиксировать начало гелеобразования в каждой из них. На примере смеси ПИ/ПБ 70/30 можно отметить ,что изменение вязкости и составляющих комплексного модуля фиксируют разные стадии гелеобразования в системе. Так вязкость композиции резко возрастает осле появления первого максимума на зависимости tg & от времени точке гелеобразования в матрице ПИ. Появление второго экстремума на этой зависимости, соответствующего со зданию сетки в фазе ПБ, фиксируется перед началом роста модуля упругости. Очевидно изменение последнего связано образованием единой пространственной сетки совулканизата. Этим методом удалось зафиксировать уменьшение времени индукционного периода сшивания фазы ПБ в смеси с ПИ по сравнению с его длительностью у индивидуального ПБ с той же сшивающей системой.

Эти данные коррелируют с результатами ,полученными нами ранее методом ПМР /2/,позволившим определить кинетику формирования сетки поперечных связей и их концентрацию в каждой из фаз смеси ПИ/ПБ. Нами также было установлено сокращение индукционного периода сшивания фазы ПБ в смеси и увеличение в ней густоты сетки по сравнению с вулканизатами на основе ПБ.

Таким образом,сопоставление результатов,полученных двумя независимыми методами, показывает, что реокинетические методы исследования позволяют не только надежно определять точку гелеобразования при сшивании эластомеров в резиновых смесях, но и могут быть использованы для оценки раздельного формирования сшитых структур в каждой из фаз смесевых композиций.

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RHEOKINETICS OF NETWORK FORMATION IN BLENDS OF cis-1,4-POLYISOPRENE WITH POLYBUTADIENES.

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The process of network formation in cis-1,4-polyisoprene (SKI-3, PI) and two polybutadienes (PB) : cis-1,4- (SKD) and PB with 58% 1,2-structures (SKDL) and blends of PI with these PB was studied by the use of rheokinetic method.

The viscosity was measured with the aid of Rheomat-30 Instrument before the gel-point and rheological parameters (complex moduli,loss-tangent) with the aid of MK-3 torsion pendulum Instrument at the frequency of 1 Hz.

The change of visco-elastic properties of elastomers and their blend investigated is connected with kinetics of gel formation and depends on the nature of crosslinking agents (time of inducation period of heating before gel-point -IP). The satisfied correlation between changes of viscosity, loss-tangent and G-values was observed at crosslinking of individual elastomers investigated. Maximum of loss-tangent correspond to the time of gel formation according to Rheometer "Monsanto" method and to steep grouth of viscosity [1].

In blends of PI with PB the rheokinetiks allowed to fix the gel formation in each of the phases if IP have the different values for PI and PB. For composition of PI/PB as 7/3 the different stages of gel formation were identified (measuring of viscosity and moduli): the value of viscosity for the blend sharply increases after the first maximum of loss-tangent - time dependence which corresponds to gel formation in PI-matrix. The second maximum on this dependence corresponds to the formation of the network in PB-phase,this point coincides with the beginning of the modulus increse for the whole composition. In was possible by this method to fix the change (decreasing) of IP-time in PB-phase of the blend as compared with IP-duration for individual PB with the same crosslinking agent. These data correlate with kinetics results of network formation and crosslinks density estimation in phases of PI/PB blends by the use of NMR-method [2].

Thies rheokinetics method allow estimete reliably not only gel-points at elastomer crosslinking,but also evaluate the separate formation of networks in each of the phases of their blends.

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INVESTIGATION of POLYCONDENSATION
POLY(ETHYLENE TEREPHTHALATE) and p-ACETOXYBENZOIC ACID

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Liquid crystalline alkylen aromatic copolyester of p-hydroxybenzoic acid and poly(ethylene terephthalate) (PET) 60/40 mol.% were the objects of numerous investigation from the time of appearing the first information about it.

Examination of their morphology and structural properties allows to characterize the product as a two fraction mixture · block and random that are differenced by composition, microstructure, molecular mass and also by their ability to mesophase formation. High compositional inhomogeneity, nonregularity of chain structure and wide molecular mass distribution of polymers do not allow to obtain the materials with high mechanical properties. The reason of high polydispersity ought to find in peculiarities of liquid crystalline polyester synthesis that is consisted partially in existence of destruction step of the PET macromolecules by p-acetoxybenzoic acid (PAB). Formation block oligomer fragments leads to appearance block type fraction that reached by PET-sequences.

Polycondensation of PET with PAB have been studied by using viscometry, NMR and gel permeation chromatography techniques. The relationship of the acidolysis and esterolysis reactions was studied, it was shown that esterolysis was of great importance in the interchain exchange reactions. Influence of the degree of acidolysis affecting the composition and microstructure of oligomers on efficiency of polycondensation and composition heterogeneity of the reaction product was shown. Modifyin methods of synthesis with low content of the by-product copolyester were proposed.

SHEAR FLOW of the LIQUID CRYSTALLINE POLYMERS, ITS FEATURE and STABILITY

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Rheological properties of liquid crystalline polymers (LCP) have been investigated. For theoretical consideration of the shear flow features of the LCPs the Akay-Leslie nonlinear constitutive equations of anisotropic viscoelastic fluids are selected. On this basis the viscometric functions are derived and bounds of numerical values of the parameters appearing in the equations have been obtained to describe some unusual rheological features at the shear flow of a lyotropic and thermotropic LCPs - three-region viscosity curves and double sign change in the first normal stress difference vs shear rate. Task of the parallel and orthogonal superposition of the small amplitude oscillatory shear on steady flow has been solved for a Akay-Leslie model. Solution of the superposed shear is used for the prediction of the stability limit at stedy flow, particularly for the ensure of instability in the flow of LCPs. The latter for the shear flow of the lyotropic LCPs have been obseved expermentally by N. Grizzuti et al., Rheol. Acta, 1993, Vol. 32, pp.218...226. Prediction of the onset of the shear fracture for stationary flow of the isotropic viscoelastic fluids is given by L. Faitelson and E. Jakobsons MKM, 1981, No 2, pp. 193...201. By steady shear flow of polymeric fluids the original structure of the system loses stability, if $d(N_1/q)/dq$ change the sign and new structure begin generated. Here N_1 - first normal stress difference; q - shear rate.

COMPUTATIONAL RHEOLOGY AND APPLICATION TO DESCRIPTION OF POLYMER COMPOSITES VISCOELASTIC PROPERTIES

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Polymer composites are heterogeneous bodies whose structure and properties depend as on the properties of the matrix and fillers so on interaction between the components. The existence of interphase layers between composite components is very important. These factors must be considered by modeling of composite structure and calculation of its viscoelastic and mechanical properties. The problem consists primarily in selecting a physically substantiated model and theory.

The construction of various models and the need to study them require a search for new analytical and numerical methods of their analysis.

The new molecular and three dimensional structure models as well as the imitation modeling by methods of Brownian and Molecular Dynamics and Finite element method were used for calculation. The set of different numeral methods and original computer programs were developed and proposed for description of physico-mechanical properties and strain-stress behavior of polymer composites of different structure.

Both theoretical predictions and experimental results are discussed for different kinds of composite systems as in solid in a rubbery and fluid states.

The examples with respect to the experimental appraisals witness their good prognostic ability.

СЕКЦИЯ II. РЕОЛОГИЯ ДИСПЕРСНЫХ СИСТЕМ

A STUDY OF PHYSICO-CHEMICAL PROPERTIES IN THE GELATIN-

SODIUM ALGINATE-WATER SYSTEM.

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Multicomponent systems in particular on the basis of polymer mixtures are used when food products are manufactured.The structure and rheological properties of these complicated systems are not studied sufficiently.In this connection the mixtures of gelatin-sodium alginate-water are of interest as they can have great practical application for the working out of the new forms of food.

Rheological properties of aqueous solutions of the mixtures of gelatin(G) and sodium alginate (A) in dependence of molecular weight and total polymer concentration have been investigated.It is established that for the given system there is a range of polymer ratios which is characterized by a distinct anomaly of rheological properties.In this range the system viscosity increases IOO-IOOO per cent in dependence of molecular weight of A and total polymer concentration.

On the basis of the viscosity kinetics it is that in the range of polymer ratios responsible for anomaly viscosity the rate of structure forming in the system increases significantly.The rate of structure forming decreases when the content of A increases further.The temperatures of gel forming are determined in the whole range of ratios.

Physico-mechanical properties of gels are studied in dependence of the total polymer concentration and the ratio of G:A. The increase of the strength properties of gels in the range of ratios of G:A analogous to the ratios which are characterized by the viscosity anomaly in solutions is observed.

Fragments of the phase state diagram were obtained on the basis of rheological investigations of the G-A-water system.

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ИСПОЛЬЗВАНИЕ ГИДРОСТАТИЧЕСКОГО ДАВЛЕНИЯ ПРИ ОБРАБОТКЕ ПИЩЕВЫХ ПРОДУКТОВ

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Реологические и гидродинамические аспекты использования давления в технологических процессах пищевых производств начали изучать около 30 лет назад. Применение "высоких" гидростатических давлений (до IOOO МПа, IOOOO ат) позволили выявить и изучить ряд оригинальных сопутствующих процессов: микробиологических, механо-химических и др., например, пастеризация (стерилизация) продукта, доведение его до потребительской готовности без дополнительной обработки.

Процесс баростатической обработки продукта для сжимаемой жидкости сопровождается первоначальным незначительным повышением температуры и может быть охарактеризован дифференциальным уравнением по первому закону термодинамики:

$$\rho \frac{dE}{d\tau} = Q + div(\lambda\, grad\, T) - p\, div\, V + \varphi,$$

где ρ - плотность, E - внутренняя энергия единицы массы, Q - количество теплоты за единицу времени, поступающее в единицу объема (кроме теплоты, за счет теплопроводности), λ - коэффициент теплопроводности, T - абсолютная температура системы, p - гидростатическое давление, V - скорость движения системы, φ - диссипативная функция, которая зависит от сдвиговой и объемной вязкостей, скорости объемной деформации и дивергенции скорости; дивергенция определяется на единицу длины (I/м), τ - время.

Эксперименты, расчеты показали, что для достижения эффекта кулинарной готовности продукта при использовании ГД расход энергии в 4-6 раз меньше, чем при тепловой обработке. При этом, определяли комплексно микробиологические, физико-химические, биологические характеристики контрольных (традиционно обработанных) и экспериментальных образцов продуктов. По ряду показателей (перевариваемость, влагосвязывающая способность, реологические свойства и др.) опытные образцы превосходят контрольные.

Таким образом, использование аппаратов ВГД с однофазовым или циклическим нагружением имеет существенные перспективы перед традиционными методами по расходу энергии в достигаемому эффекту.

APPLICATION OF REOLOGIC CONSTANTS IN PREPARATION OF DRUG FORMS WITH LOW-MOLECULAR POLYETHYLENE

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Low-molecular polyethylene (LMPE) with molecular weight of 1500-5000 and density of $0.88^{+}_{-}0.02$ g/cm^3 is a side product in commercial manufacture of polyethylene by a method of free-radical polymerization at higher pressure.

The LMPE structural-mechanical properties were studied by the authors to use as a side material in a technology of ointment bases, medical penciles and floaming pellets for veterinary.

A definition of reologic constants of the materials was carried out with a rotation viscosimeter "Rotovisco RV-3" at various temperatures.

LMPE viscosity was found to be decreased with a further reduction under the effect of high pressure of a shift, that confirmed a presence of plastic-viscosous and tixotropic properties. The plastification adducts mineral and plant oils, polyethyleneglycol, PAV were used to decrease a high viscosity of LMPE and to use that as a component in ointment bases and medical penciles.

The alloys of LMPE and oils presented the systems with specific reologic properties, the study of those gave a possibility to state hydrophobic phase and to develop a rational composition of emulsion ointment basis.

Medical pencile presented LMPE compositions with curing agents, plastificators and PAV and were characterized as solid-dispersive systems. The addition of plastificating and tightening materials to LMPE up 10% was found to give some elastic and ointment properties for the medical pencil.

The addition of LMPE (0.05-0.15 g) to pellet mass imparted properties allowing to consider that as a structural-mechanical type and to prepare pellets with various drug preparations with the use of impact and rotor presses with rates of all ranges.

УДК 625.859

ОЦЕНКА ВЯЗКОСТИ БИТУМА ПО МЕТОДУ УТОНЧАЮЩИХСЯ НИТЕЙ.

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В лаборатории Харьковского государственного автомобильно-дорожного технического университета были исследованы температурные зависимости вязкости битумов на микрореотесторе ИПМ РАН по методике [1]. Объектами исследования были битумы всех дорожных марок, полученные путем окисления одного и того же сырья и битумы разных структурных типов. Диапазон исследованных температур (от 70°С до 140°С) был ограничен эффектом прядомости [2]. Выполненные настоящие исследования с высокой степенью надежности (доверительный интервал не более 5%) показали, что в области указанных температур эти битумы характеризуются ньютоновским типом течения.

Для битумов разной глубины окисления температурные зависимости вязкости смещаются параллельно друг другу в направлении оси температур. Битумы же разных структурных типов значительно отличаются по углу наклона к оси температур, что в координатах $\eta = f(1/T)$ количественно характеризует энергию активации вязкого течения. Полученные значения энергии активации согласуются с данными [3].

Использование микрореотестора ИПМ РАН в отличие от существующих ротационных вискозиметров позволяет выполнить исследования при малых затратах времени и объеме пробы. Ньютоновский тип течения битумов при указанных температурах позволяет использовать вязкость в качестве объективного критерия класификации битумов по маркам, а оперативность метода делает его исключительно эффективным для контроля степени соответствии битума требуемой марке в процессе получения на нефтеперегонных заводах. Он может быть использован для других менее вязких нефтепродуктов, таких как: гудрон, мазут, минеральные масла.

В докладе также обсуждаются особенности метода измерения вязкости при высоких температурах и результаты этих измерений и приложений для дорожного производства.

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II3.

EVALUATION OF BITUMENS VISCOSITY BY THE THE METHOD OF THIN STABLE LIQUID FILAMENT.

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At the laboratory of Kharkov state automobile and highway technical university was studied the tempretural dependence of bitumens viscosity by the microrheometer constructed at the institute of mechanical problem (Russian academy of science) with the methodology [1].

Objects of study were the bitumen of different grade obtained by the oxidation of tarand the bitumen of different structural type. The range of studied tempreture (from 70 C°to 140°C) was limited by the effect of "spinnable fluid" [2]. The performed study with the high degree of reliability showed that, at the field of indicated tempreture these bitumens define the Newtonian type of flow.

For the bitumens with different depth of oxidation, the tempretural dependence of viscosity move parallely to each other towards the direction of tempretural axis. Bitumens of different structural type are significantly differby the angle of inclination to the tempretural axis, which the coordination of η = f(1/T) quantitivly define the energy of activation of viscous flow. The obtained values of the activation energy agree with the data of [3].

The use of microrheometer in difference with exisiting rotary viscometer allow to perfer the study at iow cost of time and volume of sample. The Newtonian type of flow of bitumens at indicated tempretur allow to use the viscosity as the objective criterion to classify the bitumens by grade and the effectivness of method make him exceptionally useful to control the grade of bitumens while obtaining them at the petroleum refining factories. It is also may used to study the other not so viscous materials.

In the paper also discussed the pecularities of method while measuring the viscosity at high tempretures and their results with the application for the road industry.

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МАГНИТОРЕОЛОГИЧЕСКИЙ ЭФФЕКТ В УГЛЕВОДОРОДНЫХ КОМПОЗИЦИЯХ

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Исследован магнитореологический эффект структурированных дисперсных композиций на углеводородной основе в трех режимах деформации в зависимости от концентрации ферромагнитного наполнителя, напряженности и направленности магнитного поля, и в сравнении с используемыми в нефтедобывающей промышленности водоцементными суспензиями. Динамическая вязкость ферромагнитных жидкостей определена при силовых потоках магнитного поля 5 - 200000 кА/м, воздействующих на композиции поперечно и продольно направлению сдвигового напряжения деформации. Графический анализ вязкоупругости композиций в зависимости от различных условий эксперимента позволил выявить следующие эффекты:

1. Магнитные потоки, направленные поперечно к деформации в сравнении с продольно направленным полем, ускоряют релаксацию надмолекулярной структуры ферромагнитной дисперсной системы.

2. Вязкоупругость наполненных композиций возрастает с увеличением напряженности магнитного поля, продолжительности намагничивания, диэлектрической проницаемости и полярности среды.

3. Вязкость углеводородной жидкости в магнитном поле изменяется экстремально в зависимости от концентрации ферромагнитного наполнителя.

4. Магнитореологическая память композиций как функция структурной вязкости сохраняется несколько часов в отсутствии магнитного поля.

MAGNETORHEOLOGICAL EFFECT IN HYDROCARBON COMPOSITIONS

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Magnetorheological effect of structured dispersed compositions based on hydrocarbons has been studied in three deformation regimes depending on the concentration of ferromagnetic filler, intensity and direction of the magnetic field. The data obtained were compared with those obtained for water-cement suspensions employed in the oil industry. Dynamic viscosity of ferromagnetic liquids was determined at the magnetic flux values of 5-200,000 kA/m. The magnetic fluxes affect the compositions in transverse and longitudinal directions to deformation shear stress. Graphical analysis of the composition viscoelasticity depending on the experiment conditions, revealed the following effects:

1. Magnetic fluxes, directed transversally to deformation relative to longitudinal field direction, promote relaxation of supermolecular structure of the ferromagnetic dispersed system.

2. Viscoelasticity of the filled compositions increases with an increase in the magnetic intensity, magnetization time, dielectric permeability and in a medium polarity.

3. Viscosity of a hydrocarbon liquid varies extremally depending on the concentration of ferromagnetic filler.

4. Magnetorheological memory of the compositions as a function of structural viscosity is retained for several hours in the presence of the magnetic field.

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РЕОКИНЕТИЧЕСКАЯ ОЦЕНКА УЛЬТРАЗВУКОВОГО ВОЗДЕЙСТВИЯ НА СТРУКТУРИРОВАННЫЕ УГЛЕВОДОРОДЫ

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С помощью непрерывного и импульсного акустического излучения исследовано деструктурирующее воздействие ультразвука на углеводородные гели комплексных полиассоциатов тетраалкилбората лития. Воздействие ультразвука на структурированные растворы и гели изменяет их вязкоупругие свойства аналогично механической деформации надмолекулярной структуры. Разрушение макроструктуры углеводородных гелей комплексов зависит от времени и напряжения излучения. При этом кинетическое изменение вязкости гелей носит экстремальный характер. После некоторого времени воздействия ультразвука структура гелей начинает релаксировать с скоростью, зависимой от напряжения излучения. С целью количественного определения кинетических параметров разрушения - релаксации структуры гелей программным методом на ЭВМ предложены математические модели для деформации:

$$\Delta \eta = \Delta \eta_0 \left[1 - exp(-k_p \cdot t) \right]$$

и релаксации:

$$\Delta \eta = \Delta \eta_0 / \left[1 + (k_\beta \cdot t)^4 \right] + a$$

Анализ кинетических данных изменения вязкости показывает, что скорость деформации (разрушения) макроструктуры гелей на 10-15% выше скорости ее релаксации. Разность между скоростями этих процессов особенно заметна с увеличением молекулярной массы комплекс -углеводород. "Чувствительность" структуры гелей к ультразвуку уменьшается с увеличением кратности его воздействия.

RHEOKINETIC ESTIMATION OF ULTRASOUND EFFECT ON STRUCTURED HYDROCARBONS

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Destructuring effect of ultrasound on hydrocarbon gels of complex polyassociates of lithium tetraalkyl borates has been studied by continuous and pulse acoustic radiation. Ultrasound affects viscoelastic properties of the structured solutions and gels similarly the mechanic deformation of supermolecular structure. The destruction of macrostructure of hydrocarbon gels of the complexes depends on time and intensity of radiation. Kinetic change of gel viscosity is of extremal character. As a result of ultrasound effect gel structure relaxes, the relaxation rate depends on radiation intensity. For quantitative estimation of kinetic parameters for destruction-relaxation of gel structures proposed are mathematic modes for deformation:

$$\Delta \eta = \Delta \eta_0 \left[1 - \exp(k_p t) \right]$$

and relaxation:

$$\Delta \eta = \Delta \eta_0 / \left[1 + (k_t \cdot t)^4 \right] + \alpha$$

calculated by a computer program method. The analysis of kinetic data on viscosity change indicates that the rate of deformation (destruction) of gel macrostructures is 10-15% higher their relaxation rate. The difference between the rates is especially appreciable with increase in molecular mass of complex hydrocarbon. "Sensitivity" of gel structure to ultrasound decreases in inverse proportion to its effect.

ВЛИЯНИЕ СТАРЕНИЯ КАМЕННОУГОЛЬНЫХ ДЕГТЕЙ НА ИХ ВЯЗКОУПРУГИЕ СВОЙСТВА.

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Старение каменноугольных дегтей обусловлено, прежде всего, испарением легких фракций, а также процессами окисления, полимеризации и поликонденсации, что приводит к изменению группового, химического состава и, следовательно, структуры вяжущих.

Старение дегтей марки Д-6 на основе каменноугольной смолы, а также антраценовой фракции, оценивали путем исследования влияния температурного фактора на их вязкоупругие характеристики. Дегти прогревали при температуре 65 С в чашках Петри (толщина слоя 5 мм) и после 25. 75 и 150 часов экспозиции изучали изменение их реологических характеристик при непрерывном режиме деформирования.

В исходном состоянии дегти представляют собой типичные дисперсные системы, для которых характерно наличие надмолекулярной структуры (пространственного структурного каркаса), образованной частицами дисперсной фазы (α- фракции). Им свойственно экстремальное изменение напряжения сдвига при относительно высоких скоростях деформирования и наличие предела текучести при малых скоростях сдвига ($\dot{\gamma} = 2 \cdot 10^{-3} c^{-1}$). В результате воздействия температуры предел текучести в исследуемом диапазоне скоростей деформирования ($10^{-3} - 10^{2} c^{-1}$) у дегтей не обнаруживается. По-видимому это связано с тем, что при прогреве дегтей повышается вязкость их дисперсионной среды в результате испарения легких фракций и прочностные свойства структурного каркаса оказываются замаскированными высоким вязким сопротивлением среды. Вероятно, предел текучести состаренных дегтей будет проявляться при более низких скоростях сдвига.

Установлено, что эффективная вязкость дегтя на основе каменноугольной смолы повышается интенсивнее, чем дегтя на основе антраценовой фракции до 35 часов прогрева, после чего темп роста вязкости снижается и выравнивается для двух исследуемых дегтей, что свидетельствует о замедлении старения во времени. После экспозиции в течение 150 часов наблюдается повышение значения вязкости дегтя на основе смолы в 1,5 раза и в 1,15 раза на основе антраценовой фракции, что указывает на предпочтительное применение последних в качестве вяжущих дегтебетонных смесей.

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ОБОБЩЕННЫЕ КОГЕЗИОННЫЕ ЗАВИСИМОСТИ БИТУМОВ.

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В исследовании механических свойств битумов традиционно приоритетными считаются вязкость и модули упругости. Однако ориентация на эти характеристики не позволяет решить задачи расчета ведущей эксплуатационной характеристики наполненных систем, их прочности.

Для этой цели целесообразно использовать когезионную прочность битума, переход от которой к прочности наполненной системы можно осуществить учетом усиливающего действия наполнителя и структурно-текстурных особенностей систем. Прогноз влияния температурно-скоростных факторов на прочность наполненных систем облегчается широкими возможностями обобщения когезионных зависимостей битумов. Основным условием обобщения является учет температуры механического или дилатометрического стеклования как фундаментальной характеристической температуры состояния битума.

Для температурных зависимостей когезионной прочности одного битума, отвечающих разным скоростям сдвига, обобщение фактически сводится к учету скоростной зависимости температуры механического стеклования (T). Для битумов разных товарных марок и структурных типов получение обобщенной температурно-когезионной зависимости основано на использовании обобщенных координат: τ_{np}/τ_{max} и $T_{np} = T - T_g^M$. Здесь: τ_{np}— когезионная прочность при температуре приведения T_{np}; τ_{max} – максимальное значение когезионной прочности при T_g^M; T температура испытания. Возможность такого применения по существу означает, что значения когезонной прочности разных битумов на равном удалении от T_g^M достаточно близки между собой.

Объективная суть показателя когезионной прочности битумов, непосредственная его связь с прочностью наполненной системы позволяет ставить вопрос об изменении на его основе всей системы маркировки и классификации битумных вяжущих.

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THE GENERALIZED COHESIONAL DEPENDENCE OF BITUMENS.

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While studying the mechanical properties of bitumens, traditionally the priority are given to the viscosity and the modulus of elasticity. However the orientation on these characteristic does not allow to decide the problem of the calculation of main operational characteristic of filled systems, their strength.

For this purpose it is expedient to use the cohesional strength, transistion from which to the strength of filled system may be realized with the account of increasing effect of filler and the structural-textural pecularities of system. The forecast of influence of tempretural-speed factors on strength of filled system may be simplified by the wide possibilities of generalized cohesional dependence of bitumens. The main condition of generalization is the account of the tempreture of mechanical or dilatometrical glass transistion as the foundamental characteristic of the tempretural behaviour of bitumens.

For the tempretural dependences of cohesional strength of one bitumen, corresponding the different speed of shear, the generalization is practically bring to the account of speed dependences of the tempreture of mechanical glass transistion (T_g^M). For the bitumen of different grade and structural type, the obtaining of generalized tempretural-cohesional dependence is based on the use of generalized coordinates: τ_{pr}/τ_{max} and $T_{pr} = T - T_g^M$. Where: τ_{pr} – cohesional strength at the tempreture of reduction T_{pr}; τ_{max} – maximum value of cohesional strength at T_g^M; T – tempreture of test. The possibility of such a application in fact means that, the value of cohesional strength of different bitumens at equal distance from T_g^M are sufficiently near between themselves.

The objective essence of the index of cohesional strength of bitumens and it's direct connection with the strength of filled system allow to put the question about the change, on it's base, of the whole grading and classification system of bitumens binder.

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ИЗУЧЕНИЕ РЕОЛОГИЧЕСКИХ И СТРУКТУРНО-МЕХАНИЧЕСКИХ
СВОЙСТВ ПРИРОДНЫХ ВОДОРАСТВОРИМЫХ ПОЛИМЕРОВ

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Целлюлоза - основной, широко распространенный скелетный
полисахарид, строительный материал растения, придающий ему
жесткость и форму, наиболее распространенное органическое
вещество в природе.

Полисахариды являются полимерами, построенными из большого
числа моноз, связанных гликозидными связями.

Из производных целлюлозы существенное значение для пищевой
промышленности в качестве питательного вещества, как балласта,
используют карбоксиметилцеллюлозу (КМЦ) в виде натриевой соли
$(C_6H_7O_2(OH)_{3-x} (OCH_2COONa)_x$ п.

Нами были разработаны технические приемы получения Na-КМЦ
пищевого и медицинского назначения. В промышленности Na-КМЦ
получали взаимодействием щелочной целлюлозы с монохлоруксусной
кислотой. Полученная Na-КМЦ пищевого назначения имеет
характеристики: аморфное бесцветное вещество, молекулярная масса
$30-25 \times 10^3$, плотность 1,59 г/см^3, температура карбонизации 252
град. С, pH = 7,5. Полученная Na-КМЦ растворима в воде, водных
растворах щелочей, поваренной соли, ПДК 10 мг/м^3, не содержит
токсичных веществ и обладает микробиологической чистотой.

Изучение реологических и структурно-механических свойств Na-
КМЦ показало, что Na-КМЦ при растворении в воде образует вязкие
прозрачные растворы, характеризующиеся псевдопластичностью,
которые сопровождаются набуханием полимера и изменением его
структуры. Na-КМЦ легко совмещается с разными вязкопластичными
массами природных соединений, деструктируется при введении в
карамельную массу при температуре 80 град. С, однако устойчива
к биодеструкции. При введении Na-КМЦ в водные пищевые растворы
частично осуществляет флокуляцию.

Отмечено, что в кислой среде происходит падение вязкости
раствора, так как молекулы принимают более компактную форму, в
связи с этим не рекомендуется вводить Na-КМЦ в сильно кислые
системы пищевых масс.

Испытания реологического поведения Na-КМЦ в составе пищевых
масс показали, что ее можно эффективно использовать как
загуститель и пластификатор мармеладов и пастообразных масс
хлебопекарной, кондитерской, консервной и маслочировой промышленности.

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IVANNIKOVA E.I., PANOV V.P., KURBANOVA R.G.

Cellulose is main and widely used skeletal polysassharide. It's
also comes as construction material for the plants, which enables
its hardness and form. Cellulose is the most widely used organic
substance in the living nature.

Polysaccharides come as polymers, consisted of lot of monoz,
connected by glycoside bonds.

One of the main cellulose derivatives is carboxymethylcellulose
(CMC) in formation of sodium salt - $(C_6H_7O_2(OH)_{3-x} (OCH_2COONa)_x$ п,
which has considerable importance for the food industry as
supplying nutriment.

We've developed technical methods of manufacture of Na-CMC for
food and medical industries. It was produced in the reaction of
cellulose alkaline with monochloracetic acid. Received Na-CMC for
food purposes has the following characteristics: amorphous,
colourless substance, molecular weight $30-25 \times 10^3$, density -
1,59 g/cm$_3$, carbonization temperature 252 degr. C, pH=7,5. Such
Na-CMC is soluble in water, in alkali water solutions, in sodium
chloride, $LD_{50}=10$ mg/m^3, it does not contain toxic substances and
is of microbiological purity.

Studying of rheological and structure-and-mechanical Na-CMC
characteristics showed that while dissolution in water Na-CMC
forms viscous, transparent, pseudo-plasticity solutions, where
polymer swells and its structure is changed. Na-CMC is easily
combined with various viscous-and-plasticity nature material,
and it is destructered in caramel medium at 80 degr C, but Na-CMC
is stable against biodestruction. Na-CMC partially cause
flocculation in water food solutions.

It was found out decrease of viscosity in acid solutions
since moleculars are converting themselves in more compact form.
That is why it's not recommended to bring Na-CMC in considerably
acid food systems.

Rheological Na-CMC tests for food industry proved that it
can be effectively used as densifiers and plasticizers for fruit
jellies and paste mass substances in baking, confectionary,
tinned goods industry and in butter and oil manufacturing.

ПОДАТЛИВОСТЬ БИТУМОВ ПРИ НИЗКИХ ТЕМПЕРАТУРАХ

Маляр В.В.,Золотарев В.А.

Необходимость исследований деформационных свойств нефтяных битумов при низких температурах связано с их особенностями поведения в дорожных конструкциях.

Испытания на податливость при осевом растяжении проводили в области линейной вязкоупругости, времени действия нагрузки до 10 минут и в диапазоне температур от +10 до -40°С. В этих экспериментах для битумов всех товарных марок БНД и различных структурных типов было установлено, что деформационную кривую можно разложить на мгновенно упругую, запаздывающую и остаточную составляющие. Предложенная четырехэлементная модель (адекватная экспериментальным данным) позволила анализировать температурные зависимостивязкости вязкости установившегося течения, доли диссипированной энергии, степени эластичности.

В исследованном диапазоне температур все дорожные битумы переходят в стеклообразное состояние, вязкость которых при Тg достигает значений около 10^{11} Па·с. Однако, для разных марок и структурных типов битумов отмечаются различные значения вязкости и податливости при их температурах теклования, определенных дилатометрическим способом. Изменение вязкости и податливости битумов при стекловании значительнее зависит от их группового состава, нежели от их средней молекулярной массы при одинаковых условиях испытаний.

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FLEXIBILITY OF BITUMENS AT LOW TEMPRETURES.

Malyar V.U., Zolotaryev V.A.

The necessity to study the deformational properties of oil asphalt at low tempretures is connected with their special behav..ur at the road constructions.

The test on flexibility at axil tension are performed at the field of linear visco-elastic condition, the action time of load was up to 10 minutes and range of studied tempreture was from +10°C to -40°C. In these experiments carried out for the bitumens of all grade and structural type was established that, the deformational curve may be expand on instant elastic, delaying and residual component. The purposed four elemented model (adequate to experimental data) allowed to analyse the tempretur 1 dependences of viscosity of established flow, the share of dispressed energy and the degree of plasticity.

At the studied range of tempreture all bitumens transist to the glassy state, viscosity of which at T_g reach up to 10^{11} pa.s. However,for the different grade and structural type of bitumens, it was fixed the different value of viscosity and flexibility at their tempreture of glass transi-tion, defined by the dilatometrical method.

The change of viscosity and flexibility at glass transistion significantly depend from their group composition, but not from their molecular mass at the same conditions of test.

Kharkov automobile and highway technical university

УДК 532(135+517.4):541.68

ЭФФЕКТ ТОМСА: МОДЕЛЬНЫЕ ПРЕДСТАВЛЕНИЯ О ЛАМИНАРНОМ ПОДСЛОЕ ТУРБУЛЕНТНОГО ПОТОКА.

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Для объяснения открытого почти полвека назад эффекта сниже ния гидродинамического сопротивления полимерными добавками пред ложено множество гипотез, но ни одна из них не может претендовать на роль ведущей из-за ограниченности применения или наличия про тиворечий известным экспериментальным фактам.

Согласно нашим представлениям перемещение разбавленного по лимерного раствора в пристенной (ламинарной) зоне турбулентного потока в трубе можно рассматривать как непрерывную совокупность деформаций - поворотов вязкоупругих тел вокруг мгновенных осей вращения, лежащих на внутренней поверхности стенки. В результате этих поворотов упруго запасенная энергия частично диссипируется, а частично превращается в кинетическую энергию поступательного движения катящихся тел. Телами качения могут быть индивидуальные макромолекулярные клубки с иммобилизованным растворителем или ассоциаты макромолекул.

Такой подход позволяет получить аналитическое выражение, свя зывающее величину приращения объемного расхода полимерного раство ра с гидродинамическими параметрами течения и физико-химическими свойствами раствора:

$$\Delta Q \approx \pi R_w^2 \cdot u_* \cdot \left(\sqrt{\frac{\tau_w}{G}} - 1 \right),$$

где $\Delta Q = Q_p - Q_s$ - увеличение объемного расхода; Q_p и Q_s объемные расходы полимерного раствора и чистого растворителя соответствен но при одном и том же напряжении сдвига τ на стенке трубки ради са R; u_* - динамическая скорость; G - модуль высокоэластичности, величина которого зависит от температуры, термодинамического ка чества растворителя, концентрации и молекулярной массы полимера.

Экспериментальная проверка зависимости увеличения объемного расхода от различных факторов, проведенная на турбулентном реометре с разными системами полимер-растворитель дала впол не удовлетворительное подтверждение справедливости полученной зависимости.

DISCOURSE ABOUT THE MECHANISM OF TOMS EFFECT

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There is no common point of view on the mechanism of Toms effect up to now. In this work we present the model which is in consent with the most experimental data.

According to this model the motion of dilute polymer solution in laminar sublayer may be interpreted as rotatory-forward movement of elements, including individual macromolecules or their agglomerations. Elementary act of movement includes deformation and turning.

Such an approach makes possible to get an equation, where flow increase is function of physical and chemical properties of polymer solutions:

$$\Delta Q = \pi R_w^2 \, u_* \left(\sqrt{\frac{\tau_w}{G}} - 1 \right)$$

Here $\Delta Q = Q_p - Q_s$ — flow increase between polymer solution (Q_p) and the solvent (Q_s) while shear stress is the same.

τ_w — wall shear stress

R_w — radius of the pipe

u_* — dynamic velocity (ρ—density of liquid)

G — rubbery elastic module, which depends on temperature and thermodynamic quality of solvent, concentration and molecular mass of polymer

This equation is in a good consent with numerous experimental facts for various polymers and solvents.

УДК 532(135+517.4):541.64

ПРИМЕНЕНИЕ ЭФФЕКТА ТОМСА НА МАГИСТРАЛЬНЫХ НЕФТЕПРОВОДАХ.

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Томским Политехническим Университетом в содружестве с Институтом химии нефти СО РАН и Томским нефтехимическим комбинатом разработана технология получения сверхвысокомолекулярного полимера, способного растворяться в сырой нефти и оказывать существенное снижение гидродинамического сопротивления. Полимер производится в виде 10% раствора в бензине, который имеет товарное название "ВИОЛ".

Разработана технология транспортировки и ввода полимерного концентрата в нефтепровод.

Описаны реологические методы контроля глубины превращения мономера в полимер, а также качество продукта.

"ВИОЛ" был испытан на магистральных нефтепроводах Александровское - Анжеро-Судженск и Тихорецк - Новороссийск (диаметры труб 1220мм и 800мм соответственно). Испытания показали 21% и 23% снижения сопротивления соответственно, причем в последнем случае содержание "ВИОЛа" в потоке составило 80ppm, что в пересчете на сухой полимер составляет 8г на тонну нефти. Эти результаты показывают, что "ВИОЛ" по своему качеству не уступает лучшим зарубежным аналогам.

Обсуждаются перспективы применения "ВИОЛа" на российских нефте- и продуктопроводах как с целью увеличения их пропускной способности, так и с целью экономии электроэнергии.

USAGE OF TOMS EFFECT FOR CRUDE OIL TRANSPORT

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Tomsk Polytechnical University in cooperation with Institute of Petroleum Chemistry and Tomsk Petrochemical Plant has worked out the technology of pro- duce ultra-high molecular polymer, soluble in crude oil and petroleum products and capable to improve their flowability.

This polymer is produced as 10% polymer solution in benzene has commercial name of "Vyol".

Transport and injecting technology has also made up.

The reological control of monomer conversion and product quality are described.

"Vyol" was tested in Central Siberia and Black Sea Trunk Lines (line diametre 1220 and 800 mm respectively) and 21% and 23% drag reduction was obtained. In the last case "Vyol" concentration was 80 ppm (8 g per 1 ton for solid polymer). This results have shown that "Vyol" commercial application is discussed with a power saving or increasing pipeline capacity.

Движение сферических частиц вдоль стенки в ньютоновской
и неньютоновской жидкости

Прокунин А Н

Экспериментально рассматривается движение сферической
частицы вдоль стенки в сдвиговом потоке жидкости и при седи-
ментации в наклонных и горизонтальных трубах.

Здесь возникают две последовательно связанные проблемы.
Первая — это гидродинамика движения частицы без учета трения
при ... ках, близких к вертикали. В работе рассмотрено влияние
различных безразмерных параметров на движение и выявлен глав-
ный из них — число Рейнольдса, определяемое диаметром частицы
и скоростью проскальзывания ее относительно жидкости.

При углах, близких к горизонтали, рассмотрено влияние на
движение частицы трения, которое с увеличением угла непрерывно
менялось от чистого качения до чистого скольжения.

При углах, близких к вертикали, рассматриваются различные
виды движений частицы, отличные от качения по стенке. Это от-
рывы частицы от стенки и скачкообразные ее движения, наблюдае-
мые в области ограниченных чисел Рейнольдса.

В заключение рассматривается обобщение полученных ре-
зультатов для неньютоновской степенной жидкости.

Модель упругого деформирования вытяжки растворов полимеров

Прокунин А.Н., Брутян М.А.

Некоторые маловязкие, но упругие растворы полимеров
можно вытягивать из резервуара вверх, перпендикулярно
свободной поверхности, например, вращающимся барабаном.
При этом длина полимерной струи может доходить до полу-
метра.
Предполагается, что раствор при таком движении теря-
ет текучесть и его поведение можно описать с помощью
реологических уравнений, применимых для эластомеров (сши-
тых каучуков). Опираясь на это рассмотрена задача о вы-
тяжке со свободной поверхностью и объяснено явление, так
называемого, открытого (упругого) сифона.
Обсуждаются возможные механизмы потери текучести
раствором.

RHEOLOGICAL PROPERTIES OF SPAGHETTI DOUGH

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Rheological properties of spaghetti dough are determined by
physico-chemical properties of gluten-protein component of flour
from wheat which is capable to gel actively in water forming zols.
Starch (the other main component of flour) gels weakly retaining
water by grain surfaces.

Dough structure is characterized by three-dimensional mecha-
nical model where gluten plays a part of a structural backbone
which gives elasticity, viscosity and plasticity to dough. Strength
of the network depends on the distance between particles and the
thickness of the layer of dispersing medium.

An addition of methylcellulose (artificial polysaccharide)
to dough changes the structure system owing to structuring pro-
perties of the polymer. Methylcellulose solution in water is
structure- and gel-forming when temperature rises.

Effect of added methylcellulose (0.01-0.5 per cent) on the
structure and rheological properties of dough has been studied.
Flow curves were obtained by the use of the automatic capillary
viscometer in the temperature range of 25-55°C. Rheological cha-
racteristics of disperse system were estimated namely the lower
range of the strength of structuring bonds, the Bingham range of
fluidity, the ultimate shear stress of taut plastic state, the
fluidity range, the viscosity of ultimately destructed system
and the plastic viscosity.

It was established that added methylcellulose changes the
structure of spaghetti dough, increasing strength and plasticity
and decreasing viscosity of ultimately destructed structure.

REOLOGY OF POLYMER ENTOMOLOGIC COMPOSITIONS

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The new data on polymer entomologic glue compositions concerning a direct control for the properties were described. On the basis of reologic, microscopic, and spectral assignments of compositions of oligoisobutylenes and various adducts, a family of entomologic glues were developed for a series of approaches and application conditions..

A variation of a structure-former nature was shown to be able to control a viscosity and a flow limit of compositions at high adhesion and transparence in a thin layer. Wax of synthetic, organic and natural origin was used as a structure-former. Specific and reologic features – parameters of structural flow and relaxation time values were also shown to be depended on wax nature.

An absence of a dependence on relaxation time, flow limit values and highest Newton viscosity indicated a specific nature effect of structure-formers – wax as an "active" filler of high affinity to a polymer matrix. That was confirmed by a fact that a crystallyzation of wax in a composition were never submitted to the known Godovsky rule.

Structure-forming properties of organic dyes were used for a creation of biologically active (functionally dyed) entomologic glue to control hothouse moth – a pest of vegetables. A value of flow limit as one of the main glue features was found to be corrected in an aerosol version of adhesives

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DYNAMICS OF STRUCTURIZED DISPERSE SYSTEMS

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The modern approach to studying the structural and rheological properties of structurized disperse systems cannot be restricted to establishing the dependence of the effective viscosity, moduli of elasticity, moduli of losses, and shear stress as functions of deformation rate. The structural and mechanical characteristics can thoroughly be described only when three basic groups of properties that are characteristic of such systems be jointly considered, as, – rheological characteristics, aggregative stability, sedimentation resistance within a wide range of changes of deformation rates. The plotting of a full rheological curve of such systems is complicated not only by changes in the sedimentation and aggregative stability as the shear rate increases, but also by a high probability of the showing of various kinds of inhomogeneity in the structure failure process.

Thus, resolution of such a complex problem must be based on the experimental and theoretical examination of each of those factors both separately and in totality – that is, taling into account their reciprocal influence on one another. Such a complex examination underlies a new approach to be developed in the field of physical chemistry of disperse systems and surface phenomena: – physico-chemical dynamics of disperse systems. When designing that approach, a theory of the full rheological flow curve has been developed, taking into account the formation of continuum disruptions in structures in the shear flow, and the aggregate mechanism of its breaking up. Simultaneously, a theory of sedimentation resistance of structurized disperse systems at rest and in flow with an increasing deformation rate has been developed. The theory enables one to correlate the effective viscosity with the sedimentation rate, taking into account that the latter depends on the structure failure degree, and increases with the deformation rate. The elements of the theory of aggregative stability of concentrated dispersions in the shear flow have been developed. The theory accounts for a possibility of inertial coagulation of particles, accompanied by the overcoming of the electrostatic repulsion forces at relatively low deformation rates, and then, as these increase, by the overcoming of the structural-mechanical barrier formed by the adsorption surfactant layers on the surface of particles.

STRUCTURAL FEATURES AND RHEOLOGICAL BEHAVIOUR
OF THE GELATINE-STARCH-WATER SYSTEM

L. I. Khomutov, N. M. Ptitchkina, N. A. Lashek and V. A. Sheyenson

Polymer thickeners and gel-forming agents are widely used to produce food products and pastries of high quality. The chemical composition and the structure of polymers determine properties of food combinations based on these polymers. Each natural polymer has its specific application.

Using polymer mixtures one can produce the enough wide range of system structures to obtain the products having different functional and custom properties on their basis.

To obtain a product of predetermined properties it is important to establish basic rules of structure influence upon properties, e.g flowability of multicomponent polymer-polymer-solvent systems.

The gelatine-starch-water system has been studied in the present work.

The diagram of this system state for polymer summary concentration 5% has been constructed. Temperature/concentration regions of the system existing in homogeneous and heterogeneous states have been determined.

Deviation from viscosity additivity of polymer mixtures of different summary concentration at various polymer ratios has been found.

It has been established that the system structure effects the manner of deviation from the curve of viscosity additivity.

The flow curves for different regions of the diagram of the gelatine-starch-water system state have been constructed.

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СЕКЦИЯ Ш. РЕОЛОГИЯ БИОСИСТЕМ.

HEMORRHEOLOGICAL DISTURBANCES IN PATHOGENESIS OF THE BRAIN VASCULAR DISEASES.

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The structural and functional properties of the erythrocytes was used to study in 47 patients with ishemic brain stroke and discyrculatory encephalopathy (in 38 cases). It was examined the absorbtive and deformability properties of the erythrocytes, the shape, diametr, the physical and chemistry composition of the lipid matrix of plasmatic membrane and contents of the receptive albumens (R-albumens) in blood.

For the most part of the ishemic brain stroke is detected the increased contents of erythrocytes with alterative shape (echinocytes) and diametr (macro-and microcytes). Per cent of erythrocytes with decreased diametr (on an average to 6,53 mcm by norm 7,48 mcm) is increased to 30-33 % (control group 15,2 %). It is gone with increasing percentage contents of echinocytes and surplus aggregetive ability of them up to formation of the intravascular erythrocytes conglomeration. It was discovered in 19 cases the increasing percentage contents of macrocytes (erythrocytes with diametr from 8,3 to 9,2 mcm). It is gone with the change for the worse of the deformability ability of the erythrocytes in the microcirculation system.

Besides that it was detected the change of the balance and fraction contents of the membrane phospholipids. It was determineted the decrease of the general phospholipid contents, phosphatidilcholin faction and free lipid acides faction in erytrocytes membrane, wich is known itself alterative membrane action. The made in parallels investigation of R-albumens, wich are the intermediate product of dissolution of the cell receptor , was showed it titre increase in both cases.

Thus in cases of the cerebrovascular diseases the significant changes of the lipid and albumen methabolism of erythrocyte membrane is formed. It is caused of the disturbance of oxygen transport and formation of the chronic hypoxia of brain tissue. Therefore the membranestabilized remedes shoud be used in the complex treatment of the cerebrovascular diseases.

ТЕОРЕТИЧЕСКИЕ ПРЕДПОСЫЛКИ СОЗДАНИЯ МЕТОДА ИССЛЕДОВАНИЯ РЕОЛОГИЧЕСКИХ ХАРАКТЕРИСТИК ВАГИНАЛЬНО-ЦЕРВИКАЛЬНЫХ СЛИЗЕЙ
АДИЯТУЛИН А.И., ШТЕНГОЛЬД Е.Ш.

Кроме известной механической защиты и,отчасти,трофической функции,муцины несут в себе чрезвычайно важную информацию о нейрогуморальном состоянии организма.Задача сводится к разработке методов и средств для регистрации и расшифровки этой информации. Основными компонентами муцинов являются гликопротеиды.Это самые большие биомолекулы с массой в несколько миллионов дальтон. Присутствие в них большого числа отрицательно заряженных гидроксильных групп структурирует воду за счет водородных связей и,тем самым,определяет вязкоупругие свойства слизей.Эстрогены,в частности,могут конкурировать с молекулами воды за связи с мукополисахаридами ,таким образом,влияя на реологию муцинов.Известные попытки определения по физическим свойствам цервикальных слизей плодные и неплодные периоды менструального цикла служат подтверждением справедливости предположений об изменении вязкоупругих свойств цервикальных слизей под влиянием эстрогенов.В то же время, на современном этапе развития биомеханики этот бытовой метод кажется довольно архаичным.Современная теория вязкоупругости позволяет достаточно корректно описывать реологические характеристики слизей и конструировать приборы для измерения их параметров.Полагаем,что разработка методов и приборных средств для исследования реологических свойств вагинально-цервикальных слизей дозволит достигнуть нового уровня понимания целого ряда физиологических процессов и явлений,что должно способствовать разработке методик для регулирования численности семьи, уточнения сроков родов и определения вероятности бесплодного брака, представляющих диагностическую и лечебную ценность в акушерстве и гинекологии.

Адиятулин А.И.,Роддом N 2, Саратов.
Штенгольд Е.Ш., ИПМ РАН, Москва.

HAEMORHEOLOGICAL ASPECTS OF EFFECTIVITY
AND TREATMENT RISK OF RHEUMATIC PATIENTS

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The efficiency of furosemide, ethacrinic acid, triampure and verospirone was studied in 393 patients with rheumatism and circulatory insufficiency by its effect on microcirculation condition. The studies showed that furosemide triampure decreased perivascular oedema of bulbar conjunctiva in 24 hours after their use, but verospirone did this by the end of the week use. Furosemide, triampure as a result of their single-dose taking decrease sludge-syndrome, increase blood flow in microvessels, but as to verospirone it acts the same after the course treatment. High efficiency of treatment by furosemide was noted. According to our results hypercoagulations effect of diuretics met in medical literature is not very significant. However, verospirone gives the decrease of heparin deficit in blood plasma and leads to the risk of thrombus complications.

The efficiency of non-steroidal anti-inflammatory drugs (acetylsalicylic acid, voltaren, ibuprophen) on microcirculatory and hemorheological conditions in 102 rheumatic patients were studied during 4 weeks. All studied drugs influenced positively on the microcirculatory and rheological indications: decrease maximum amplitude of thromboelastography, hematocrite, fibrinogen in blood plasma, intravascular aggregation of erythrocytes in microvessels, but those drugs did not remove the disorders completely.

For increasing effect of non-steroidal anti-inflammatory drugs inhalation heparin was used. This method of heparin injection did not show a significant hypocoagulation effect. That is why inhalation heparin can be used not only in hospitals, but in polyclinic either, because it needs no the laboratory control of coagulation system.

Our studies show the necessity of control to mark the effect of anti-rheumatic and diuretic drugs with conjunctival biomicroscopy and the thromboelastography indications.

Influence of He-Ne-Laser Irradiation on Brain Hemodynamiks in Patients with Post-Traumatik Cerebral Arachnoiditis

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Discirkulatory disorders of brain blood flow play an importent role in pathogenesis of disturbances resulting from post-traumatik cerebral arashnoiditis, the former being of funktional character and depending on reflektive effect from membranes, venous sinuses, brain basis vessels. Therapy aimed at brain hemodynamics normalization should be of great importance in treatment of patients wiht cerebral arachnoiditis.

Recently there appeared reports on laser therapy high efficiency in different brain vaskular disъases. Curative effect of this method is based on laser irradiation ability to increase blood from in carotid basins, to improve mikrocirculation in brain cortex by normalizing vaskular tonus, rheological and coagulatory blood properties.

Taking into consideration the positive vasoactive effekt of He-Ne-laser irradiation we started to investigate the influence of transcutaneous laser irradiation of blood in carotid arteries on brain blood flow in patients with post-traumatic cerebral arashnoiditis.

Irradiation was performed on the side of the main brain damage. Irradiation power density was 20 mvъ. Duration of exposure was 20 minutes. The course of treatment/varied from 10 to 15 sessions depending on the effekt achieved.

Effect of the carried out treatment was evaluated by the patients'subjective statements, by dynamics of neurologic symptomatics and by rheoencephalographic data. In all cases the patients revealed significant improvement of their health condition following laser therapy course. In the majority of cases there was achieved significant focal neurologic disorders regress. Rheoencephalography fixed vascular tonus normalization and increase of brain blood supply in all patients undergone the course of laser treatment.

Thus, transcutaneous laser blood irradiation in common carotid arteries positively influences the brain blood flow normalizing the vascular tonus, and rheological blood indices, and may be used while treating patients with post-traumatic cerebral arachnoiditis.

THE PECULIARITIES OF ARTERIAL-VENOUS HEMOSTASIS
IN CASE OF HEMODILUTION

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Blood coagulability and irreversible trauma of its structural elements, especially platelets, are the changes of blood microstructure which influence its rheologic properties.

In experiment it has been shown that hemocoagulation and the functional activity of platelets in aorta and vena cava inferior differ in the starting state. Venous blood as compared with arterial has higher coagulation activity and in this case the aggregational properties of platelets and fibrinogen concentration is higher in arterial blood.

Exchange hemodilution with rheopolyglukin contributes to the activation of hemostasis system which is however different in arterial and venous blood. Platelets functional activity immediately after the exchange transfusion and 1 hour after it decreases a little and remains at the same level in arterial and venous blood. Two hours later there appears a tendency to recover the difference in response reaction of the platelets from arterial and venous blood.

It is expected that in case of hemodilution a comparative levelling of rheologic properties of arterial and venous blood takes place, which is likely to determine to a great extent the same response reaction of platelets thus facilitating the blood circulation in venous system under such conditions.

DIHYDRATED ERGOT ALKALOIDS AS DRUGS WITH COMBINED RHEOLOGIC, ANTITHROMBOTIC AND PROFIBRINOLYTIC ACTION

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Dihydrated ergot alkaloids (DEA's) are known as drugs with nonselective a-adrenoblocking activity, and fairy selective and longlasting venoconstrictor action. These drugs bearing venotonic and antiplatelet activity are widely used in the combination with heparin for prophylactic of deep vein thrombosis. Taking into account the marked DEA's-induced increase in venous blood flow, predomin nt synthesis of tissue-type plasminogen activator (t-PA) in the venous endothelium and an existence of a shear stress-mediated mechanism of t-PA release we investigated the profibrinolytic properties of these drugs. It was shown that the intravenous administration of Dihydroergotoxine (DET) into rats leads to a short-term (60 min) increase in plasma fibrinolytic and plasminogen activator activities, and a slight decrease (=10%) in fibrinogen concentration. Histological examination demonstrated that in 1-1.5 h after injection DET induced a partial lysis of preformed venous thrombi in rat v. jugularis. Mechanism of DET profibrinolytic action was investigated using perfusion of the isolated rat hindlimbs by Norepinephrine-containing buffer solution in the presence and absence of DET. This a-adrenoblocker liberated plasminogen activator from the preconstricted vessels into perfusates, probably by the shear stress-mediated pathway. Marked potentiation by des-AA-fibrin of this plasminogen activator catalytic activity against plasminogen allows to identify it as t-PA. Comparative study of the antithrombotic activity of DET in combination with unfractionated (UH) or low molecular weight heparins (LMWH) in the models of venous stasis and platelet-dependent arterio-venous shunt thrombosis in rats is shown that the prophylactic antithrombotic effect of these drugs and their combinations was distributed as: DET+LMWH>DET+UH>LMWH>UH>DET. The combination of DET with LMWH was more effective in the prophylactics of arterial platelet-dependent thrombosis, than for the prevention of venous thrombosis provoked by vascular stasis and blood coagulation activation. Thrombolytic action of a-adrenoblocker in combination with human Lys-plasminogen was studied in the model of pulmonary embolism in guinea pigs using FITC-labeled thrombus. In 15 min after administration this combination produces 8.2 ± 0.4% (P<0.001) lysis of thrombus. Thrombolytic effects of a-adrenoblocker, Lys-plasminogen and saline were significantly lower (2.3 ± 0.1, 3.9 ± 0.3 and 2.7 ± 0.2%, respectively). It is possible to suggest, that in addition to the above mentioned pharmacological effects DEA's possess the t-PA-dependent shear stress-inducible profibrinolytic action.

RHEOLOGICAL EFFECTS OF THROMBOLYTIC DRUGS: POSSIBLE INTERLINK WITH EARLY REOCCLUSION?

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Since it is known that an increase in plasma fibrinogen concentration increases both plasma viscosity and erythrocyte aggregation, a reduction in plasma fibrinogen is a logical procedure to improve the flowing properties of blood. All plasminogen activator (PA's) in a high doses induce systemic plasminogen activation that leads to fibrinogen splitting. Reduction in plasma fibrinogen concentration decreases plasma viscosity and red cell aggregation. In addition to the thrombolytic properties fibrinolytic drugs are also used in acute myocardial infarction (AMI) and unstable angina pectoris to improve the impaired microcirculation. Early reocclusion after successful thrombolysis is a frequent problem that precludes improvement in left ventricular function and increases mortality. Most of these arteries reoccluded while the drug was being administered, or had a persistent lytic effect, showing that ongoing thrombosis was presented at the same time as thrombolysis occurred. It is still unclear whether fibrinogen reduction and consequent decreases in plasma viscosity, erythrocyte and platelet aggregation prevent the early (24 h post administration of PA's) reocclusion? Cumulative data on the early angiographycally confirmed reocclusion in the main trials in patients treated with fibrin specific and non fibrin specific thrombolytic drugs for AMI are shown in Table.

Incidence of Early Reocclusion in AMI After Thrombolytic Therapy

Drugs	Route of administration	No. patients	% (Means) patients with early reocclusion
Non fibrinogen-sparking			
Streptokinase	i. c.	872	24
Streptokinase	i. v.	14.121	6.4
APSAC	i. v.	14.136	6.3
Fibrinogen-sparking			
t-PA	i. v.	14.630	12.6
scu PA	i. v.	~150	0.8
t-PA + scu-PA	i. v.	11	0

APSAC-acylated plasminogen·streptokinase activator complex, t-PA-tissue-type PA, scu-PA-single-chain urokinase-type PA.

It may be conclude, that the rate of early reocclusion in AMI is not dependent on the fibrinogen-sparking properties of PA's, but depends on the other properties of thrombolytic agent, such as antiplatelet activity of scu-PA.

THE INFLUENCE OF LOW POWER LASER IRRADIATION ON HAEMOCOAGULATION SYSTEM IN DIFFERENT FORMS OF STRESS

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Modern literature has information about antistressor action of low power laser irradiation (LPLI). The influence of LPLI on haemocoagulation system was studied in this work on different models of stress. Experiments were conducted on white rats. Stress was induced by rigid fixation of animals during 5 min or by combined exposure to immobilization and sound stimulus (120 dB,150-500 Hz) during 2 min. Animals of a certain group were laser exposed during the stress. Depilated skin of the femur in the zone of vascular nervous bundle projection was irradiated by He-Ne laser (power density 5 mW/cm^2). The blood for investigation was obtained immediately after the stress and laser irradiation. Intact animals were used as control. Haemocoagulation was estimated by thrombelastography (TEG) data and standard laboratory tests.

Investigations showed that a marked hypercoagulation shift in both forms of short-term stress was observed. Phase changes in haemostasis system are characteristic to combined stress. In 60% of animals the initial hypercoagulation phase is followed by fibrinolysis phase and then goes the second wave of hypercoagulation. Reduction of linear TEG parameters and blood coagulation constants, reliable enlargement of TEG angle, maximal amplitude and indices of clot density are characteristic for the phase of initial hypercoagulation. During this period recalcification time is reduced, kaoline, thrombin and partial thromboplastin time reduce as well, thrombocyte factor 3 activity increases and fibrinogen content becomes greater.

Transcutaneous laser irradiation during immobilization and combined stress prevents many TEG changes induced by stress. Besides, in irradiation silicone and kaoline time do not increase, prothrombin and thrombin time are not reduced, antithrombin III activity increases. Intermediate phase of fibrinolysis activation is usually not determined during laser exposure.

Thus, transcutaneous He-Ne laser irradiation prevents hypercoagulation shift development, characteristic for the early phase of acute stress.

INFLUENCE OF He-Ne LASER IRRADIATION ON THE VISCOSITY
OF BLOOD, PLASMA AND ERYTHROCYTE HEMOLYSATE

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Experiments were performed on noninbred white male rats. Blood received after decapitation was mixed with heparin, plasma was separated and hemolysate was prepared. Every sample was devided into two parts: one part served as a control one, the second was being irradiated by He-Ne laser light (λ - 632.8 nm, power density - 2 mW/cm^2) during 5 or 15 min in the cuvette. Fluids viscosity was investigated by rotation viscosimeter with shear rates (ν) from 7 to 94 s^{-1}. Viscosity of the sample analysed was correlated with viscosity of distilled water. 5-min irradiation of the whole blood was stated to cause only slight rise of its relative viscosity in ν = 13-48 s^{-1} (by 17% in the average, $p < 0.05$). Changes in viscosity of irradiated plasma, as well as hemolysate, were statistically insignificant. Prolongation of exposure time up to 15 min resulted in a marked increase of relative blood viscosity in all investigated shear rates. Thus when ν = 7 s^{-1} viscosity of the irradiated sample increased by 34% ($p < 0.02$). Maximal changes were registered in ν = 20 and 34 s^{-1}: viscosity had a 44% increase. Less marked though significant changes were revealed in ν = 94 s^{-1}: viscosity had a 20% increase. Plasma irradiation in vitro caused no changes in plasma viscosity. More marked changes were registered in erythrocyte hemolysate irradiation. In control samples viscosity was determined in 30 and 90% of samples in shear rates 7 and 13 s^{-1} correspondingly. After irradiation in these rates movement of the internal cylinder of viscosimeter was noted only in 10 and 30% of samples correspondingly. In ν = 20 s^{-1} after hemolysate irradiation 3-fold increase of its relative viscosity was noted ($p < 0.001$), in ν = 48 s^{-1} viscosity increased by 3.3 times ($p < 0.001$), and in ν = 94 s^{-1} - by 2.7 times ($p < 0.01$).

Thus irradiation of the whole blood and erythrocyte hemolysate in vitro by He-Ne laser light results in a significant increase of their relative viscosity.

РЕОЛОГИЧЕСКИЕ СВОЙСТВА N-СОДЕРЖАЩИХ АНТИСЕПТИКОВ ПОЛИФУНКЦИОНАЛЬНОГО ДЕЙСТВИЯ

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Для защиты древесины от грибов и плесени разработан порошкообразный антисептик ИН-3 на основе уксуснокислого амина.

Изучены его реологические свойства, характеризующие лучшие свойства при определенной концентрации веществ и среды, что позволило определить его высокую защитную способность при пониженной вязкости и снизить энергетические затраты.

Фунгицидную токсичность антисептика во времени изучали путем инокулирования грибами Alternaria humicola (синевы) и Trichoderma harzianum (плесени) сусло-агаровой среды. В стерилизованную в автоклаве сусло-агаровую питательную среду добавляли антисептик в концентрациях 0,01 и 0,10 и разливали по 20 мл в чашки Петри. Застывшую среду инокулировали в пяти листах по схеме "конверта" и выдерживали при температуре 20-22 град. С и влажности 70% в течение 5-и суток, фиксируя через каждые сутки диаметр и характеристику колоний грибов.

Результаты приведены в таблице.

Концентрация, %	Гриб	Средний диаметр колоний, мм после выдержки, сутки				
		1	2	3	4	5
0 (контроль)	синева	4	15	28	234	сростание
0,01		4	14	26	33	34-сростание
0,1		0	0	4	6	8
0 (контроль)	плесень	12	34	с р о с т а н и е		
0,01		6	26	34	с р о с т а н и е	
0,1		0	0	0	1	2

Экспериментальные данные свидетельсувуют о том, что в концентрации 0,1% антисептик полностью подавляет развитие грибов синевы в течение первых 2-х суток, а грибов плесени - в течение 3-х суток, тогда как на среде без антисептика грибы синевы полностью срослись на четверные сутки, плесени - на вторые. Разработанный антисептик готовится к производственным испытаниям.

RHEOLOGICAL PROPERTIES OF N-CONTAINING ANTIEPTICS OF POLYFUNCTONAL OPERATION

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Antiseptic IN-3 in powder form based on acetic acid amine was developed to protect timber from fungus and mould.

We studied its rheological characteristics which proved its best properties at definite concentrations of compounds and medium, which enabled us to define its high protective ability at decreased viscosity and to decrease powder energy costs.

Fungicides toxicity of antiseptic in time was studied by inoculation of fungus "Alternaria humicola" (blue stain) and "Trichoderma harzianum" (mould) of wort. In sterilised in autoclave wort feeding medium antiseptic was added in concentrations of 0,01 and 0,10 and then in the quantity of 20 mm this medium was poured in Petri dishes. Solidified medium was inoculated "in five sheets according to envelope system" and then it was hold for 5 days at 20-22 degr. C and humidity 70%. Diameter and fungal colony characteristics were observed every 5 days.

The results obtained are shown in the table below :

Concentration, %	Fungus	Average diameter of colonies, mm, time interval, days				
		1 day	2	3	4	5
0 (control)	Blue	4	15	28	234	intergrowth
0,01	stain	4	14	26	33	34-undergrowth
0,1		0	0	4	6	8
0 (control)	Mould	12	34	intergrowth		
0,01		6	26	34	intergrowth	
0,1		0	0	0	1	2

Experimental data shows that antiseptic completely overwhelms growth of "blue stain" fungus at 0,1% concentration within the first 2 days and it overwhelms growth of mould fungus - within 3 days period while without antiseptic "blue stain" fungus are completely intergrowed together on the 4-th day and mould fungus - on the 2-nd day. Antiseptic IN-3 is being prepared for industrial trials.

"Changes of hemostasis and lipid metabolism from patients with atherosclerosis of aorta arch branches"

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Aim and tasks:To investigate changes of hemostasis and lipid exchange from patients with atherosclerosis of aorta arch branches with different degree of cerebrovascular insufficiency.
Material and methods:247 patients with atherosclerosis was divided into 3 groups :first group-202 patients, who received drug treatment;second group-11 patients, who received therapeutic plasmapheresis;fird group - 34 patients,who receiv li intravenous laser radiation of low intensity by CO_2 laser.Coagulation changes,viscosity,hematokrit,cholesterin,blood electrolits,lipids of hight and low density had been determined from all patients; and besides free radical peroxid oxidation of lipids(FR POL) had been determined from 45 patients before and during the treatment.
Results of investgation:The commonacceptable medicinal treatment of atherosclerosis with usig of modern lipostabilising drugs gives the opportunity to reach of remission of pathological process in arteries and improvement of cerebral circulation from patients with onset signs of cerebral circulation impairment.From patients with diffuse occlusional process of aorta arch branches and with stable cerebrovascular insufficiency and with TIA(transitory ischemic attacks) medicinal treatment gives temporary,unstable improvement of cerebral circulation and blood rheology,without of changes of lipid metabolism.If therapeutic plasmapheresis and laser therapy was used from this category of patients,improvement of cerebral circulation had been reached due to improvement of blood rheology,stabilisation of atherosclerotic process and correction of FR POL.The more successful correction of FR POL is reached during intravenous laser therapy.

Vascular tonus and pulse blood filling in patients with
closed skull injury according to rheoenchephalography.
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Rheoenchephalography was performed in 120 patients; 40
patients had concussion of brain, 35 - brain contusion of mild
degree, 30 - brain contusion of medium degree and 12 patients had
severe brain contusion.

In group with concussion rheoenchefalography revealed
increase of vascular tonus and 20-50% decrease of pulse blood
filling in 32 patients during first days after trauma. The most
frequent (90%) and significant decrease of pulse blood filling
was found in vertebral arteries' area (symmetrical and bilateral)
and was less significant in carotic arteries' area. The decrease
of pulse blood filling in 13 of 30 cases was combined with
increase of vascular tonus had normal values.

We registrated the asimmetric vascular reactions in 28
patients with brain concussion.

All patients with mild brain contusion and 13 of 30 patiets
with medium degree brain contusion had decrease of pulse blood
filling and increase of vascular tonus up to 21%.

But it should be mention that in some cases of medium
degree brain contusion the decrease of pulse blood filling was
accompanied by decrease of vascular tonus.

All patients with severe brain contusion had increase of
pulse blood filling, appearance of venous waves and displace of
dicrotic wave to basis.

We concluded that patients with brain concussion and mild
brain contusion have mainly hypertonic type of REG and bilateral
character of hemodynamic cerebral disturbances.

In medium and severe brain contusion the pulse blood
filling increases and the tone of vascular wall decreases,
l modynamical asimmetry become more frequent as a result of
contusion foci and foci of more significant brain swelling.

Peculiarities of hemostasis system state
in patients with angina pectoris
in medicinal and non-medicinal treatment.

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The aim of the work was to study the dynamics of hemostasis
system state in 119 patients with angina pectoris when
medicinal and non-medicinal methods of treatment are used.

In the group of patients getting nitrate and β-adreno-
blocker treatment no hypocoagulation action of therapy was
revealed, deviatons of the hemostatic system indices had
different directions.

When therapy included calcium antagonist there was noted
some hypocoagulation effect: the level rise of natural
anticoagulants and the increase of fibrinolytic blood activity.
The joint use of medicinal therapy including calcium antagonist
and non-medicinal method of treatment of angina pectoris -
EHF-therapy exerted the greatest hypocoagulation effect on the
hemostasis system: the anticoagulation level increased,
procoagulation potential decreased, fibrinolytic activity
reduced.

This EHF-therapy potentiates hypocoagulation effect of
calcium antagonists which allows to recommend this combination
for correction of disturbances of the hemostasis state in
patients with angina pectoris, especially when some signs of
disseminated intravascular coagulation syndrome are present.

Dynamics of hemocoagulation indices
and physical working capacity in patients
with angina pectoris under EHF-therapy.

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The aim of the present work was to investigate the correlation of hemostasis system reaction and physical working capacity in 119 patients with angina pectoris under EHF-therapy.

Positive or negative hemostasis system reaction as a result of treatment was defined by means of integral index with the regard of dynamics of 15 studied hemocoagulation parameters.

The improvement of general hemostasis system state (n = 89) was accompanied by the 1,5 increase of physical load tolerance. In the given group of patients statistically proved decrease of heart rate was also registered. The aggravation of hemostatic system state (n = 28) did not reveal any statistically proved increase of physical working capacity in patients with angina pectoris. Heart rate changes were not observed either.

Thus, it was on the positive reaction of hemocoagulation to EHF-therapy that the objective improvement of hemodynamic and physical working capacity indices was registered which is the evidence of close correlation between hemostasis and functional state of cardio-vascular system in patients with angina pectoris.

The obtained data also allow to consider the improvement of hemostasis system state to be an objective criterion of EHF-therapy effectiveness in patients with angina pectoris.

POTENTIAL ANTICOAGULANT REMEDY ON THE BASE SULPHOPOLYSACCHRIDES.

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Exposed bond between chemical structure and anticoagulant function by derivatives of polysulphate chitozan (PC) in experiments on rabbits.Sixteen polymers of PC (viscosity from 0,15 to 0,41 dl/g and quantity of sulphur from 8,8 to 16,9%%) possessed heparinous function by intravenous injection.Samples with high activity (30-52 UE/mg) and long action (250-350 min) had viscosity from 0,22 to 0,30 dl/g, quantity of sulphur not under 15%,period of semidisappearance was 35-50 min and constant of elemination from $1,39*10^{2}$ to $1,88*10^{2}min^{-1}$. It was determined that PC with viscosity 0,26 dl/g,quantity of sulphur 13% and specific activity 20 UE/mg inhibit blood coagulation by the way of acceleration of thrombin inactivation by plasma antithrombin III and heparin cofactor II (it is reaction need in 2 UE/ml PC,what is mush more then in reaction with AT III).Analysis of kinetice parameters of the catalytic activity of PC to action of the thrombin on chromogenous substrat in $1,17*10^{-5}$ M AT III presence,showed that PC catalysate noncompetitory inhibition AT III amidolytic activity of thrombin also how heparin.It was observed anticoagulant effects of simultaneous injection of heparin (H) with PC (spec.act.20 UE/mg) in the ratio of 1:1 w/w.Potentiation of heparin activity by PC was found and came to 1,95+/-0,15 in experiments on rabbits.Intravenous injection of mixture of (0,5 H + 0,5 PC)mg/kg caused the same effect at on injection H in a dose of 1 mg/kg.Haemorrhagic effect of this mixture was less the same anticoagulant and antithrombotic activities.

THE EFFECT OF HUMORAL HEMOLYTIC FACTORS UPON RHEOLOGIC
PROPERTIES OF RED BLOOD CELLS IN CASE OF EXTREMAL FACTORS

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As it is known the rheologic properties of blood in large
vessels are mainly determined by the concentration and mechanic
properties of red blood cells (Levtov V.A. with co-author,
1982,et al), which allows to use them as "target cells" for
potentiaally pathogenic ethiological factors (blood loss,
trauma,pathologic processes and so on).

We have shown the dependence of the changes of red blood
cells rigidity (IR as per filtration test at 1g) upon extracel-
lular conditions. Specifically we studied the chances of defor-
mation of red blood cells of "low resistant " populations with
the total index of acid resistance (TR) 410.5 %min in infusions
to the body suffered an acute decompensated blood loss (1 day).
At the same time the utilization of "young fraction" red cells
with TR 521.6 %min. stimulates less changes of IR. In the latter
case the process s of erythrodieresis stated as per the tissue
hemosiderosis and free blood serum hemoglobin are less pronounc-
ed.

Mathematically calculated blood serum hemolytic activity (HS,26-
29 UA) in acute blood loss associated with renoprival high-mo-
lecular humoral hemolytic faetors of the molecular mass of 80-
100 kD is realised with relation to low-stable and rigid popula-
tions of red blood cells,which promotes their distruction making
this antianaemic infusion therapy less effective.

In the clinic the patients with terminal renal insafficien-
cy red blood cells transfusions with the parameters characteriz-
ed by ow resistency,the deformity of the red blood cells at the
time of mostly pronounced HS of blood is much less effective,
which shows that for planned infusions it is neccessary to col-
lect donor red blood cells with high resistancy to hemolysis.

Under discussion now is the significance of the results
of the changes of red blood cells rheologic properties, of spe-
cial indices of blood dieretic activity for the purpose of de-
termining the feasibility of blood cells infusions at the mini-
mum adaptation "price" under extremal factors.
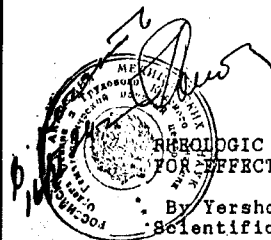
RHEOLOGIC PROPERTIES OF RED BLOOD CELLS AS THE TEST
FOR EFFECTIVENESS OF ENDARTERIAL INFUSIONS OF SOME
PREPARATIONS

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It has been found that the deformity of intact red blood
cells is lower when thay are incubated with cytostatic substan-
ces (cyclophosphamide - CP); the effect is seen in the increase
of IR (index of rigidity of red blood cells by filtration method
at 1g) by 2.5-3 times but the changes of the red blood cells
properties (IR,TR - total acid resistance, the duration of hemo-
lysis, the percentage of red blood cells of different stability
groups) appear directly upon the contact with CP. The effect of
red blood cells distruction is dose-dependent, that is when the
dose is 0.5 mg/ml the IR is 48%, with the dose of 1.5 mg/ml of
blood the IR is equal to 60.2% (test in vitro). This effect is
possibly connected with the fluidization of red blood cells mem-
brane because of the substance under study, which is manifested
by erythrodieresis of different degree.

In the experiment in vivo the infusion of CP bolus to
aorta at a.lienalis was accompanied by changes of deformity and
the indices of acid erythrograms of blood taken mainly from the
vascular region of the splenic vein, of the portal system, as
compared with the corresponding blood indices of v.v.jugularis,
renalis, which shows the cumulation and possible elimination of
the preparation under study from the regional vascular blood
flow of the portal system partioularly due to the disturbances
of erythrocytes deformity.

Under discussion are the problems of importance of the
tests on the changes of red blood cells rheologic properties in
different vascular regions for local accumulation and direct or-
ganic-cellular effect of the preparations, which potentiates the
mechanism of their remote action.

THE FEATURES OF MICROCIRCULATION AND REFLECTORY BLOOD CIRCULATION REGULATION FOR ARTERIAL HYPERTENSION PATIENTS

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The state of microcirculation and reflectory blood circulation regulation were compared for 73 essential hypertension patients and 18 persons of the control group. The former was assessed by the television capillaroscopy method and the developed method of micropletismography along with the functional load testing. The latter was evaluated by varying values of arterial pressure and heart contraction frequency while recording the electrocardiogram. The patients were tested for the reflectory regulation, i.e., Ashner test, orthostatic test, the test of low pressure receptors, and the test of high pressure receptors were made. In the last case, the negative pressure of 70 mm Hg was initiated in the synocarotodic zone. Correlation between the microcirculatory channel state and the reflectory blood circulation regulation was revealed. For the patients with the high venous microcirculatory vessel resistance, their blood-overfilling, and their low response to functional tests, the system blood circulation reflectory regulation was destroyed predominantly at the low pressure receptors. The destriction was followed by a higher diastolic pressure and small heart contraction frequency variation when performing the reflector tests. As the venous section of the microcirculatory channel was not overfilled, a high reactivity of microvessels at the level of precapillary sphincters was established. In this case a high activity of spontaneous rhythmic blood filling variation was observed, a great contribution into the arterial pressure regulation was made by the high pressure receptors with the pronounced variation of the heart contraction frequency. As this group of patients were subjected to medicinal testing, the hypotensive effect was obtained in response to vasodilators (prasosin, niphedipin). The first group patients reacted positively to diur.tic drags.

THE STATE OF MICROCIRCULATION AND HEMORHEOLOGY IN SEVERE FORMS OF MENINGOCOCCAL INFECTION IN CHILDREN

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Indices of microcirculation in vessels of bulbar conjuctiva, rheologic properties of blood were studied by the method of aggregation of erythrocytes and thrombocytes in 40 children with severe forms of meningococcal infection. Most marked changes in microcirculation were detected in memingococcal infection with infectious-toxic shock(ITS). In ITS of the 2nd degree clinical disorders of microcirculation were manifested by abrupt pallor of the skin, acrocyanosis, large hemorrhagic eruption with necrosis, dull rapid heart sounds, weak pulse, fall of arterial pressure by 50% compared to the appropriate age group, breathlessness, oligoanuria. Clinical symptoms of microc..riation disorders correlated with results of biomicroscopic and hemorheologic investigations. Vasodilatation of venule part, massive stases, sludge syndrome, emptying of carillary system, arteriolo-venular anastomoses, hemorrhage, stagnant anoxia of tissues, increased aggregation ability of erythrocytes and thrombocytes were determined.

In ITS of 3-4th degree total cyanosis, massive hypostases on the skin, anuria were clinically stated, arterial pressure and peripheral pulse were practically not determined.

Blockade of microcirculatory system, multiple ischemic zones, prolonged stases, tissue hypoxia, appearance of shock organs, polyorganic insufficiency were noted at the same time.

Thus, disturbances in microcirculation are the main ones in the clinic picture and pathogenesis of severe forms of minongococcal infection. Course and outcome of ITS depends on the degree of manifestation of microcirculatory block, duration of ischemia. Resistance to etiotropic and pathogenetic therapy is considerably conditioned by disturbances in microcirculation.

Curative tactics in the early period should be aimed at prophylaxis, and further at restoration of microcirculatory disorders.

HEMORHEOLOGIC DISTURBANCES IN INTESTINAL INFECTIONS IN CHILDREN

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Rheologic properties of blood were investigated by the method of rotation rheometry. Erythrocyte deformability was determined using fine filters. Electric conduction of blood and plasma was measured by alternating current of high frequencies. Volume disorders were estimated with the help of an apparatus "Indicator of circulating blood deficiency".

100 patients with different severity and course of toxicosis were examined.

Manifestation of rheologic shifts was proportional to toxicosis severity in patients. In acute period of the disease the syndrome of increased blood viscosity was diagnosed. Thickening of patients' blood was accompanied by reliable increase of blood viscosity in a wide range of velocity and tension shift, gradient of reduction of blood viscosity, limit of blood fluidity and coefficient of cell aggregation, as well as disorders of erythrocyte deformability. Decrease in electric conduction of blood and tissue was noted at the same time.

In most severe cases with prolonged toxicosis and polyorganic disorders with the increase of circulatory blood deficit, blood viscosity lowered when measured as in low as in high shift rate, but considerable damage of plastic and microrheologic characteristics of blood remained.

Strong reverse correlation between viscosity and electric conduction of blood was revealed($r=-0.88$). The latter parameter was determined quicker, a small sample of blood was needed and it made it possible to use it as a quick method for diagnosing the severity of toxicosis.

The data obtained show the dynamics of rheologic disorders in severe course of intestinal infections in adaptative response of the organisms and serve as the basis for administration of rheocorrection therapy.

NONMEDICINAL METHODS OF CORRECTION OF HEMORHEOLOGIC SHIFTS IN HEPATITES

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Hemorheologic shifts in pathogenesis of hepatites comprise one of the important components which demand a serious approach to the problem of their diagnostics and correction. Present methods of therapy of existing hemorheoloic disorders use medicinal or invasive instrumental ones as a rule. That's why it is important to study the possibility of using low power irradiation of millimetric wave band as a noninvasive method of therapy in hepatites. This method is able to produce a considerable influence on rheologic properties of blood.

The effect of millimetric irradiation on clinico-laboratory indices in 155 children with hepatites was investigated. Irradiation with wave length of 5.6mm and 7.1mm was used, one session lasting from 5 to 45 min. Epigastric region served as the irradiation zone, number of sessions was 12-15. Indices of prothrombin time, antithrombin III activity, fibrinogen level, amount of fibrinogen degradation products and fibrin-monomere complexes were used as criteria allowing to judge on rheologic properties of blood. Clinical data and routine laboratory tests(general and direct bilirubin, ALT activity) were evaluated in the present work.

When analysing results obtained, a positive effect of millimetric irradiation on important clinico-laboratory indices of pathological processes in hepatites was stated: shortening of jaundice duration, time of liver size normalization, indices of general and direct bilirubin and especially of ALT activity under the influence of millimetric waves. Comparison of different irradiation regimen revealed the greatest efficacy of sessions with irradiation duration of 30 min. Considerable differences in the use of wave lengths of 5.6mm and 7.1mm were not stated.

On studying the efficacy of millimetric irradiation influence on rheologic indices, the greatest effect was stated to be on the indices of antithrombin III activity, blood content of fibrinogen degradation products and fibrin-monomere complexes. This is a very important fact because shifts in these parameters were very significant in hepatites.

Summing up the results of usage of low power irradiation of millimetric wave band as means of correction of hemorheologic shifts in hepatites we should state the perspective of more detailed study of mechanisms of action of millimetric waves on the given component of homeostasis.

СТРУКТУРА И РЕОЛОГИЧЕСКИЕ СВОЙСТВА ВОДОРАСТВОРИМЫХ АНИОНИТОВ (КАТИОННЫХ ФЛОКУЛЯНТОВ)

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Для ускорения процесса при осветлении соков, вин, напитков, удаления из воды различных коллоидных, минеральных и органических примесей широко используются водорастворимые высокомолекулярные вещества.

В технологии виноделия процессы оклейки, стабилизации, осветления соков и вин с применением этих веществ, протекают медленно и требуют больших затрат труда и емкостей, поэтому стадии осветления до сих пор являются одним из самых узких мест в технологическом процессе.

В связи с вышеизложенным представлялось целесообразным разработать новый метод осветления, который позволял бы быстрее удалять вещества, вызывающие помутнения, с образованием компактных и легко фильтрующих осадков.

Для использования флокулянтов в небольших концентрациях и получения крупных, быстро оседающих хлопьев необходимо иметь водорастворимые катионные флокулянты, макроион которых имеет положительный заряд. Использование таких флокулянтов не требует предварительного коагулирования высокодисперсных коллоидов и суспензий.

При изучении структуры катионных флокулянтов на основе полиакриламида использовались электронно-микроскопические методы исследования. При изучении реологических и физико-химических свойств флокулянтов лучшие результаты получены у модифицированных полиакриламидов, в которых часть групп $-CO-NH_2$ заменена на группы $-CO-NH-CH_2-N-CH_3$ и $-CO-N-CH_3$.

$$\underset{CH_3}{} \qquad \underset{CH_3}{}$$

Для получения флокулянтов катионного типа был использован 1%-ный раствор полиакриламида (ПАА), который обрабатывали формальдегидом, диметиламином или триметиламином.

Водные растворы флокулянтов имеют высокую вязкость, размер макроионов и вязкость которых резко возрастает с понижением pH.

Результаты измерений потенциалов протекания показали, что макроионы флокулянтов имеют положительные заряды, а ПАА - отрицательный. Методом ИКС установлено, что возникновение свойств катионного полиэлектролита связано с появлением в спектре деформационных и валентных колебаний групп вторичных амидов, вторичного и третичного аминов.

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Chemical high-molecular substances soluble in water are widely used for acceleration of brightening process for juices, wines, drinks and for removal of different types of colloidal, mineral and organic impurities out of water.

In wine-making technology processes of clarification, stabilization and brightening of juices and wines with above mentioned chemical substances take much time and require lot of labour and capacities, that is why up to nowadays brightening stage is a "bottleneck" for the whole technological process.

With this in view it's reasonable to develop a new method of brightening, which would allow to take away agents caused turbidity. This new method should also comprise formation of low bulk and easy-removed residues.

For flocculants' application in small concentrations and for getting large and quickly coagulated flocculents it's necessary to use soluble in water cationic flocculants with "plus" signed macroions. While using such flocculants one shouldn't need preliminary coagulation of high-dispersed colloids and suspensions.

Electron-microscopic research methods were used to study structure of cationic flocculants based on polyacrylamide. While studying rheological and chemical-and-physical flocculants' characteristics the best results were obtained with modified polyacrylamides, where part of complexes of $-CO-NH_2$ were replaced with $-CO-NH-CH_2-N-CH_3$ and $-CO-N-CH_3$.

$$\underset{CH_3}{} \qquad \underset{CH_3}{}$$

Polyacrylamide (PAA) with 1% concentration specially treated with formaldehyde, dimethylamine or trimethylamine was used to get cationic flocculants.

Flocculants soluble in water have high viscosity with dramatic increasing of macroions' size and viscosity while decreasing of pH.

Flow potential measurement results proved that macroions of flocculants are "plus" charged while PAA are "minus" charged. Infrared spectroscopy research methods showed that cationic polyelectrolyte properties' formation appears due to emersion in spectrum of deformation and valence oscillations of secondary amides complexes as well as of secondary and tertiary amines, it was found out, that efficiency of flocculants is determined by its high molecular weight.

РЕОЛОГИЧЕСКИЕ СВОЙСТВА N-СОДЕРЖАЩИХ АНТИСЕПТИКОВ НА ОСНОВЕ ЧЕТВЕРТИЧНОГО АММОНИЯ

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Для защиты сырых, свежевыпиленных пиломатериалов от действия деревоокрашивающих и плесневых грибов широко применяются антисептики. Соединения на основе четвертичного аммония обладают высокой бактерицидной и фунгицидной активностью $(R_4N)^+X^-$ для соли, $(R_4N)^+OH^-$ для основания, где R - органический радикал, X^- - анион кислоты.

С целью расширения ассортимента этих веществ и получения продуктов со специальными свойствами была разработана технология производства четвертичного аммониевого основания, - алкилдиметилбензиламмоний хлорида.

Технологический процесс получения препарата включает три стадии: 1. Получение первичных хлоралканов из жирных спиртов и хлористого водорода; 2. Получение алкилдиметиламина из хлоралканов и диметиламина; 3. Получение алкилдиметилбензиламмоний хлорида из третичного амина и бензилхлорида. Изучение вязкости различных концентраций препарата показало, что уменьшение концентрации препарата до 0,1% концентрации в водном растворе оптимизирует процесс распрямления молекулы, увеличивает площадь радиуса действия, способствует снижению энергетических затрат.. Чтобы обеспечить полное прохождение основной реакции синтез проводят в избытке кислотных компонентов. При этом обеспечивается полное связывание аминов, и избыток кислоты нейтрализуется кальцинированной содой, дополнительно введенной в среду.

Для привлечения бактерий в зоны наибольшей концентрации биоцида, все биоциды в связанном виде содержат Р-содержащие соединения. Полученный препарат обладает хорошим поверхностно-активными свойствами. При изучении структурно-механических и реологических свойств установлено, что молекулярная масса препарата составляет 346-376, плотность раствора 0,96-0,97 г/см³, вязкость при 20 град. С 140-150 спз., критическая концентрация мицеллообразования - 0,6%. Препарат умеренно токсичен $Д_{50}$ = 350 мг/кг белых мышей.

RHEOLOGICAL PROPERTIES OF N-CONTAINING ANTISEPTICS BASED ON QUATERNARY AMMONIA

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Antiseptics are widely used to protect raw, fresh timber from wood-colouring and musty microorganisms. Chemical compounds based on quaternary ammonia have high bactericidal and fungicidal activity $(R_4N)^+X^-$ for the salts, $(R_4N)^+OH^-$ for bases, where R - organic radical, X^- - acid anion.

To increase range of such chemical compounds and to develop products with specific properties, production technology for quaternary ammonia base, - alkyldimethylbenzilammonium chloride, was worked out.

There are 3 stages in alkyldimethylbenzilammonium chloride production technology process: 1. Synthesis of primary chlorinated alkanes from fatty alcohols and chlorine hydride; 2. Synthesis of alkyldimethylamine from chlorinated alkanes and dimethylamine; 3. Synthesis of alkyldimethylbenzilammonium chloride from tertiary amine and benzilchloride. While studying viscosity of alkyldimethylbenzilammonium chloride at different concentrations, it was found out that decreasing of chemical concentration up to 0,1% in water is optimal for moleculars' unbending, increasing its reaction activity, which enable to decrease power energy costs. Synthesis of alkyldimethylbenzil-ammonium chloride takes place in plenty of acid components to secure full run of the main reaction. Thus, amines are bounded up and added into reaction soda ash neutralizes excess of acid.

All binded biocides have phosphorus-containing compounds to attract bacterium to the areas of the biggest concentration of biocides. Alkyldimethylbenzilammonium chloride has good surface activity. While studying of structure-and-mechanical and rheological properties it was found out that molecular weight of alkyldimethylbenzilammonium chloride is 346-376, density - 0,96-0,97 g/cm³, viscosity at 20 degr. C - 140-150 centipoises, critical concentration for micelles' formation - 0,6%. Moderate toxicity for white rats - LD_{50} = 350 mg/kg.

БИОЛОГИЧЕСКАЯ АКТИВНОСТЬ ВО ВРЕМЕНИ N-СОДЕРЖАЩИХ ОЛИГОМЕРОВ И ИХ РЕОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ

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Четвертичные аммониевые соли являются дизенфицирующим средством, они прекрасно растворимы в воде, растворы не имеют никакого запаха, совершенно безвредны для людей, а свое действие на микробы проявляют на объекты при очень большом разбавлении.

Для привлечения деревоокрашивающих и плесневых грибов в зоны наибольшей концентрации биоцида использовали фосфор-содержащее соединение диметилфосфат.

Р-органические соединения в сочетании с N-содержащими олигомерами усиливают функции биоцида, выполняя роль приманки грибов и полимикроорганизмов.

Установлено, что в рабочем растворе в процессе обработки пиломатериалов возможно создание условий, когда не вся поверхность древесины смочена биоцидом. При этом полимикробы (грибы) концентрируются в тех местах, где базируется Р-содержащий компонент. Тем самым достигается высокий уровень защиты древесины.

Биологическую активность препарата во времени в зависимости от концентрации водных растворов определяли при испытаниях образцов из свежевыпиленной заболони сосны, влажностью 80-120%, размерами 5x15x180 мм. Стерилизованные образцы антисептировали методом окунания в водные растворы 3;5;7%-ных концентраций. После подсушки образцы инфицировали суспензией спор 4-х видов плесневых и 4-х видов деревоокрашивающих грибов. Осмотр образцов производили через 10, 20 и 30 суток.

ОБРАСТАНИЕ АНТИСЕПТИРОВАННЫХ ОБРАЗЦОВ ГРИБАМИ

Концентрация раствора, %	Обрастание образцов грибами, % через		
	10 суток	20 суток	30 суток
3	19	19	21
5	0	5	6
7	0	1	2
0 (контроль)	43	56	60

Из приведенных данных видно, что с повышением концентрации биоактивность антисептика значительно возрастает.

BIOLOGICAL ACTIVITY IN TIME OF N-CONTAINING OLIGOMERS AND THEIR RHEOLOGICAL CHARACTERISTICS

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Quaternary ammonia salts come as disinfectants. They possess perfect solubility in water. Their solutions are ordorless, absolutely safe to people, but affect the microbes of the different objects being diluted in big portions of water.

Dimethylphosphate (P-containing compound) was used to attract timber-colouring and musty microorganisms in the areas of the highest biocides' concentration.

Phosphorus-containing substances in combination with N-containing oligomers increase properties of biocides to attract fungus and polymicroorganizms.

It was found out that in process solution in the treatment of lumber it's possible to create conditions, when not all the surface of timber is wettable by biocide. In this case polymicrobes (fungus) are concentrated in those areas, where phosphorous-containing substances are located. Thus, high level of timber protection is achieved.

Biological activity in time dependant on concentration of water solution was studied when fresh pine lumber was tested with humidity 80 - 120% and dimensions 5x15x180 mm. Sterilized samples were treated with antiseptic by dipping into water solutions with 3;5;7% concentrations. After drying the samples were infected by suspension of 4 types of musty spores and by 4 types of timber-colouring fungus. Evaluation of samples was made after 10, 20 and 30 days period.

Fungus overgrowing of the treated with antiseptic samples

Concentration of the solution, %	Fungus overgrowing of the samples in the period of		
	10 days	20 days	30 days
3	19	19	21
5	0	5	6
7	0	1	2
0 (control)	48	56	60

It can be seen from the obtained results, that when concentration is rising, antiseptic's activity is considerably increasing.

MEVACOR EFFECT ON HEMORHEOLOGIC PARAMETERS IN IHD PATIENTS WITH HYPERLIPIDEMIA

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Mevacor effect on clinico-functional state of cardiovascular system, parameters of lipid metabolism and microcirculation was investigate in IHD patients with hyperlipidemia.

Po. tive Mevacor effect on the clinical state of examined patients was noted during normalization of blood lipid profile, it was manifested by rare attacks of angina of effort, decrease in the number of nitroglycerin tablets used daily. When studying microcirculation parameters, shifts to normalization of hemocoagulation indices were found out. The drug produces the most positive effect on the fibrinogen level and thromboelastography indices: maximal density of the thrombus, coefficient of thrombus elasticity, blood coagulation constant.

Using bulbar biomicroscopy, distinct positive dynamics of intravascular changes was determined, it was manifested by considerable revival of blood flow with disappearance of erythrocyte aggregation phenomenon and restoration of blood flow in microvessels in one half of patients examined.

Under Mevacor influence some shifts of vascular indices were noted which is manifested by relieving the spasm of arterioles and venules.

Thus, a hypolipidemic drug Mevacor produces antianginal effect in IHD patients, improves the functional state of cardiovascular system, contributes to shifts to normalization of hemocoagulation indices and microcirculation, especially on the level of intravascular component

J.A.KATS

CHANGES IN THE STRUCTURE OF ERYTHROCYTES OF PATIENTS SUFFERING WITH RHEUMATISM ARE AN IMPORTANT FACTOR IN DISTURBANCE OF BLOOD REOLOGY.

(Saratov Medical University)

Multicomponent system determining the changes of blood reology of a patient with rheumatism (R) is disturbed in several directions: vascular side, outside cellularan and cellular composition of blood. Only some single works discribe ultra structure of erythrocytes (E) in the period of hard rheumatism fever. We could not find in literature any analysis of (E) during (R) between attacks. At the some time it is very important to know about "deinformation" in blood (E),its quantity and structure. Taking everything said above into consideration we have analysed 7 patients ultra structure of (E) with the help of electronic microscope "Tesla-580". Great changes both in membrane (E) and cytoplasm were found out. Membrane (E) often has breaks it looks like "a fringe", it is of a fibre type. In some cells instead of a thin gentle membrane there is irregular thickening with a lot of "pore" and integrity disturbance. Matrix (E) is of irregular character of "spotty" type. The density of electronic "spots" is of different size is a rule and the distribution in cytoplasm is chaotic, sometimes it becomes full of holes because of the great quotity of vacoles of different size. Described character of ultra structure (E) and morphometric research allow us to come to a conclusion that in the period between attacks of rheumatism changes in blood reology depend on disturbance of (E) and itmakes necessary to include suitable means of correction into therapy.

ROLE OF HORMONES IN REGULATION OF RHEOLOGIC PROPERTIES OF BLOOD

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Rheologic properties of blood depend on its structural components(formed elements, plasma) and their interaction. More fully it is shown in the development of homeostatic reactions aimed at keeping blood in liquid state. Hormones of endocrine glands play an important role in regulation of coagulation homeostasis.
Coagulative, lytic, kininogenic activities of blood, functional state of erythrocytes, thrombocytes were studied in experiments on rabbits and white rats to find out the mechanisms of hormone effect on different components of hemostasis.

Thyroxin, insulin, adrenaline, oxitocin are stated to be one of the pathogenic mechanisms contributing to development of thrombo-hemorrhagic syndrome. Hormones cause differet shifts in hemocoagulation depending on the dose used, time of investigation and initial functional state of regulation system of aggregate blood state. Disturbances in hemostasis are due to the change in activity of plasma factors, aggregation ability of erythrocytes and thrombocytes. Reaction of jointly functioning systems of fibrinolysis, kininogenesis and complement depends on peculiarities of biological effect of the hormone used.

Thus, the studied hormones changing the rheologic blood properties may be the cause of hemodynamic disturbances, in microcirculatory vessels particularly.

Effect of haemosorption on cardiohaemodynamics and microcirculation in patients with IHD.

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Our experience of using haemosorption (HS) in patients with angina pectoris of different functional classes (FC) with early manifestations of cardiac insufficiency is presented in this paper.

The main group included 70 patients with angina pectoris of HF IA, HF IB, HF IIA stages, with received traditional therapy together with HS.

The increase of physical activity was due not only to the decrease of coronary insufficiency, but also to the increase of the contractile function of myocardium. In patients with HI stage complete restoration of the contractile function of myocardium due to a significant decrease of the end-systolic and end-diastolic volumes of the left ventricle was observed. The disturbances of diastolic processes were preserved in the group of patients with HF IIA stage. Manifestations of the blood flow insufficiency were correlated with the disturbances of microcirculation. After using of HS the general conjunctival index lowered statistically significant in the all groups. The positive effect was markedly revealed at the intravascular level. The increase of the blood flow, a considerable decrease of intravascular aggregation of the formed elements of blood were noted in patients ith HF IA and IIA stages.

Therefore, the use of haemosorption together with the drug therapy in patients with IHD, with manifeststions of HF I and IIA stages is followed by high antianginal effectivity (81.4%), an improvement of the contractile ability of myocardium.

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Mirobilko, O.A.Shunova, L.G.Molchanova, A.F.Shepelenko,
N.I.Pchereviatnikova, I.V.Pris izhniuk, M.M.Shashina

HEMORHEOLOGIC ASPECTS OF DIAGNOSTICS AND THERAPY IN PULMOJOLOGY

Hemorheologic aspects of pulmonary pathology are poorly studied.
Among the most obscure are those of general mechanisms, peculiarities
of development of microcirculatory disorders in acute and chronic in-
fectious-allergic, inflammatory and purulent diseases of the lungs;
as well as further clarification of particular features of course of
a disseminated -intravascular coagulation syndrome (DIVC-syndrome) in
these diseases; and choice of therapeutic techniques taking into ac-
count hemorheologic disorders.

For 1983 - 1994 we have been studying with the help of modern tech-
niques microcirculatory systems of 460 patients; among them 150 cases
of bronchial asthma, 148 of acute pneumonia, 162 cases with acute chro-
nic suppurative processes in the lungs.

DIVC-syndrome was proved to be essential of microcirculatory system
disorders in non-specific diseases of the lungs (NSDL). Different forms
of NSDL showed common regularity in initiating the DIVC-syndrome, high
plasticity of microcirculatory system in unfavourable conditions, se-
condary character of these involvements into pathological process, their
reversibility. Temporary or long-lasting loss by hemorheologic system
of its ability to respond adequately to the changes of homeostasis due
-to the development of cor pulmonalis, water intoxication or excessive
organism dehydration is observed only in severe hypoxia, infective-
toxic shock, allergic reactions and exacerbation of pyogenic process.
DIVC-syndrome in such cases contributes to the organ involvement (e.
g. lungs, kidneys).

Pati nts in need of hemostasis evaluation and correction of its
disorders, patients with asthmatic status, in acute period of severe
pneumonia, with severe course of acute purulent diseases of the lungs,
patients with marked exacerbation of chronic pyosis in the lungs, and
those patients undergoing intensive infusive, hormonal and antibiotic
therapy, as well as pregnant women should be attributed to the cases
of NSDL.

Microcirculatory dynamics control can be used as one of the assess-
ment criteria of therapy effectiveness and rehabilitation of patients
with NSDL.

PECULIARITIES OF BLOOD AGGREGATION STATE IN YOUNG PATIENTS WITH HYPERTENSION AND ITS CORRECTION

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Changes in rheologic state of blood often occur to be
one of pathogenic components of some diseases(IHD, hyper-
tension).

We used the method of determination of blood aggregation
state with the help of laser aggregation analyzer integra-
ted with an IBM-compatible computer.

Functional activity of thrombocytes was investigated in
young men(18-29 years of age) suffering from hypertension
of I-II stage without drug intake and simultaneously with
incubation with new antiaggregants - 1,4-dihydropyridine
derivatives.

Aggregation status of patients compared to the control
group was stated to be characterized by the increase of
blood viscosity which was proved by increase of thrombo-
cyte aggregation rate by 13.4 + 1.3%(P<0.01). Increase of
intitial and maximal aggregation rates by 9.7 +0.3%
(P<0.01) was observed at the same time.

Substances having arylophilic fragments(IOS-1212,
IOS-2137) influenced viscous properties, reducing the
aggregation rate by 17.7 + 1.3%(P<0.01).

While medicines having symmetric alkyl fragments in
molecules influenced the early stages of adhesion-aggre-
gation process. Medicines IOS-397, R-4-25 and IOS-4950
reduced the initial aggregation rate by 13.2 + 1.1%(P<0.01)
Thus aggregant state of blood in patients with hyperten-
sion is characterized by the increase of functional acti-
vity of thrombocytes accompanied by changes in rheologic
properties. Correction of rheologic changes is better to
carry out with 1,4-dihydropyridine deri itives using the
principle of connection of structure and action.

The hemocoagulation state in treatment of patients
with angina pectoris and concomitant arterial hypertension.

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The aim of the work was to estimate the influence of
EHF-therapy on hemostasis system state in patients with angina
pectoris depending on the blood pressure level.

In the group of patients with normal blood pressure (n =
52) a procoagulant potential decrease (due to the reduction
of fibrinogen level and prolongation of blood coagulation time)
and the reduction of intravasculscular activation of blood
coagulation (according to the results of fibrinogen "B"
definition) were noted. Besides, there were estimated the
level rise of natural anticoagulants (of free heparin) and
fibrinolysis activation (the rise of summary fibrinolytic
activity and plasminogen contents).

In patients with angina pectoris and borderlike
hypertension (n = 30) (blood pressure 140/90 - 159/95 mm of
Hg) hypocoagulation effect of electromagnetic wave therapy
consisted first of all of the increase of anticoagulant blood
activity (due to the rise of heparin level and prolongation of
thrombin time); as for the dynamics of fibrinolysis index it
was different.

In patient with concomitant arterial hypertension (n =
21) the reaction of hemostasis system to EHF-therapy consisted
of the increase of antithrombin-III and total fibrinolytic
activities.

Thus with the rise of arterial pressure, hypocoagulation
effect of EHF-therapy in patients with angina pectoris reduces
due to cessating of influence on procoagulant elements of the
hemostasis system and difference in directions of shifts of
fibrinogen indices.

THE STATE OF HEMOSTASIS SYSTEM IN THE FOLLOW-UP PERIOD
OF THE DISEASE AFTER MILLIMETER WAVES TREATMENT OF
PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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The aim of the work is to study the dynamics of sys-
tems of hemostasis and fibrinolysis in different periods
after treatment of patients with acute myocardial infarc-
tion(AMI) by EHF irradiation.

68 patients(the main group) who had acute myocardial
infarction and underwent EHF therapy from the first day
of the disease(10 sessions all in all) were included into
investigations. 20 patients having no EHF therapy served
as the control group. The control group was compared to
the main group in age, the degree of severity, character
of drug therapy.

EHF therapy was carried out by "Yav" apparatus with
"Yastnost" device attached to it, using the wave length of
5.6 and 7.1 mm.

Examination of patients was performed in 1,3,6 and 9
months after discharge from the inpatient department.

It was stated that in 6 months after discharge pati-
ents of the main group continued to maintain the lower le-
vel of procoagulative activity of blood, and it being
proved by the prolongation of silicone coagulation time
and index of the range of contact activation compared to
the control group(p<0.05). The level of fibrinolytic acti-
vity of blood plasma was also higher in the main group as due
to the increase in activity of plasminogen activators as
to the decrease in antiplasmin activity.

Thus more favourable dynamics of hemostasis indices in
patients in the follow-up period after acute myocardial
infarction and undertaken EHF therapy may play an import-
ant role in prevention of thrombus formation.

COMPARATIVE EVALUATION OF DYNAMICS OF HEMOSTASIS INDICES
IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION WHEN USING
DIFFERENT REGIMEN OF EHF THERAPY:CONTINUOUS AND INTERRUPTED

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The aim of the present work is to find out the regimen of
EHF irradiation optimal for patients with acute myocardial
infarction(AMI).
When using EHF therapy in interrupted regimen total amount
of exposure during one session is cut to 10 min(instead of
30 min as in continuous regimen).
It was found out that increase of anticoagulant and fib-
rinolytic blood activity was observed in patients under-
going EHF therapy in continuous regimen after 3 EHF ses-
sions compared to the control group. By the middle of
EHF course(on the 7th day of the disease) decrease of
fibrinolytic, and further on of anticoagulant blood ac-
tivity was noted that was probably the result of marked
activation and depletion of the above mentioned systems
caused by the course. Therefore, usage of EHF therapy in
continuous regimen for patients with AMI is unsuitable.
Usage of EHF therapy in interrupted regimen gave fa-
vourable effect on all components of hemostasis systems
in AMI patients. We observed reduction of procoagulant
component and activation of anticoagulant and fibrinolytic
components of hemostasis, decrease of hypercoagulation and
restoration of anticoagulant mechanisms taking place gra-
dually(in contrast to continuous regimen).
Thus, interrupted regimen of EHF irradiation is most
favourable for treatment of AMI patients that probably
conditions the clinical effect and improvement of hospi-
tal prognosis in EHF therapy.

RHEOLOGY AND IMMUNITY DISTURBANCES IN ATHEROSCLEROSIS

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Immunologic investigations in atherosclerosis allowed to
state the development of immunity disturbances to be clo-
sely connected with disturbances in hemostasis system. De-
tected autoimmune disturbances change the activity of
leucocytes, thrombocytes and erythrocytes, increase vas-
cular permeability, activate hemocoagulatic mechanisms.
Connection between immunity system and hemocoagulation
hemostasis may be realised not only through complement
system, but with the help of tissue antigens, diferent
autoantibodies and immune complexes. Correction of hemo-
stasis disturbances is closely connected with correction
of autoimmune disturbances and vice versa.
These observations give the opportunity for further
purposeful investigations of hemorheologic and immunolo-
gic factors of atherosclerosis pathogenesis and for search
of effective methods in correction of immune disturbances,
hemocoagulation homeostasis and microcirculation distur-
bances.

NEW APPROACHES TO CORRECTION OF THE STATE OF HEMOSTASIS SYSTEM IN ANGINA PATIENTS

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The aim of the present work is to work out methods of choosing the optimal parameters of EHF irradiation in treatment of angina patients depending on individual peculiarities of the state of blood coagulation system. The present work is a logical continuation and generalization of results obtained in investigations performed earlier. We showed that EHF therapy or electromagnetic irradiation of millimetric wave band produced hypocoagulative effect on the state of hemostasis system in angina patients due to the increase of anticiagulant and fibrinolytic blood potentials.

According to our data different methods of EHF therapy (depending on the use of different wave lengths and irradiation regimen) influence different components and mechanisms of blood coagulation which served as the basis for a suggested method of individual choice of EHF irradiation parameters for every patient. Individual choice is performed with the help of a specially compiled table composed on the basis of an original mathematic apparatus. Not only character but degree of manifestation of pathologic shifts in hemostasis system of the patient before the start of treatment are taken into account.

The suggested technique of individual approach is theoretically substantiated not only from the point of view of a mathematic apparatus, but considering the main peculiarities of millimetric wave band in their interaction with living organisms. Besides the given technique possesses an obvious advantage because it is based on one of the pathogenetic components of angina development - the state of hemocoagulation processes.

The use of the suggested technique of individual approach to administration of EHF therapy in clinical practice allowed to increase hypocoagulative effect of the undertaken therapy of angina patients statistically significant.

MECHANISM OF REGULATION OF THROMBOCYTE COMPONENT OF HEMOSTASIS IN LABOUR BY AMNIOTOMY

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We determined the effect of amniotomy on the hemostasis system(V. F. Kiritchuk, I. V. Sokolova, 1990).

After amniotomy thrombocyte consumption in the process of intravascular coagulation takes place in all parturients. Amniotomy in the first stages of discoordination of uterine muscles causes shortening of thrombocyte aggregation time under the influence of the subthreshold dose of erythrocyte hemolysates. This fact proves the appearance of activated thrombocytes having increased aggregation ability in the blood flow. The increase of thrombocyte aggregation ability under the influence of different hemolysate doses in spastic contractions and hyperetonus of uterine muscles also shows the increase of the functional activity of thrombocytes. Amniotomy in tetanic contractions of uterine muscles results in shortening of thrombocyte aggregation time under the influence of a hemolysate subthreshold dose. However, aggregation time and aggregation ability of thrombocytes do not normalize under the influence of the maximal hemolysate dose. A complex but differentiated medicinal correction is needed for correction of disorders in myometrium muscles contractions, the correction resulting in normalization of functional activity of a thrombocyte component of hemostasis.

ON THE ROLE OF ADRENERGIC INFLUENCE IN THE REGULATION OF HEMOSTASIS IN NORM AND PATHOLGY

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In experiments on intact noninbred white rats, as well as dynamics of botulinic and plague intoxication(BI and PI), the influence of sympatholytic reserpin, alpha- and beta adrenoblockers on the state of integrative indices of procoagulantive, anticoagulative components of hemostasis and fibrinolysis system were studied. Exhaustion of reserves of tissue catecholamines in reserpinized healthy animals was accompanied by development of hypocoagulation or prevented hypercoagulation formation in BI. Propranolol administration contributed to activation of anticoagulative mechanisms and fibrinolysys system in intact animals, prevented excessive activation of anticoagulative mechanisms in PI and development of anticoagulative factors deficiency in BI. The study of alpha- and beta-adrenoblockers effect in BI model allowed to find out not only the principal difference in mechanisms of action on procoagulative component of hemostasis and fibrinolytic blood activity, but general effect of inhibition of anticoagulative mechanisms. The data obtained permit to conclude that resulting effect of influenc on hemostatic potential through alpha- and beta-adrenoblockers is determined not only by the character of influence, but by initial state activity of sympathoadrenal system, adrenergic reactions as well.

HEMODYNAMICS AND DIC IN PARTIRUENTS WITH DISCOORDINATED LABOR ACTIVITY

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Discoordinated labor activity provokes different character not only of hemodynamics but causes the development of consequently different stages of DIC.

The first stage of discoordination of uterine muscular contractions when simultaneous contractions of circular and longitudinal muscles with the latter prevailing take place and the rise of arterial pressure only during labor pains is noted is ch racterized by activation of the contact phase of blood coagulation process which is associated with the increase in the tonus of a sympathetic part of automomic nervous system and elevated blood noradrenaline.

Discoordination progression in the second stage is accompanied by the activation of the internal mechanisms of blood coagulation changes in microcirculatory and coagulative hemostasis. Marked stimulation of symp hoadrenal system in uterine hypertonus results in catecholamine manifestation of their effect on hemodynamics due to activation of presynaptic terminals of choline-, purine-, dophamine-, prostagglandin-, serotoninergic structures. The function of efferent organs synthesizing and consuming factors of hemocoagulation is changed. Just because of uterine hypertonus that symptoms dangerous for the mother and fetus appear: tachycardia, persisted hypertension, symptoms of threateneing hysterorrhexis, placental detachment, acute intrauterine fetal hypoxia.

The change in hemodynamics progress in the third stage of dicoordination occurs. In uterine muscular tetanus, parturients develop tachycardia, asymmetry of elevated arterial pressure, increased respiratory ate manifesting heart-lung insufficiency, functional ability of kidneys decreases. Tetanic uterine contractions contribute to hypercoagulation progression caused by consumption coagulopathy in microcirculatory and coagulative components of hemostasis. Activation not only of internal but external mechanisms of hemostasis takes place influencing the hemodynamics and showing the DIC syndrome progression.

MECHANISMS OF HEMOSTASIS DISORDERS IN BACTERIAL INTOXICATIONS

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Investigation of the character and mechanisms of disorders
in coagulative hemo asis and fibrinolysis in dynamics of
botulinic, plague and gasgar..rene intoxication(BI, PI, GGI)
allowed to find out peculiarities of DIC syndrome condi-
tioned by specificity of molecular-cellular mechanisms of
toxin action, as well as to determine some general princi-
ples of drug correction of disturbances in hemostatic
blood potential induced by secondary nonspecific metabolic
disorders.
Consecutive change of hemocoagulation phase by hypocoagu-
lative disorders is one of the general laws of nature in
hemostasis disturbances. Howevere, there is a stable acti-
vation of fibrinolysis and anticoagulant mechanisms up to
terminal pathologic state in PI. In BI, fibrinolysis acti-
vation is combined with anticoagulant mechanism deficien-
cies in the severe stage of intoxication. Hypercoagulation
beginning while GGI development was combined with
increased anticoagulant properties of blood and tissues,
inhibition of fibrinolysis system.
Hemostasis disorders in bacterial intoxication were com-
bined with activation of LP processes, with the increase
of the leve' of lipid hydroperoxides and malonic dialdehyde
in blood and tissues despite some activation of enzymatic
component of antioxidant system of blood and tissues.
LP activation in bacterial intoxication was combined with
destabilization of biological membranes, disorders of
transport ATP-ase activity of cytoplasmic, synaptosomal
membranes - Na-, K-, Ca- ATPases proving it, as well as
rise in activity of serum transaminases - AST, ALT, corre-
lating with severity of intoxication development, hypoxia,
LP activation.
Determination of general laws of combination of hemosta-
sis disorders with LP processes activation and destabili-
zation of biological membranes in different bacterial in-
toxications makes the possibility of using antioxidants,
membrane protectors as one of the means of regulation of
hemostatic blood potential obvious.

THE STATE OF ANTITHROMBOGENIC ACTIVITY OF VESSEL WALL IN IHD PATIENT

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In healthy people endothelial lining of vessels is
athrombogenic, it has a high anitaggregative, anticoa-
gulative and fibrinolytic activity due to the synthesis
of prostacyclin, antithrombin III and plasminogen acti-
vator by endothelial cells. Decrease of antithrombogenic
activity of a vascular wall is one of the leading risk
factors in thrombus formation, it may lead to increased
deposition of thrombocytes on the vascular wall, contri-
bute to atherosclerosis progress. Functional damages of
vascular walls are components of IHD pathogenesis.
We studied the state of antithrombogenic activity of
vascular walls depending on the clinical stage of IHD
(exacerbation, remission).
In patients with exacerbation of the coronary syndro-
me (firstly developed angina pectoris, progressing angina
pectoris) antithrombogenic activity of vascular walls is
lowered. Reduction of antithrombogenic activity of vascu-
lar walls was more significant in patients with a longer
period of the disease and more frequent exacerbations
Prolonged remission was accompanied by restoration of
antithrombogenic activity of the vascular wall.
Restoration of antithrombogenic activity of a vascular
wall must be an obligatory component in prophylaxis of
atherosclerosis process and treatment of IHD patients.

HE-NE LASER EFFECT NORMALIZATION OF ERYTHROCYTE AGGREGATION CHANGED BY GLUCOCORTICOIDS

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Existance pf hormone-resistant forms of chronic glo-merulonephritis(CG) in childrem makes the achievement of a positive effect from glucocorticoid adminstration difficult. Results we obtained earlier prove that use of transcutaneous laser irr 'lation of blood in the complex therapy of CG results in quicker achievement of remission, its maximal prolongation and reduction of single as well as course dose of prednisolone.

To reveal mechanisms of effective glucocorticoid therapy, changes in aggregative activity of erythrocytes under the influence of prednisolone and under He-Ne laser radiation effect were studied. Washed erythrocytes concentrated 1 ml cells/1 ml 135 μM NaCl solution and 10 μM tris-HCl solution in four test-tubes comprised the experimental system. Test tubes 1 and 2 had 0.1 ml(3 mg) of prednisolone, and test-tubes 3 and 4 contained 0.1 ml of saline solution each. After careful mixing solutions in test-tubes 1 and 3 were irradiated by He-Ne laser(λ=632.8 nm, power density at the end of the light guide was 1 mWt, exposure time - 10 min.) Then all samples were incubated in thermostate (t=37 C) during 20 min. After incubation the degree of erythrocyte aggregation was determined by aggregation index.

A model experiment showed that prednisolone injection into the system increased reliably the degree of erythrocyte aggregation - 2.88 $\pm$ 0.06(the value was 0.89 $\pm$ 0.024 when saline solution was added, P<0.05). The use of He-Ne laser irradiation in both systems(erythrocytes+prednisolone, erythrocytes+saline solution) contributed to significant reduction of aggregative activity of erythrocytes(1.16 $\pm$ 0.015 and 0.41 $\pm$ 0.006, correspondingly).

Efficacy increase of corticosteroid therapy with transcutaneous He-Ne laser irradiation takes place due to reduction of aggregative activity of erythrocytes induced by the disease itself and by the glucocorticoid administration.

Changes of some Data of Hemostasis in Patients with the Atopic Dermatitis in Process of EHF-therapy.

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For the first time complex investigations of the hemostasis with the atopic dermatitis in the process of the EHF-therapy were conducted. 30 patients the age from 8 to 35 were under observation. Many foci of infiltration, erythema localized particularly in the area of ulnar bends, subleneed pits and neck. Subjectively intensive itching troubled. Essential decrease of the blood coagulation time, reduction of the heparin level and increase of the blood fibrinogen were stated before treatment.

Influence upon cervicothoracical section of the spine was conducted with Jav-1 (Явь-1) apparatus (wave length 5,6 мм) exposition 7 - 10 min.

The distinct clinical effect was st ted after 10 -15 daily procedures. Disappearance of itching, solution of erythema, reduction of the infiltration took place at the average for 5 - 6 days earlier than in the group of comparison with the use of general medicamental preparations.

At the same time data of hemostasis (increase of blood coagulation time, increase of heparin level and reduction of blood fibrinogen content) normalized under influence of EHF- therapy.

SYSTEMIC APPROACH TO EVALUATION OF HEMORHEOLOGIC CHANGES IN CARDIOVASCULAR DISEASES

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At present there is enough information of disturbances of blood fluidity in cardiovascular diseases (CVD). However, according to results mentioned in literature and according to our own data disorders in rheologic indices in CVD occur often, but they are determined not in all patients, even severe ones. There are patients with acute and subacute forms of ischemic heart disease (IHD) whose parameters conditioning blood fluidity are better than one should expect basing on generally accepted conceptions: low blood viscosity, relatively high fluidity of erythrocyte membranes, somewhat reduced fibginogen level, significant activity of fibrinolysis system. Usually these results are considered to be accidental.

However these facts may be explained basing on the theory of functional systems of the organism. In CVD blood fluidity may be considered as one of the most important parameters. There is a functional system including some subsystems to support this parameter (functional system of blood fluidity support -FSBFS). Due to this the above mentioned changes as well as such phenomena as dilution syndrome in cardiac insufficiency and some forms of arterial hypertension, significant increase of blood fibrinolytic activity in some patients with congenital cardiac defects may be considered as adaptation of some components of FSBFS in response to disorders in other components or as a compensatory reaction of the whole system to vascular narrowing and some other factors increasing resistance to blood flow. What concerns ierarchy and intersystemic interaction of FSBFS and hemostasis system, hemorheology system probably has a priority and hemostasis system has the role of a subsystem in considerable prevailance of factors of vascular narrowing in disease pathogenesis (e.g. hypertension). In case of prevailance of damag to the intactness of a vascular wall, hemostasis system is more important (e.g. nonstable angina pectoris and myocardial infarction), and rheology system is a subordinate one.

Changes of rheologic indices in cardiovascular diseases are better to consider as not deviation from norm, but as a result of adaptative changes in FSBFS or as a result of disorders in this adaptation. Systemic approach to evaluation and correction of rheologic indices allows to specify indications for administration of medicines and methods of treatment aimed at improving blood fluidity.

Influence of Laser Irradiation with the Wave Lenght of 0.48-0.51mcm in Brain Rheology.

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Preliminary studies showed efficiency of Ar-laser application in brain vascular tumours removal. Due to that there appeared the necessity to investigate processes taking place in laser irradiation zone. Morphological picture as well as local brain blood flow dynamics and statys of edema-swelling process in laser alteration zone were investigated.

In small power densities (0.5-1.25 Vt/mm) attention was attracted by appearence of sludge-phenomenon, resulting later in parietal thromboses formation. Thromboses increasing in size filled blood vessels lumen at considerable lenght and made brain blood flow difficult. Besides, brain tissue was intact.

In irradiation power density of 1.26-2.5 Vt/mm irradiated blood vessels diameter decreased up to complete obliteration. Brain substance in perivascular zone revealed reactive-destructive changes, phenomena of central and peripheral chromatolysis. There was observed venous plethora and intravascular thrombosis formation.

In power density of more than 2.5 Vt/mm brain substance revealed tissue defect formation.

To evaluate the degree of manifestation of brain tissue edema and swelling processes in laser irradiation impedance measurement method was used, and to investigate local brain blood flow hydrogen clearence method was used.

The carried out investigations revealed impedance indices decrease at the distance of 0.5-1.5 mm from exposure centre by 15% on an average compared to the initial level on the 1-2 days after irradiation. Since the 3-d day on there was noted the indices increase and by the 9-10 days — there return to the initial level.

Local brain blood flow at the distance of 0.5-1.5 mm from exposure centre decreased on the 1-3 days following irradiation by 20% on an average compared to the initial level, and on the 5-7 days it returned to the initial level.

The data received verify strict location of brain tissue changes during Ar-laser irradiation, predominant Ar-laser effect on blood vessels and accompanying blood flow disorders in brain vessels.

HEMORHEOLOGY AND IMPEDANSOMETRY OF THE BLOOD

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A system of instant-diagnosis of the hemos asis pathology (SIDH) has been worked out in the laboratory of pathophisiology of Saratov Traumatological and Orthopaedic Research Institute, the system is based on the data of the impedometry of blood and plasma while they were being coagulated. Hemorheologic blood characteristics are affected by the changes of the hematocrit, plasma viscosity, red blood cell aggregation and deformability, they also bring about the shift in electrical parameters of blood, its form elements and other components. The volume concentration of the red blood cells, which are dielectrics, characterises the blood resistance and the blood viscosity value in healthy subjects. The incorporation of the red blood cells into aggregates increases the viscosity and decreases the blood plasma surface area and the volume resistance of the blood.

128 patients of the traumatological and orthopaedic type were examined. The blood and plasma viscosity, the erythrocyte aggregation, deaggregation and deformability indices (using the rotational viscosimeter AKP-2) and the volume blood and plasma resistace, the parameters characterizing the coagulation and the blood fibrinolysis, hematocrit, the erythrocyte and hemoglobin content, were determined with the help of SIDH. Disordeis of the hemostasis system and the variations of the hemorheologic characteristics and the impedance parameters have been observed in the patients of the trau atological and orthopaedic type.

The results of the cross-correlation analysis prove, that these ·characteristics are correlated; the results also help to find out the adaptation-compensatory mechanisms of the reactions, maintaining the optimal conditions for microcirculation in the organism. It is shown how one can use SIDH for the estimation of the microcirculation components and the diagnosis of the functional state of the hemostasis system.

ADAPTATIONAL MECHANISMS IN MICROCIRCULATION, HEMORHEOLOGY AND HEMOSTASIS

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Adaptation is a constituent part of accomodation reaction of the biological system to the changes of the environment. The system for preservation of the functions promoting the existence of this system as a whole in the changed environment reorganizes and changes its structural-functional relations. The development of the adaptation state is characterized by the biochemical, morphological and physiological shifts observed on different "stages" of the biological organization (molecules - organisms). The biochemical nature of the protective reaction on the molecular stage manifests in providing the cells with plastic and energetic materials. The nature of the blood cell protective reactions displays by changes of the blood cell forms, rheologic properties (aggregation, deformability, viscosity, etc.), structurization in the flow and blood coagulation characteristics.

One must distinguish some stages of the realization of the adaptational reaction in the system of microcirculation: biochemical (molecular interactions); cellular (cellular interactions; the interaction of enzymes and cell systems; this stage is observed when the biochemical stage "exceeds" the limits of the "adaptation norm"); vascular (vasoconstriction, vasodilation in response to the changes in the flow velocity and viscosity of blood, the redundancy of the biochemical reaction products; this stage becomes apparent when the biochemical and cellular stages "exceed" the limits of the "adaptation norm". The final purpose of the microcirculation system functioning is the realization of the cell metabolism, the adequacy of which is preserved with the help of the interactions of the mentioned stages of adaptation.

COMPRESSION AND SURFACE CHARGE OF THE ERYTHROCYTE MEMBRANE IN ARTERIAL HYPERTENSIA PATIENTS UNDER THE ACTION OF MILLIMETER ELECTROMAGNETIC WAVES

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The influ nce of 5.6; 6.0; 6.9; 7.1 millimeter wave 5 mW/cm^2 electromagnetic fluctuations on the erythrocytes of 56 arterial hypertension patients was estimated in the conditions of irradiation of blood cells "in vitro". The erythrocyte membrane surface charge was defined on the basis of the change values of the erythrocyte dielectrophoretic mobility in alternating electromagnetic field with the calculation of the Shtern potential. It was stated that electromagnetic fluctuations of various wave lengths change the erythrocyte membrane potential in different directions.Preliminary irradiation of 0,9% NaCl solution with subsequent incubation of nonirradiated erythrocytes in it has also caused the cell membrane charge to change. The obtained results may mean that millimeter range electromagnetic fluctuations can influence the cell either directly, causing probable resonance effect, or indirectly, that is through water solution. When placing erythrocytes into the saccharous buffer, erythrocytes were fixed at the electrodes when their shape changed with increasing the electric field strength. The application of the developed me.hod for determination of erythrocyte compression enable us to ascertain that the erythrocyte compression was improved as the result of their irradiation by millimeter electromagnetic waves.

MICROCIRCULATION AND HEMOSTASIS CHANGES IN DIABETES MELLITUS PATIENTS UNDER INFLUENCE OF LASER BLOOD IRRADIATION

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The objective of the investigation is the use and evaluation of clinical effectiveness of transcutaneous laser blood irradiation (TLBI), study its influence on the microcirculation state and the hemostasis indices in insulindependent diabetes mellitus patients with lower limbs angiopathy. TLBI was used in 30 patients ranging from 16 to 53 years who had been treated in endocrinolody hospital and had earlier received different kinds of pathognomonic drug therapy without particular effect. The investigation such as rheovasography, thermography of lower extremities, the estimation of the indices of lipid peroxidation, antioxidant defense, blood coagulation, fibrinolysis and hematocrit were carried out before and after the application of 10 days long laser therapy. TLBI was realized by helium-neon laser with the reflecting mirror at the end of the lightguide. All patients were on the diabetic diet and insulin therapy. Good immediate clinical effect has been obtained in 33.3 % of cases, satisfactory - in 61.1%. Mircocirculation improvement meaning the total reconstruction of the lower limbs thermography picture or the reducing of the lower extremities amputation level at the thermography picture has been observed in 83.3% of patients. Before the laser therapy the increase of lipid peroxidation products content, hematocrit, fibrinogen, the antioxidant defense decrease and erythrocyte membrane destabilization have been revealed in most patients. The improvement of the rheological blood properties, the reduction of the tendency to hypercoagulation have been found after this treatment. At the same time the decrease of the antioxidant defense indices along with initially heigh content of the lipid peroxidation products has been stated. This fact predetermines the necessity of subsequent study of the TLBI influence mechanisms and the elaboration of the indications for its differentiated use, possibly, in combination with medicinal preparations decreasing the lipid peroxidation intensity and or increasing the antioxidant defense activity.

RHEOLOGICAL BLOOD PROPERTIES CORRECTION IN CHILDREN WITH MULTIPLE AND COMPLEX ABDOMINAL INJURIES

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252 patients with abdominal and 334 extraabdominal injuries complicated by shock, bleeding and peritonitis were clinically examined. 67 children with complex and combined abdominal injuries revealed fibrinogen level elevation, prothrombin and thrombotest indices increase, plasma recalcification rate acceleration and decrease of plasma fibrinolytic activity during the first two days of the traumatic disease. Disorders severity correlated to shock degree. Severely shocked patients revealed blood coagulation system activation similar to the subacute type of disseminated intravascular coagulation syndrome.

Resuscitation correcting rheological disorders included the following measures: 1/ oxygenotherapy; 2/ transfusion of erythrocyte mass, of rheological hemocorrectors, of crystalloid plasmosubstitutors; 3/ infusion of sodium oxybutirate, seduxenum, droperidole, of antienzyme activity remedies, glucocorticoid hormones, antihystamin medicines and spasmolytic drugs; 4/ physical factors (magnetic fields, low power laser radiation).

Emergency aid organization improvement, due and adequate emergency aid measures, active surgical tactics, intensive transfusion therapy, modern anasthesia and purposeful antibacterial therapy, intensive post-operation treatment made it possible to decrease mortality rate in children with multiple abdominal injuries up to minimum, with complex injuries - in 1,5 times, with complex and multiple injuries - in 2 times, which proved all of recommended measures to be effective.

THE BLOOD VISCOSITY AND ADEQUACY OF THE SURGICAL HEMOSTASIS

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The problem of hemostasis in the cancellous bone is not completely solved technically in traumatology and orthopaedics. In large traumatic operations, such as operations on the hip, intraoperative and postoperative blood loss reaches 1,5-2,0 l. Even in adequate blood loss volume compensation by way of transfusion-infusion the blood loss may bring about the changes of the rheologic properties and the start of the disseminated intravascular coagulation. One must give particular attention to the postoperative blood loss, in the soft tissues too, as it is more difficult to be followed up and it may induce significant changes in the blood coagulation system.

The purpose of the present investigation is to study rheologic properties of blood, the coagulation system indices in relation to the blood loss in 18 patients of traumatological and orthopaedic type (age 35-62). The patients divided into 2 groups were operated at the hip. A standard surgical technique was applied in the patients of group I. As for the patients of group II, the final stage of their operation was the hemostasis, using the ultrasonic exposure of the bleeding tissue surface via fibrinogen and epsilon-aminocaproic acid solution in the operative wound. The blood viscosity was measured with the rotational viscosimeter "AKP-2".

The intraoperative blood loss in patients of groups I and II appeared to have no significant difference. But the postoperative blood loss in group II is significantly lower, this correlates with the less profound changes of the rheologic and coagulation properties of the blood in the patients of this group.

HEMORHEOLOGIC DISTURBANCES IN HEMATOLOGICAL DISEASES AND THEIR CORRECTION

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Hemorheologic disturbances are ι vital importance in the pathogenesis of such hematological diseases like olycythemia vera (PV) and paraproteinemic hemoblastoses (PPH). Irrespective of their common nonspecific features of hemorheologic distur- bances their mechanisms are not of the same type. In case of PV the hyperproduction of red cells leads to an encrease of their volume concentration in peripheral blood which results in high blood viscosity. The complex of changes at erythrocyte level: the reduction of ATP level, the encrease of calcium content, the decrease of electrophoretic mobility are the main mechanisms of hemorheologic disturbances. In case of PPH the pathologic para- proteins circulating in the blood channel and adsorbing on ery- throcyte membrane contribute to the rise of aggregation and re- duce the damage of these cells, t' it me. s that the microrheolo- gic properties of blood change while its dinamic viscosity re- ma.nes unchanged.

Gravitation surgery is an adequate method normalizir- the changes of blood rheological properties in PV and PPH. Taking into account that in PV the leading link in hemorheologic dis- turbance. are cellular factors and in PPH those are plasma fac- tors cytopheresis was used as a torrecting therapy in case of PV and plasmapheresis was used in case of PPH.

The improvement of blood rheologic properties after gra- tation surgery ensures the rise of perfusion level of microcir- culation channel, which determines the positive clinical effect of this kind of therapy.

Losev R Z

Biometrical investigation of human main arteries.

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For the first time the tension of different sections of arterial system affected and not affected with atheroscle- rosis was investigated in 98 cadavers.
The new coefficient of vascular tension allowers to compare (kgsm) of different arteries without relation to their diameter, wall thickness and localization.
It was determined that there are spesific values of vascular tension. With years the coefficient of arterial tension changes, and the rate of these changes is not the same for different arteries.
The tension of the arteries in the body is one of the main factors causing different effort on specific section of arteries. These anatomo-functional difference acts from early childhood and during the man life. With the athero- sclerosis development the coefficient of vascular tension sharply decreases and become equal.
It was presumed that the factor of tension and it's differences for arteries of certain localization determines the zones and frequency of atherosclerotic lesions of arteries.

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Shestericov I. H. , Gorfinkel I. V.

Blood rheology changes in patients with significant disturbances
of lower limbs blood flow.

Saratov Medical university.

The rheological parameters of blood were investigated in
30 patients with atherosclerotic occlusive arterial disease and
significant disturbances of lower limbs blood flow.

Blood viscosity values (apparent blood viscosity, plasma
viscosity, hematocrit, red cell deformability) are significant-
ly impaired in patients with decreased blood flow in lower limbs
and the severety of blood flow deficit is related to the extent
of the rheological abnormalities.

Plasma exchange was applied to ameliorate the haemorheolo-
gical disorders. The removal with plasma macromolecules of fib-
rinogen and globulins, cholesterol, triglyceride, VLDL, LDL and
use of rheological active solutions for plasma replacement re-
sult in decrease of apparent blood viscosity at different shear
rates and fall of plasma viscosity, red cell deformability im-
proved due to fibrinogen removement from red cell membrane and
changes in membrane lipids.

The evaluation of blood flow in arteries of lower limbs
with doppler and multilevel manometry shows that after plasma
exchange blood flow significantly improved mainly in small
arteries. The increase of blood flow was only in 4.1% of patients
with lesions in aorto-iliac arterial segment , 50% of patients
with lesions in arteries of crus and foot and in 50.5% cases
of lesions in profundal femoral arteries

The improvement of blood flow was usual in arteries with
stenoses but not with occlusions

CRITERIA FOR PROGNSTICATION OF CLINICAL EFFICACY
OF INTRAVENOUS BLOOD LASER IRRADIATION IN PATIENTS
WITH ATHEROSCLEROSIS OF PERIPHERAL ARTERIES

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Use of intravenous blood laser irradiation(IBLI) in
complex treatment of patients with atherosclerosis oblite-
rans of arteries of lower extremities with subcompensation
of disordered blood circulation allows, as our data state,
to achieve clinical effect in 92.2% of patients. However,
manifestation of the clinical result is different.
Analysis of some clinico-functional and biochemical data
of patients with subcompensation of disordered blood circu-
lation in extremities was performed to reveal criteria for
prognostication of clinical IBLI efficacy.
Best results of treatment were obtained in patients with
the course of the disease up to 3 years, w th occlusion of
the distal femur arterial segment, fibrinogen level in blood
plasma of 6.0 g/l, its fibronolytic activity up to 4% and
hematorcit up to 4 %.
When hematocrit is over 47%, IBLI should be combined with
chronic hemodilution.
Finbinogen content over 6.0 g/l in blood plasma serves
as the indicator for combined laser blood irradiation with
therapeutic plasmapheresis. Combination of the given methods
provides more marked clinical effect when indices of rheolo-
gic properties of blood are normalized.

MEASUREMENT OF THE REGIONAL BLOOD FLOW IN PATIENTS WITH VASOMOTOR RHINITIS AND CHRONIC TONSILLITIS BY THE HYDROGEN CLEARANCE METHOD

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For the purpose of studying the microcirculatory blood bed, the hydr gen clearance method has been employed in the examination and treatment of 36 patients with va motor rhinitis and 34 patients with c..ronic tonsillitis.

The reports issued in our country contain no information about application of this method in otorhinolaryngology. There are some data published abroad in the papers presenting investigation of the blood flow in the turbinated bones of the patients with vasomotor rhinitis (Okuda M.,1974, Tanimoto H.,1983).

The measurements of the regional blood flow in the inferior turbinates have shown the remarkable decrease of the flow to the value of 88 ± 12.3ml/min/100g as compared to 116 ± 14.4ml/min/100g observed in normal subjects. After magnetic treatment by alternative magnetic field, the regional blood flow has increased to 114 ± 13.6ml/min/100g in 72% cases.

For the patients with chronic tonsillitis it was found out evident blood flow to decrease depending on the form of the disease: at compensated form it was 102 ± 12.6ml/min/100g; at decompensation by quinsy and peritonsillitis recurrence it was 96 ± 11.3ml/min/100g; at decompensated form with tonsillogenic diseases it was 67 ± 13.7ml/min/100g as compared to the blood flow of 112 ± 14.2ml/min/100g ($p<0.05$) in normal subjects.

Thus, the hydrogen clearance method used in the study of the regional blood flow in patients with vasomotor rhinitis and chronic tonsillitis showed its informative validity and possibility of the pathology quantitative diagnosis, thus reflecting the morphologic and functional changes in an organ.

MICROCIRCULATION AND CENTRAL HAEMODYNAMICS IN ARTERIAL HYPERTENSION PATIENTS

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The state of microcirculation and central haemodynamics were evaluated for 72 essential hypertension patients and 16 persons in the control group. The microcirculation was investigated by the television capillaroscopy method and the developed method of acropletismography involving determination of microcirculation channel vessels reactivity, their venous resistence along with functional tests. The central haemodynamics was investigated by the echodopplercardiograph "APOGEY" (England) with the determination of heart haemodynamics, the perepheric vessels diameter and bloodflow in them. Correlation between the central haemodynamic state and microcirculation was revealed. The hyperkinetic hayemodynamic version of hypertension was described by the high rate of bloodfilling into the peripheric vessels and small loss of bloodflow energy into the large vessels. The microcirculatory channel vessels had the high reactivity of the precapillary regulation, high degree of the capillary bloodfilling and low venous resistance of the capillarity channel. The hypokinetic version of hypertension was described by the low rate of bloodfilling with great losing of energy while motion of blood and the elastic vessels were dilatated. At this haemodynamic version the microcirculatory vessels were characterized by the low reactivity during functional tests and high venous resistance. For the selection of individual therapy to the patients with arterial hypertension received microcirculatory criteria, that characterized the state of the large vessels were suggested as a diagnostically significant tests.

THE FUNCTIONAL FEATURES OF MICROHAEMODYNAMICS IN ARTERIAL HYPERTENSION PATIENTS

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The state of microhaemodynamics was compared for 162 arterial hypertension patients and 23 persons of the control group. The former was assessed by the television capillaroscopy method and the developed method of micropletismography involving determination of the amount of monochromatic light reflected by the scin surface at the starting state and at carrying out of the functional tests while compressing the vessels. The spontaneous rhythmic activity of bloodfilling the microcirculatory channel vessels, the reactivity of the precapillary vessels, the resistance of the venous vessels, the degree of bloodfilling the microcirculatory channel were observed. The various changes of the microcirculatory channel vessels function were established as the cause of arterial hypertension. The character of spontaneous rhythmic bloodfilling was changed at the initial stages of arterial hypertension development, as well the high reactivity of precapillary sphincters was observed. Further, the spontaneous rhythmic activity of bloodfilling is suppressed, the reactivity of the precapillaries is decreased and the venous resistance of the capillarity channel vessels is increased. When the functional activity of microcirculatory vessels changed, the bloodfilling of capillaries changed, too, and tissue swelling was developed. The character of changes in arterial pressure depended on the functional state of the microcirculatory channel when performing the medicinal tests with using of the vasodilatators (α-adrenoblockes, antagonists of calcium), diuretic medicaments, the sharp salt oral test, the tests with using of EHF radiation. For the choice of pathogenetically substantiated therapy of the patients with arterial hypertension the significance that described the functional state of microcirculatory channel can be used.

VARIATION OF ERYTHROCYTE PROPERTIES AND MICROCIRCULATION UNDER THE ACTION OF MILLIMETER ELECTROMAGNETIC WAVES FOR ARTERIAL HYPERTENSIA PATIENTS

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The influence of 7.1 mm-long electromagnetic waves on erythrocytes of 102 essential hypertension patients was estimated at the incident power of 0.004 mW/cm² to 10 mW/cm² under conditions of "in vitro" irradiation of blood cells. It was stated that electromagnetic fluctuations increase the erythrocyte membrane charge and compression for most patients. The activity of the energy exchange of blood cells was revealed to grow and to appear as the increase of the glucose demand rate. Begining from the power of 0.004 mW/cm², the spontaneous rhythmic activity of bloodfilling the microcirculatory channel vessels was varied with the irradiation of the patients by millimeter waves. The capillary bloodflow rate was observed to increase. The bloodfilling of the microcirculatory channel vessels and venous pressure were decreased. It was established that the arterial pressure was reduced for the vasoconstrictory hypertension patients and that hypotensive action was absent at the volume mechanism of hypertension. The available vasodilatory effect was accompanied by variation of the character of reflectory arterial pressure regulation, particularly, when assessing the responses of low pressure receptors and ortostatically testing. The findings obtained are representative of an active influence of low power millimeter electromagnetic waves on the rheological blood properties and on the microcirculatory channel vessels. Thus, a positive therapeutic effect is provided for hypertension patients.

Plasma exchange - the method of the rheological correction
in patients with thrombotic and post-thrombotic diseases.

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Hemorheological disordes are important pathogenetic components
of the acute deep venous thrombosis /DVT/ and post-thrombotic synd-
rome /PTS/. The disorders determine the degree of clinical manifis-
tations of these disease, correction of rheological blood properties
being the key to their successful treatment.

For that purpose in complex treatment of 56 patients with DVT
and PTS plasma exchange /PE/ was used. PE was performed by blood
fractionator following intensive programme with removal of 3,5-5 1
of plasma for the course of treatment. Plasma substitution was pro-
tein free.

After the first PE procedure the swelling of affected legs dec-
reased, cyanocis disapperead, acute inflammation reduced, and in PTS
patients rapid epitalization and healling of old non-healing ulcers
tock place.

On completing the course of PE fibrinogen c ncentration reduced
from 5,26+0,31 to 2,34+0,18 g/l, blood visco ty - from 5,2+0,14 to
4,2+0,11; plasma viscosity - from 2,1+0,1 to 1,9+0,1, and hemato-
crite - from 53,1+2,4 to 43,6+2,1%. Red cell deformability increased
from 0,83+0,04 to 0,95+0,06.

Central and regional hemodynadics was also improved: stroke vo-
lume index increased by 26,8%, cardiac index - by 34,1%, maximum veno-
us outflow according to plathysmographic data increased from 15,6+3,1
to 24,8+3,6 ml/min.

Thus, PE proved to be an effective method of treatment of DVT and
PTS due to its intensive influence on blood fluidity, resulting in
improvement of microcirculation and cardiac work.

Homeostasis in patients with post-thrombotic syndrome.

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Homeostasis in post-thrombotic syndrome /PTS/ is not well
investigated problem. Under our observation there were 64 PTS
patients with different severity of the disease. Blood fluidity
indices, hemostasis indices as well as regional and central he-
modynamics were studied.

Group of PTS patients without trophic disorders revealed
insignificant worsening of blood fluidity indices, and moderate
hemostasis activation. Central and peripherical hemodynamic in-
dices were also moderately redused.

Group of PTS patients with trophic disorders /ulcers, ecze-
mas, indurative cellulitis/ revealed considerable worsening of
blood rheological prorerties, hemostasis activation, thrombocytes
aggregation, fibrinolysis inhibition. In this group central and
regi nal hemodynamics indices were worse han those in the pre-
vious group.

Those biochemical blood stracture changes , functional myo-
cardiac condition and venous outflow from legs in PTS patients
with trophic disorders are also typical for patients with deep
venous thrombosis /DVT/ in acute phase. All above mentioned makes
it possible to suppose that PTS and acute DVT are different sta-
ges of one and the same disease, i.e. the thrombotic vein disease.

Moreover, dependence of regional and central hemodynamics
indices on blood fluidi y was established: the worse blood rheo-
logical properties, the more redused were heart work indices and
blood outflow from leg. All this makes it possible to treat PTS
patients by means of blood fluidity improvement.

THE PHENOMENON OF RETROGRADE MICROCIRCULATORY BLOOD FLOW AT ARTERIAL HYPERTENSIA

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The functional state of microcirculatory channel vessels were evaluated for 162 patients by using a method which was developed by the authors. The method involved determination of the amount of monochromatic light reflected by the scin surface of the finger while compressing the humerus vessels. The phenomenon of paradoxial hyperimy was observed in 15.4% of cases when performing the ischemic test. The television capillaroscopy method allowed us to record the retrograde blood flow in the microcirculatory vessels. This can be explained by the blood deponent in venous postcapillary vessels and high venous pressure for this group of patients. The phenomenon of the retrograde microcirculatory bloodflow was observed for women having destroyed hormonal regulation (hypertension development due to pregnancy, obesity, uterine fibroid postsurgical climax) or the varicous veins expansion of lower extremities. The arterial pressure was slightly decreased when using medicaments, such as prasosin. niphedipin, nitroglycerin, for the patients with retrograde microcirculatory bloodflow. The electromagnetic millimeter wave action on these patients was also ineffective. The arterial pressure was effectively lowered when using diuretic medicaments, such as furosemid in the sharp test and ghipotiasid by system prescription. The results obtained are representative of a high contribution of venous blood circulation into the arterial hypertension development. With such a mechanism of hypertension development, vasodilatatory medicaments are ineffective.

THE HEPARIN—ASPIRIN COMPLEX INFLUENCE ON THE HEMOSTATIC AND INSULAR SYSTEMS AT EXPERIMENTAL DIABETES.

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It was established that during the development of insulin dependent diabetes there is the depresion of insular and anticoagulating system.

It was shown that heparin- aspirin complex (weight components relation is 6:I) has the antithrombotic and thrombolytic effects in vivo and improves the reological blood properties after its intravenous, intramusoular and peroral administration.

It was shown that after heparin-aspirin complex administration (I.5 ml twice in the day, I ml of complex preparation contains 2.56 mg of heparin and 0.43 mg of aspirin) to the rats with alloxan diabetes the blood nonenzymatic fibrinolytic activity increases in 2 times and blood concentration of plasminogen activator also increases in I2 times. The heparin-aspirin complex prevents the experimental diabetes development and improves the functional state of insular system of rats with alloxan diabetes. This effect maintains during 2 months after stopping complex administration.

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РЕОЛОГИЧЕСКИЙ ФАКТОР КРОВОТОКА ПРИ ЛОКАЛЬНОЙ ГИПЕРТЕРМИИ

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Локальная СВЧ-гипертермия успешно применяется при лечении онкологических больных. Для более эффективного решения задачи оптимального управления нагревом биоткани при проведении этой процедуры необходим корректный учет в биотепловом уравнении (БТУ) конвективной составляющей теплопереноса (перфузии). Перфузия и ее изменения при локальной гипертермии обусловлены как вазомоторными сосудистыми реакциями, так и реологическими свойствами крови и их изменениями при нагреве.

Роль реологического фактора в терапии опухолей мы оценивали решая одномерное стационарное БТУ с учетом неньютоновости крови. Реологический фактор кровотока характеризовался параметром вязкопластичности (параметр Ильюшина). Микрососудистая система моделировалась эквивалентной трубой. Параметры антенны СВЧ-излучателя, характерные режимные параметры (мощность, интенсивность охлаждения кожи), теплофизические свойства разных типов биотканей (кожа, мышца, жир, опухоль) и относительные изменения параметра вязкопластичности при локальной гипертермии брались из литературы. Рассматривались различные размеры и глубины локализации опухоли, степени перфузируемости ее ядра, активно растущего слоя и нормальной биоткани.

Найдено, что перфузия прямо пропорциональна кубу гидравлического диаметра эквивалентной трубы и обратно пропорциональна величине параметра вязкопластичности.

Получены аналитическое и численное решения БТУ для гомогенной и гетерогенной биоткани. Варьирование относительных изменений гидравлического диаметра и параметра вязкопластичности в физиологически оправданных для условий гипертермии пределах показало, что реологический фактор кровотока оказывает существенное влияние на максимальное значение температуры и величину неоднородности распределения температур в опухолевой и нормальной биоткани.

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The influence of different hemodilutants on the coagulative blood activity.

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The topikal problem of the efferent medicine is the artificial hypocoagulation creating methods. Hemodilution is suggested as one of the components, however, the problem of choosing the infusion preparation for this purpose is not clearly solved. The aim of the presented research is to examine the influence of different preparations and with different dosages on the coagulative blood activity at the artificial hypocoagulative creation.

120 blood test examinations of 30 donors of both sexes were carried out. The blood was taken from the peripheric vein and if was poured at into 4 test tubes: the 1st one - without any dilution; the 2nd one was 1/3 diluted, the 3rd one - 1/2 diluted and the 4th one - 2/3 diluted. Three experiment sets weve recognized (40 experiments in each set) depending on the used dilutant. Plasma - in the 1st case; colloid - in the 2nd case; crystalloid - in the 3 rd case. The coagulative activity was tested with the hel pof the electrocoagulography method.

The results of these tests show that the coagulative blood capacity reduces and fibrinolysis extends as the dilution degree increases. However, in the 1st set (plasma) these changes were shown only slightly. In the 3rd set (crystalloids) it was much more important, peaked in the 2nd set of experiments (colloids) where the overall coagulative blood potential drastically reduces and fibrinolysis extends as dilution increases.

In this way colloids have had the greatest coagulative impact and they can be used for creating of artificial hemodilutants with the aim of the following extracorporeal perfusion.

HEMORHEOLOGICAL DAMAGE IN GOUT PATIENTS
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Vascular damages frequency , their prognostic value determine interest to hemorheologic blood characteristics status in gout disease .

61 male patients were examined,24 of whom revealed intermittent and 37- chronic forms of gout.The diagnosis was made on the basis of characteristic clinico-laboratory signs and verified with the help of Reumatology Scientific Research Institute criteria . Microcirculation (MC) , hemocoagulation indices , as well as hematocrite and blood viscosity values were investigated .

Apart from revealed hypercoagulation shifts and anticoagulation mechanisms inhibition in gout patients,hemorheologic damage was testified by significant hematocrite level ele - vation (50.1+1.5% , p< 0.001) and by the tendency to blood viscosity increase . Each 8-9-th patient revealed fibrinogen B test positive reaction .

Hemorheologic parameters in different phases of gout occur not to significantly differ,but fibrinogen B was 3 times more often observed in chronic form of the disease .

While conjunctiva biomicroscopy intravascular pathology was noted in the majority of cases (in 53 of 61),the damages being erythrocytes aggregation in venules in 53 patients,in capillaries - in 39 patientts,and in arterioles - in 14 patients (Kniseli phenomenon,degrees I,II,III). 49 patients revealed blood flow deceleration.

Using clearance method of radioindicator [133] Xe from intratissue depot made it possible to reveal generalized tissue microcirculation disturbances : statistically significant , abrupt (2.6 times) decrease of effective cutaneous blood flow indices (p<0.001).Muscular hemocirculation was also damaged , which manifested in decrease of effective muscular blood flow at rest and its insufficient elevation while post - occlusive responsive hyperemia (physical test response occurred to be inadequate)-blood flow increased only 3.9 + 0.7 times (p<0.01).

Comparing the results of the indices investigated it became possible to establish interaction between their parameters.

Thus hemorheological damages were found out in gout disease the former contributing to the development of vascular lesions

The detection of vascular changes in patients with dishormonal hyperplasia and breast cancer,with help of thermography

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The increased growth of breast cancer morbidity,lack of detection of this pathology on early stage requre the application of new effective methods of diagnostic. Thermography is one of this methods,which allows to evaluate character of pathological process by registration of temperatures from body surface.Method of thermography based on detection of focus of heating,measuring of it's area and intensity(difference of tempertures between focus of heating and contralateral point of other mammary gland),registration of vascular picture of changed tissue.

In our clinic 590 patients with mammary gland tumors underwent thermography examination /unit ATP-46/. Breast cancer was detected in 301 patients and different forms of disgormonal hyperplasia-in 289 patients.All the patients got treatment in R.C.Hospital and the diagnosis wos confirmed by clinikal. X-Ray and morfoligical examination.

Difference of temperatures from 2 to 2.9 C was characterists of breast cancer. However this difference may be higeper in patients with inflammatory forms of breast cancer, and, on the contrary, it may by less at early stages of the disease. Size of the focus of "heating" intensivity of asymmetry of vascular picture were found to on anatomic form of growth of malignant umor, on it's hystotype.The lower the depree of tumor differentiation the more is the difference in temperatures.

Moderafe asymmetry of vascular picture, bilateral areolar increase of thermogenic activity are noticed in disgormonal hyperplasias. In nodular forms the increase of termogenic activity in tumor projection achieved 1.5 C.

Data of termographic studies greatly depending on vascular changes in mammary gland give information about the activity of tumor process.

The Effect of Endocrine Cells of the Antral Portion
of Stomach which Secrete β—endorphine and Histamine on the
Rheolodgy and Microcirculation in Patients with Chronic
Chol.cystitis Incalculosa.

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V.F.C.irichuk\ Mili.ari Medical Faculty of SMU\the chief
vice-professor A.L.Nosov\

The main aim of this paper is the stady of the influence
of the functional morphology of the endocrine cells of the
antral portion of the stomach which   β-endorphines and hista-
mine on the main processes of inflammation followed by rheolo-
gical and microcirculatory disturbances. 57 patients with chro-
nic cholecystitis incalculosa were studied. The control group
included 32 healthy subjects Verification of chronic cholesys
titis incalculosa was provided by clinical, laborotory and ul-
trasaund methods. Biopsy materyal from the antral portion of
the stomach was taken during FGDS and fixed in 10% neutral
formaline by Lilly. Functional morphology of endocrine cells
secreting β-endorphine and histamine was determined by histo-
hemmical and immunoperoxidase meth ds using the commercial AMER-
CHAN sera\England\ Functional activity of endocrine cells :
microcirculation and rheology was estimated by light electrone
microscopy.

The results obtained prove that chronic cholecistitis incal-
culosa is characterized by the moterade hypoplasie of endocrine
cells secreting β-endorphine and histamine with the preserved
functional activit of these cellular elements. The changes
were followed by intravascular and extravascular chages of the
capillary bed of the mucous coat of the antral portion of the
s omach.

We think that the decrease of regenerative and immunomodula-
tion propeties of histamine and β-endorphine promotes the
increase of dystrophic processes.

On the basis of the mentioned above the principles of forma-
tion of chronic cholecystitis incalculosa can be as follows:
the decrease of histamine effect on the processes of cellular
maturation on the basis of the immunodeficiency (the decrease of
β-endorphine level) leads to the increase of the dystrophic
microcirculatory changes and arising of a bacterial infertion at
a certain stage of the pathologic process.

Osipova O. V.
rheological analisis of blood in patients with athero-
sclerotic renal artery stenosis.

Saratov medical university.

The rheological behavior of blood was investigated in
40 patients with atherosclerotic renal arter, stenosis and
renovascular hypertension. Significant deterioration of cell
and plasma rheological components was found. Apparent blood
viscosity at different shear rates was considerably increased
as a result of elevated hematocrit and plasma viscosity. The
last was affected by fibrinogen, cholesterol and atherogenic
lipoproteins.

Red cells lipid membrane disorders and large amount of
fibrinogen on red cell membrane impaired erythrocytes defor-
mability index and increased whole blood viscosity at high
shear rates.

Elevated blood viscosity was responsible for deficiency
of blood flow to kidney with s motic artery ,renal insuf-
fience and hypertention.

Haemorheological values were particularly abnormal in
patients with atherosclerotic lesions of renal and other
main arteries, such as extracranial and peripheral arteries.

Plasma exchange was used for improvement of haemoreologi-
cal disorders.

THE INFLUENCE OF NEW SYNTHETIC DERIVATIVES OF ROSTAGLANDIN E1 ON THE HEMOSTASIS DISTURBANCES AFTER EXPERIMENTAL THROMBOPLASTINEMIA

G.N.Petrukhina, V.A.Makarov, Y.F.Freimanis, E.V.Lozha, A.V.Sirotenko

National Haematological Scientific Center, Russia:, and Institute of Organic Synthesis, Latvia

Intravenous injection into rabbits of 1,0-1,2 ml/kg thromboplastin solution (20 s activity) induces a decrease in platelet count, protein C level, and antithrombin III (A-III) activity. The purpose of our investigation was the estimation of capability of prostaglandin E1 (PG E1) and its new synthetic derivatives (IOS 4732, IOS 3933, IOS 3933 sodium, IOS 3933 and polyvinylpirrolidon compound) to prevent these DIC-like changes. These substances we administrated intravenously at 5 min before thromboplastin injection. Blood samples were collected before prostanoids administration and in 15, 30 and 60 min after thromboplastin treatment. It was shown that PGE1 at a dose of 100mkg/kg did not prevent the hemostasi changes induced by the experimental thromboplastinemia. IOS 4732 (IOS 3933 oxim) at a dose of 5 mg/kg was not effective, too. IOS 3933 at a dose of 5 mg/kg efficiently prevented thrombocytopenia and decrease in AT III level, but had no influence on the protein C activity fall. IOS 3933 sodium and IOS 3933 and polyvinylpirrolidon compound had the same prophylactic effect. The results of this investigation demonstrate the antithrombotic effect of the new PGE1 analogue IOS 3933.

THE INFLUENCE OF NEW SYNTHETIC ANALOGUES OF PROSTAGLANDIN E1 ON SOME PARAMETERS OF BLOOD COAGULATION EX VIVO.

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The aim of this work was the investigation of prostaglandin E1 (PGE1) and its new synthetic analogues (IOS 3933, IOS 3933 sodium, IOS 4732, IOS 3933 and polyvynilpirrolidon compound) effect on some parameters of blood coagulation. These substances were injected into rabbits and blood samples were obtained before administration and in 2, 15, 30, 60, 90 and 120 min after substances administration. Platelet count, ADP- and collagen-induced platelet aggregation, antithrombin III, plasminogen activator activities, fibrinogen level and APTT were determined. It was found, that the injection of PGE1 induced a short-term reversed (approximately 1 min) decrease in platelet aggregation ex vivo. Intravenous injection of IOS 4732 at a dose of 5 mg/kg diminished ADP-induced aggregation during 30 min, but this effect was not observed experimental animal. IOS 3933 treatment at the same dosage lead to the stable decrease in platelet adhesion to collagen and ADP- and collagen-induced aggregation long-lasting of 120 min. The increase of plasminogen activator activity was detected 30-60 min after this prostanoid injection. There no changes in other parameters of blood coagulation. IOS 3933 sodium and compound of IOS 3933 with polyvynilpirrolidon had the same effect on hemostasis function. The results of this investigation demonstrate the prominent action of the new synthetic PGE1 analogue IOS 3933 on cell hemostasis and fibrinolytic activity of blood. Taking into account the vasodilatatory and antiplatelet activity this substance may be used in the prophylaxis and treatment of the different hemodynamics disturbances that accompanied by the platelet thrombus formation.

THE RHEOLOGICAL PLASMA SUBSTITUTE DOES NOT IMPROVE FIBRINOLYSIS DEPLETION AFTER ACUTE HAEMORRHAGE

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Isovolaemic haemodilution originally proposed preoperatively in order to avoid heterologous transfusion is now widely used in ischaemic diseases and haemorrhagic shock. The haemorheological effects of isovolaemic haemodilution by dextran derivates are a decrease in whole blood viscosity, decrease in plasma viscosity (due to loss of plasma proteins), a borderline reduction in erythrocyte aggregation, and practically no change in red cells deformability. Both increased and reduced fibrinolysis during acute haemorrhage has been reported in surgical patients and trauma. We have studied the time-course changes in blood fibrinolytic activity and blood pressure in dogs during acute haemorrhage and after blood loss substitution by Polyglucin (dextran derivate, mol. weight 60 ± 10 kD). Experiments were conducted on pentobarbitone-anaesthetized (30 mg/kg, i. v.) animals weighing 12 ± 5 kg. Acute haemorrhage was produced by blood loss from the cannulated a. femoralis in about 50% of the circulating blood volume (CVB). Mean arterial blood pressure in the left ventricle was constantly monitored using electromanometric device. Total fibrinolytic and plasminogen activator activities of euglobulin plasma fraction were measured using heated and unheated plasminogen-rich bovine fibrin plates. It was determined that the fall in a blood pressure from the baseline level 151 ± 11 to 50 ± 10 mm Hg was accompanied by a rise in the total fibrinolytic and plasminogen activator activities from 200 ± 50 and 140 ± 41 mm^2 to 262 ± 67 (P<0.05) and 218 ± 26 mm^2 (P<0.01) respectively. The following fall in a blood pressure up to 15 ± 5 mm Hg led to decrease in total fibrinolytic and plasminogen activator activities to 168 ± 36 (P<0.05) and 117 ± 19 mm^2 (P<0.05). The substitution therapy with Polyglucin i. v. infusion in a dose equivalent to 50% CVB led to the increase of blood pressure to 128 ± 11 mm Hg and subsequent depression of fibrinolysis. In one hour after blood loss substitution the total fibrinolytic and plasminogen activator activities were 104 ± 28 (P<0.01) and 87 ± 16 mm^2 (p>0.01) only. In conclusion the acute haemorrhage induced the short-term activation of fibrinolysis depending on the plasminogen activator release from the vascular wall. It may be proposed that the consequent fibrinolysis depression is connected with the fibrinolytic system depletion and/or increase in fibrinolysis inhibitors level. The reconstitution of abnormal haemodynamic by means of Polyglucin administration did not lead to increase in the blood fibrinolytic activity after massive blood loss.

AGGREGATE PECULIARITIES OF BLOOD IN PATIENTS IN EXTREME STATES OF THE ORGANUSM

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Extreme state of the organism is a powerful stress factor causing the complex of adaptative reactions aimed preservation of homeostasis or at the supply of a new level of homeostatic constants which is able to allow the organism to function in the stress situation developed. In the present work results of a complex investigation of rheologic and aggregate properties of blood in patients with thermal damages and traumatic damages of the central nervous system are given. Considerable vascular asymmetry and marked spasm of central and peripheral vessels are determined when studing rheographic indices. Changes in the functional state of coagulative blood potency, decrease of fibrinolytic and anticoagulative properties are found out in the pathology under study. Development of thrombo-hemorrhagic syndrome, its stages using disturbances in rheologic properties of blood, is observed depending on the severity of the damage and stage of the disease. The determined factors reveal that in thermal and traumatic damages patients have the possibility to develop thromboembolic as well as hemorrhagic complications, these facts should be taken into consideration by clinicians when administering pathogenetic therapy.

THE RHEOLOGIC PROPERTIES OF THE BLOOD
IN PATIENTS WITH COXARTHROSIS

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In studying the pathogenesis of the coxarthrosis special interest is shown for microcirculation disorders in the affected joint. But in its turn the microcirculation state is strongly influenced by the rheologic properties of blood.

The purpose of the investigation is to study the rheologic blood properties in patients with coxarthrosis in relation to the disease severity and the incidence of the pathological process.

We have observed 83 patients (29 men and 54 women at the age of 22-65 years) with unilateral and bilateral coxarthrosis; in this group of patients the I-II stage osteoarthritis of the hip was diagnosed in 13 patients, and the III stage osteoarthritis - in 70. The control group consisted of 32 healthy individuals at the age of 20-65. The blood viscosity in different shift velocities, the limit of the blood flow resistance, the erythrocyte aggregation rate and degree, the erythrocyte deformability index and ESR were measured.

The results of the study demonstrated that marked changes in the rheologic properties of blood are typical of the patients with coxarthrosis, these changes bring about the increase of the limit of the blood flow resistance, the blood viscosity in low shift velocities, erythrocyte aggregate size and degree of the erythrocyte aggregation; the decrease of the blood suspension stability and erythrocyte deformability. There is a close relationship between the magnitude of the hemorheologic disorders and the severity of the degenerative-dystrophic process in the hip and its incidence.

CHANGES OF HAEMOCOAGULATION AND BLOOD PROSTAGLANDIN LEVEL IN
DYNAMICS OF DEVELOPMENT OF CEREBRAL HAEMORRHAGES IN STRESS

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Disturbances of coagulative properties of blood and balance of vasoactive prostaglandins (PG) were analysed in stress-induced haemorrhagic stroke. The stroke was modelled on spontaneously hypertensive rats (SHR) of Okamoto-Yamori line by means of combined influence of interrupted acoustic stimulus (120 dB, 150-500 Hz) and immobilization during 2 hours.

In one hour and 24 hours after stress electrocoagulogram was registered and PGE and PGF_{2a} level was determined in blood plasma by radioimmune method.

It was stated that in 1 hour after acute stress action a sharp rise of arterial pressure observed and 80% of SHR developed large local haemorrhages in the region of subcortical ganglia and zone of the thalamus. The early stage of cerebral haemorrhages formation was accompanied by lowering of blood coagulative properties, two-fold increase of duration of blood clot formation compared to the rat control group proving it. The rate of retraction and fibrinolysis had also a two-fold reduction compared to indices of intact SHR. Hypocoagulation was accompanied by changes in ratio of vasoactive PGE/PGF_{2a}, PGE prevailing ($p < 0,001$).

During the first 24 hours hypocoagulation continued to increase: the clot formation time increased by 2.5 times, rate of retraction and fibrinolysis continued to reduce. These changes in blood coagulation system contributed to the progress of haemorrhagic process, enlargement of haemorrhage size in subcortical ganglia and adjacent structures of the brain witnessing it.

Disturbances in coagulative properties of blood were combined with greater increase of PGE plasma content which produced prolongation of bleeding time and blood coagulation time due to inhibition of thrombocyte aggregation.

ФАКТОРЫ, ОПРЕДЕЛЯЮЩИЕ РЕОЛОГИЮ КРОВИ БОЛЬНЫХ В РАННИЕ СРОКИ ПОСЛЕ ОПЕРАЦИИ В УСЛОВИЯХ ИСКУССТВЕННОГО КРОВООБРАЩЕНИЯ

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У 50 больных с ишемической болезнью сердца(ИБС) и приобретенными пороками сердца(ППС) исследовали факторы, определяющие изменения параметров реологии крови в раннем послеоперационном периоде.

Влияние операции в условиях искусственного кровообращения(ИК) и проводимой инфузионной терапии на гемореологию оказалось сходным у больных ИБС и ППС. Результаты исследования свидетельствуют, что в ранние сроки после операции общим для больных ИБС и ППС явилось снижение суспензионной стабильности крови, ухудшение ее текучести и функциональных свойств эритроцитов. Различия между группами проявились в следующем. У больных ППС адекватный уровень гемореологических параметров определяется новыми (после коррекции) условиями кровотока и значительной зависимостью гомеостаза больных от функциональной активности почек и состояния водно-электролитного баланса. Несмотря на более глубокие нарушения микроциркуляторного кровотока, ответ на проводимую терапию выражен отчетливее и наступает быстрее у больных после коррекции ППС. Для больных ИБС характерна тенденция к восстановлению дооперационного уровня значений показателей реологии крови к исходу 1-х послеоперационных суток, что обусловлено состоянием хронической тромбинемии, и более долгим формированием ответа на каждое мероприятие, восстанавливающее нормальные реологические характеристики крови.

Использование методов вспомогательного кровообращения и кардиостимуляции приводит к стойкому повышению относительной вязкости крови и снижению деформабельности эритроцитов даже на фоне использования антикоагулянтов и антиагрегантов у больных обеих групп.

Проведенное исследование показало, что одновременное повышение относительной вязкости крови, вязкости плазмы, снижение агрегационных и деформационных способностей эритроцитов является одним из ранних признаков нарушений микроциркуляции. В этих условиях своевременная коррекция гемореологических параметров позволяет снизить риск таких осложнений как тромбоз, кровотечение, шок и т. п. еще до их клинического проявления.

FACTORS THAT DETERMINED BLOOD RHEOLOGY IN PATIENTS IN EARLY TERM AFTER EXTRACORPOREAL CIRCULATION SURGERY

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In fifty patients with ischemic heart diseases(IHD) and with acquire heart diseases(AHD) factor that determined changes of blood rheology in early postoperative period were research.

In all patients open-heart operation and during infusion therapy influenced to hemorheology equally. Results obtained showed such common changes of blood rheology in early postoperative period that were a decrease of blood suspension stability, a reduction of blood fluid and deterioration of erythrocyte functional condition. Distinction between patients groups was in following. In AHD-patients adequate level of hemorheological parameters were created by new (after surgical correction) blood flow state. Renal function and water-and-electrolytes balance had high influence upon homeostasis of same patients. In spite of more heavy microcirculation diseases in AHD-patients following response by during therapy manifested strongly and rapidly. In patients with IHD it was stated tendency to reconstruction of preoperative levels of hemorheological parameters to the end of first 24th hours. It was caused on chronic thrombinemia and long time form of responses by every action reconstructed normal blood rheological characteristics.

All methods of assist circulation and cardiac pacing had resulted a firm increase in relative blood viscosity and a decrease in erythrocyte deformability. It was stated in both groups when even anticoagulants and antiaggregants drug were interesting.

The studied showed one of early feature of microcirculation failure is an increase in relative blood viscosity, and plasma viscosity, and a between in erythrocyte aggregation and deformability simultaneously. In this case timely correction of hemorheological parameters can to lead a risk of complication as thrombosis, hemorrhage, shock, etc. before its clinical manifestation.

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The influence of dilution degree on the coagulative
blood potential. —

Saratov   Medical   Univ :sity.

The topical problem of the efferent medicine is the elaboration
of new technology of extracorporeal detoxication aimed at a loss of
comlications. The same holds true for the attempt to reduce heparin
do-es with the help of different methods, which makes possible to crea-
te artificial hypocoagulation and to base on it the extracorporeal per-
fusion.

The aim of the presented work is to study the dilution imppact of
different degrees on coagulative blood characteristics.

120 examinations of 30 donors of both sexes at the age of 28-42
were carricd out. The blood was taken from the ulnar vein without
any mechanical actions at a limb. 3,8 solution of sodium-citrate was
used as a stabilizer. The blood was poured out into test tubes followed
by 1/3, 1/2 and 2/3 dilution of the initial point. Different mediums
were used as dilutants. The dilution degree was determined by the hema-
tocrit member and the coagulative blood characteristics were determi-
fted by the method of electrocoagulography.

During the progress of the pursuance of the research it has been
found that in the ist test tube (Ht=48,8 + 1,2 %) coagulation indica-
tors correspoud to the avgrage statistical norm. The coagulation degree
reduces in parallel with reduction of hematocrit number, reaching the
minimum (66,8 + 2,7 %) when Ht = 18,4 + 0,8 %. There is little of coa-
gulative activity. The progressive increase of fibrinolysis degree in
parallel to the increase of dilution degree was noted. Fibrinolytical
potential had the same directionality but to a smaller degree. Hemo-
static potential was reduced by one half with the dilution increase.

In this way the dilution may be used as a method component for
creating of artificial hypocoagulation at extracorporeal perfusion

CORRELATION OF THE DEGREE OF REOLOGICAL BLOOD PARAMETERS ISTUBANCES WITH HEAVINESS OF THE DIC-SYNDROME IN NEUROLOGY

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In laboratory testing of the state of the hemostasis
the following number of patients was probed: 56 – with
strokes, 40 – with epilectic status, 80 – with a multiple
sclerosis, 88 – with subarachnoidal hemorrhage, 40 – with
titic meningitis, 30 – with encephalopathy as results of
therapeutic diseasos' after-effects. The DIC-syndrome was
iscovered as the most frequently occuring pathological
ffect of the hemostasis under the said conditions. Each
single case of the DIC-syndrome had specific manifestation
ranging from clinical to latent.

A simultaneously conducted testing of blood viscosity
and plasma on a rotational viscosimeter "AKR-2" allowed us
to conclude that the reological blood parar ters
significantly correlated on heaviness of the DIC-symdrome
and in particular on the form of its manifestations: whether
it is clinical or latent.

In cases of light DIC-syndrome plasma viscocity
increased with low speed of rotation shift, which indirectly
indicated microcirculation disturbances in small vessels. In
cases of heavier DIC-syndrome plasma viscosity increased
with an accelerated speed of rotation shift. In cases of the
heaviest DIC-syndrome total blood viscosity increased. One
of the reason of the reological blood parameters

disturbances under the DIC-syndrome is that this syndrome

under the nervous system deseases is frequently accompanied

by a fibrinogen quantity increase in plasma, which in its

turn causes reological disturbances.

In view of this, we recommend that complex therapy

measures should necessaril, include correction of reological

dist rbances on different stages of DIC-syndrome

development.

SOME HEMOSTASIS INDICES IN PREGNANT WOMEN WITH IRON DEFICIENCY ANEMIA

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Among extragenital diseases of mothers died of hemorrhage, anemias prevail. Up to now the hemostasis state in pregnant women with iron deficiency anemia(IDA) as well as its interconnection with ferrokinetics is not studied.

To solve partially this problem 120 pregnant women in the 3rd term having alimentary IDA were examined. The following indices of ferrokinetics were studied: serum iron content(SIC) general iron binding ability of blood serum(GIBAS), transferrin level(Tf) and its saturation by iron. To evaluate the hemostasis state integrative tests were used: blood clotting time, prothrombin index, duration of bleeding, fibrinogen level, calcium clotting time, antithrombin III, plasma tolerance to heparin, fibrinolytic activity.

Pregnant women with SIC decrease up to 10-12 mkm/l comprised the first group with a mild form of the disease. The number of erythrocyte was 3.5x10 /l, hemoglobin was from 90 to 110 g/l, other coagulogram indices practically being unchanged but plasma tolerance to heparin which was somewhat decreased.

Pregnant women with a moderate IDA form when SIC decreased up to 8-10 mkm/l, GIBAS - up to 80 mkm/l, and Tf level increased up to 490 mg% were in the 2nd group. The number of erythrocytes and hemoglobin level were reduced as in the first group. Coagulogram indices remained practically unchanged but fibrinogen content reliably increased up to 4.5 g/l.

Severe form of IDA(the 3rd group of pregnant women) was characterised by SIC decrease less than by 8 mkm/l simultaneously with a reliable Tf increase. The number of erythrocytes remained reduced as in first two groups with simultaneous progressive fall of hemoglobin level ? to 79 g/l. Coagulogram indices showed development of hypercoagulation shifts.

Comparative analysis of coagulogram indices and ferrokinetics in pregnant women with IDA of different severity allowed to conclude on the possibility of hemostasis disorders induction in progressing iron deficiency and to work out prophulactic methods of DIC syndrome in pregnant women under study.

PLATELET AGGREGATIONAL ACTIVITY IN BLOOD
OF PATIENTS WITH ALCOHOL HEART DISEASE.

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Aggregational activity of platelets in blood of 50 patients with alcohol heart disease was researched by the laser analyser of aggregation. As was shown the viscosity of blood of patients examined increased significantly at the average of 9.7+-0.31% (P<0.01). Rheological properties of blood were characterized by the acceleration of blood platelets releasing-reaction. Use of diltiazem in the dose of 0.01 mg/kg resulted in decrease of platelets initial rate of aggregation on 7.3+-0.21% (P<0.01), while, finoptin inhibited the rate of platelet aggregation only by 6.1+-0.25% (P<0.01). The use of the new calcium-antagonist isradipine (lom.) resulted in the marked reduction of rate of the platelets aggregation and degree of aggregation (by 12.7+-0.33%, P<0.01 and 17.3+-0.27% accordingly). Rheological properties of blood under the effect of this drug returned to the level of healthful donors of similar age.

THE STATE OF HEMOSTASIS MECHANISMS IN TRAUMA OF THE
SPINAL CORD IN PREMATURE NEWBORNS

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Ischemic disorders due to defective vertebral arteries play the leading role in pathogenesis of natal damages of the spinal cord. At the same time hemostasis system which changes rheologic properties of blood is of great importance in the development of these damages.

48 premature newborns were examined: 15 healthy premature newborns comprise the 1st (control) group; 33 premature newborns suffering from natal trauma of the spinal cord comprised the 2nd group. We determined the prothrombin time, activated partial thromboplastin time, antithrombin III activity, ethanol and protamine sulphate tests, fibronogen content, fibrinolysis activity by the method of fibrin plates.

Hypercoagulation due to activation of prothrombinase formation(shortening of prothrombin time and activated partial thromboplastin time) and depression of anticoagulant component took place in 32% of premature newborns of 2nd group in acute period of disease. Excessive thrombogenesis was accompanied by HMWK appearance in blood(positive ethanol and protamine sulphate tests). These patients had a marked stimulation of fibrinolysis due to the increase of plasminogen activators. Hypocoagulative changes due to inhibition of prothrombinase formation(prolongation of prothrombine time and activated partial thromboplastin time) in the presence of hypofibrinogenemia, reduction in antithrombin III activity and fibrinolysis depression were detected in 68% of premature newborns of the 2nd group. Marked hypocoagulative changes are, probably, the sequence of great deficiency of synthesis of K-vitamin dependent factors of blood coagulation.

PROGNOSIS OF EFFICACY OF Ca ANTAGONIST INFLUENCE
ON THE THROMBOCYTE AGGREGATION IN PATIENTS WITH
DIFFERENT FORMS OF ISCHEMIC HEART DISEASE

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The state of microcirculation in IHD patients is an actual
problem in clinical cardiology, as information on correction
of hemostasis by means of peripheral vasodilators of
different mechanisms of action is obscure and controversal.

In the present work the influence of different blocking
agents of slow Ca channels(corinfar, infecard, verapamil) on
aggregative properties of thrombocytes in patients with dif-
ferent IHD forms was studied:effort angina of 1-3 functional classes,
myocardial infarction in subacute stage. 135 patients were
examined and 15 healthy persons served as a control group.
Aggregative function of thrombocytes was investigated follow-
ing Born method. Parameters under study were   angle - va-
lue showing the rate of aggregation formation; the time of
aggregation start, the time of maximal aggregation start and
aggregogram amplitude. On comparing the results obtained
with the data of control group reliable changes in aggregram
indices were   determined:IHD patients had increased throm-
bocyte tendency to aggregation manifested by shortened time
 f aggregation beginning,   angle enlargement, more quick
achievement of aggregation maximum.

Heterogenous clinico-laboratory shifts were obtained in
single-dose intake and administration of Ca antagonist course
treatment:reduction of the number of angina attacks and of
the level of arterial hypertension which combined with
quantitatively different properties of some parameters of the
aggregogram. Manifestation of the complex reaction observed
in single-dose administration of drugs serves as a prognos-
tic criterion of efficacy of influence of some Ca antagonists
on thrombocyte aggregation in a certain patient.

Qualitative criteria of thrombocyte aggregation were de-
termined basing on investigations undertaken. Using these
criteria and the method of stat'stical processing - the me-
thod of main components on the basis of image recognition
following Forel algorhithm - it is possible to prognose the
efficacy and advisability of using one or other drug in a
certain patient. Individual dose-dependent reaction of throm-
bocytes should be taken into account.

PECULIARITIES OF HEMOSTATIC REACTIONS AND THEIR DIAG-
NOSTICS IN MALIGNANT PROCESS IN THE LUNG

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To study disturbances of rheologic properties of blood,
aggregate state of blood particularly, modern methods
of investigation of blood coagulation system, fibrino-
lysis, kininogenesis and complement were used. 85 opera-
ble patients with lung cancer(I-II stage) with T   N
M and 79 inoperable patients(III-IV stage) with T
N M   were examined. 50 practically healthy people
of the similar age(45-59 years) comprised the control
group.

Peculiarities of enzyme activity of blood components
under study, their interaction were stated to determine
blood rheologic properties. They are connected with the
developmnet of a chronic form of thrombo-hemorrhagic sym-
drome with a latent course in the examined group of pa-
tients. Disturbances of coagulation homeostasis in pa-
tients with III-IV stages of tumor process in the lung are
more marked than in patients with I-II stages of the di-
sease. Deficiency of factors of prothrombin complex, de-
crease in activity of activators and fibrinolysis inhibi-
tors are more apparent in this group. Activity of proteo-
ly.ic, antiplasmin complexes in peripheral blood is con-
nected with intensity in metabolism of these biological-
ly active substances in tumor tissue.

Diagnostic tables which help in determination of latent
disturbances of aggregate state of blood in pati nts with
a malignant process in the lung are composed basing on the
estimation of weight value of the investigated indices.

ON THE ROLE OF DESTABILIZATION OF BIOLOGICAL MEMBRANES IN MECHANISMS OF HEMOSTASIS DISORERS IN EPG-GESTOSES

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Development of bleeding complicating the course of labor and postpartum period is the characteristic feature of EPG-gestoses. Up to now disorders of hemostasis blood potentia. in this group of patients, as well as molecular-cellular mechanisms of hemostasis disorders are poorly investigated.

The object of the given investigation is determination of parallelism between severity of clinical manifestations of gestosis, the charac+er of disorders of coagulative hemostasis and fibrinolysis as well as ascertainment of the ru.e of process activation of free radical lipid peroxidation in biological membranes in mechanisms of hemostasis disorders induction.

Clinical observations and clinico-laboratory investigations were performed in 3 groups of pregnant women: with a preclinical form of late gestosis, with a combined form of EPG-gestosis with renal pathology(RP), as well as EPG-gestosi with neuro-endocrine hypothalamic syndrome (NEHS).

To assess the state of coagulative hemostasis and fibrinolysis generally accepted integrative indices were used: blood coagulation time, prothrombin index, fil·inogen level, total fibrinolytic blood activity, as well as the number of thrombocytes. Intensity of processes of free radical oxidation was judged by the level of intermediate and end LP products in blood, the degr?e of stability of cytoplasmic membranes was judged by the activity of AST and LDH of blood serum.

Results of investigations performed allow to conclude:
1. Parallelism between the severity of clinical manifestations of gestosis and the state of LP intensity was deter-m..ed. Pregnant wome.. with pregestosis had an insignificant LP activation, at the sa.. time pregnant women with EPG combined with RP and NEHS had a marked distabilizat·on of cytoplasmic membranes manifested by a sharp elevation of AST and LDH in blood serum simultaneously with a marked level ncrease of malonic dialdehyde and diene conjugates in blood.
2. Pregnant women with EPG-gestosis combined with RP and NEH" had one-way changes of hemostasis manifested by shortening of blood coagulation time and hyperfibrino-genemia. However the same pregnent women had a reduced thrombocyte level.
3. LP process intensification combined wi+h disorders of coagulative and thrombocyte components of hemostasis system states the necessity of using membrane protectors-antihypoxints in complex gestosis therapy to prevent DIC syndrome.

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HEMOSTATIC SYSTEM IN PHTHISIOSURGICAL PATIENTS.

There are many references to the effect that some plications, such as thrombosis, thromboembolism and hemorrhage, of frequent occurrence in phthisiosurgical patients. Because this, the examination of the hemocoagulative disorder has been subject of our study. We investigated hemorrhagic plications in 1084 patients with pulmonary tuberculosis. We nd out intrapleural hemorrhages, which were produced by ocoagulative breach in 23 cases (2% of all patients), these ients comprised first group, and 20 patients without monary hemorrha e into the second group. We al o examined 56 lthy persons (third group). Fibrocavernous tuberculosis was gnosed in 680 patients. Antibacterial therapy lasted from 6 nths up to several years. The following operations were applied: lmonary 1-2 segment resection, lobectomy with thoracoplasty, umonectomy, pleurectomy. The coagulogram analysis was performed the first and 14th days after operation.

During operations and immediately after them hypercoagulation arted due to the coagulation time elevation (p<0.05), doubling fibrinogen concentration (p<0.001) and heparin concentration crease. Fibrinase activity was significantly reduced (patients- ,0+/-1,4 s, healthy persons - 63, 3+/-2,4 s). In patients with morrhage fibrinolysis activity was 4 times more than in a lthy group (p<0.01). Within two weeks after operation gulation time slightly increased, fibrinogen and he rin ncentrations also increased, (p<0.01). Fibrinase and brinolysis activities approached the values of healthy people. brinase activity increase responded to minor fibrinolysis tivity elevation in non-hemorrhage patients.

Considering the results achieved administration of the oteolytic inhibitors (aminocapronic acid, aprotinin and others' oved to be effective in phthisiosurgical patients during the eration and immediately after it and reduce hemorrhage volume.

Coagulogram analysis and optimal treatment prior to operation ntribute to early detection and prevention of hemorrhagic plications.

INFLUENCE OF INTRAVASCULAR LASER IRRADIATION ON RHEOLOGIC PROPERTIES OF BLOOD IN PATIENTS WITH ATHEROSCLEROSIS OF PERIPHERAL ARTERIES

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Correction of disorders in blood rheologic properties is one of the main ways in treatment of patients with atherosclerosis obliterans of peripheral arteries.

Dynamics of indices of rheologic properties of blood under the influence of intravenous blood laser irradiation (IBLI) was studied in 350 patients with atherosclerosis obliterans of arteries of lower extremities.

Influence of laser irradiation(=0.632 mcm) on blood was performed by introducing the light guide into peripheral or central vein. Power density at the end of the light guide was 2-5 mWt. Duration of one session was 30 min, there were 5-6 sessions with 48-hours interval.

Prior to the treatment, practically all patients had increased coagulative blood activity, there were significant disorders of rheologic properties. After the course of IBLI a tendency to hematocrit reduction was noted, fibrinogen level decreased reliably (by 30% in the average), fibrinolytic activity increased (by 80% in the average), erythrocyte deformability increased (by 14.6% in the average). There is a distinct interconnection between a a clinical efficacy of IBLI and changes in rheologic blood properties.

Thus, normalizing influence of IBLI method on the rheologic properties of blood is one of the mechanisms of IBLI effect, providing clinical effect in patients with chronic arterial insufficiency of extremities. IBLI practically had no influence on hematocrit, that is why to achieve maximal clinical effect in patients with hematocrit over 47% IBLI should be combined with chronic hemodilution or plasmapheresis.

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System Assessment of Erythrocyte Membrane in Patients with Unstable Angina and Acute Myocardial Infarction.

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The role of erythrocyte membrane disturbances in the pathogenesis of hemorheologic disorders in patients with coronary heart disease has been well established.

28 patients (mean age 58 +/- 10 years) with Q-wave acute myocardial infarction (AMI) were studied. In 18 cases (first group) unstable angina pectoris were noted before the development of AMI. In 12 cases the AMI outbreaks were observed (second group). Before treatment blood was collected for the following assays: phospholipid fractions of erythrocyte membranes, such as phosphotidylamin (PAm), phosphotidylinosid ( ), phosphotidylholin (PH), phosphotidic acid (PA), phosphotidylserin (PS), sphingomyelin (SM), and levels of peroxide dismutase (SOD), catalase (C), and malonic dialdegid (MDA).

We found no statistically significant difference between the two groups for any assay of PI, PH, PS, SM. The levels of PA were lower (p < 0.05) in the first group (29.6+/-2.2%) than in the second group (36.19+/-1.53%). In contrast, the levels of PA were higher (p < 0.05) in the first group (5.33+/-2.10%) than in the second group (1.07+/-0.4%). In addition, patients with unstable angina had increased MDA levels (8.11+/-1.03 nmol/ml). MDA average value in patients without unstable angina was 6.21+/-0.75 nmol/ml (p < 0.05).

It is known that PAm is the most predisposed to oxidation, and PA is an important contributor to the erythrocyte membrane phospholipids synthesis. Probably, more active lipid peroxidation caused the changes in these phospholipid fractions during the state of angina pectoris before the AMI.

However, there were significant differences (p<0.05) between the (SM/PH + SM/PAm) coefficient in the first group (0.68+/-0.20) and in the second one (1.16+/-0.24). It shows that erythrocyte membrane viscosity in the unstable angina group is less significant. The decreasing of erythrocyte membrane viscosity can be considered as one of the adaptation mechanisms developing in case of progresive coronary occlusion.

ИССЛЕДОВАНИЕ РЕОЛОГИЧЕСКИХ СВОЙСТВ
КОНСЕРВИРОВАННОЙ КРОВИ

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Реологические параметры крови и некоторых других биологических жидкостей являются, как известно, важным показателем при диагностике и в процессе лечения различных заболеваний.

На основе анализа существующих представлений о структуре крови, величине эффективной вязкости и методиках ее измерения в ИТМО АНБ разработан автоматический ротационный вискозиметр, в котором реализован режим течения Куэтта между коаксиальными цилиндрами. Применен высокочувствительный датчик крутящего момента с оптоэлектронной системой регулировки и использованием обратной связи. Это позволяет проводить измерения в маловязких жидкостях ($\sim$1мПас) при скоростях сдвига меньших,чем $0,1с^{-1}$ в образцах объемом 0,7-1,5мл. Управление работой систем вискозиметра осуществляется с помощью программируемого микрокалькулятора, встроенного в прибор. Обработка информации производится через специальные устройства связи на персональных ЭВМ типа PC-AT. Высокая точность регулирования заданной скорости сдвига обеспечивается использованием в качестве привода шагового двигателя, управляемого микрокалькулятором.

Проведены измерения вязкости консервированной крови с антикоагулянтом-гепарином в диапазоне температур $20-45^{0}С$ и скоростей сдвига $0,1-10$ $с^{-1}$. Параметры крови контролировались по гематокриту и фибриногену. В качестве реологических моделей использованы модели Кассона и степенной жидкости. Результаты аппроксимировались с применением методов нелинейного програмирования с минимизированием суммы квадратов отклонений экспериментальных данных от модельных соотношений.

В итоге установлена зависимость реологических характеристик крови от температуры и времени измерения.

INVESTIGATION OF RHEOLOGICAL PROPERTIES OF BLOOD

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It is well known that rheological properties of blood and other biological fluids are important indicators for diagnosing different deceases.

In the Heat & Mass Transfer Institute an automatic rotational viscosimeter has been developed which is based on the existing physical conception of the blood structure and the values of the blood viscosity in normal and pathological states. The measuring system operates according to the Couette's principle, i.e. the outer cylinder is driven by an electronically controlled step motor while the resulting torque is measured on the inner cylinder. The device contains a newly developed torque sensor with photodetector which registers every deflection of the inner cylinder. A magnetoelectrical heat compensates for these movements, thus returning the inner cylinder to its original position. High sensitivity of the torque sensor allows the investigation to be made of low-viscous substances ($\sim$1 mPa·s) even at very low shear rates ($\sim$0.1 s^{-1}). For measurements, 0.7 to 1.5 m3 of a substance are required. The device can be connected with any computer which have a RS232c serial interface.

The measurements of the blood viscosity were performed at the temperature from 20 to 45 °C with shear rates within the range from 0.1 to 10 s^{-1}. The Casson model along with the power-law relation have been used as the basis for the rheological concept. The investigation has demonstrated that a linkage exists between the rheological characteristics of blood and the temperature and time of measurements.

HEMORHEOLOGICAL STATUS IN BEKHTEREU DISEASE PATIENTS.

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60 you g patients with Bekhtere disease were examined to reveal antigen HLA B - 27 in the majority of cases. The central form of the disease was observed in 36 patients, periphe ral - in 24 patients, the latter group manifesting more evident inflammation activity (degrees II and III). Microcirculation status (MC) was investigated by conjunctiva biomicroscopy using the split lamp; hemocoagulation indices were estimated by means of biological methods and thromboelastography ; blood viscosity was found out;hematocrite and vascular wall permeability were determined following Kaznacheev V.P. and Dsisinsky A.A.

Biomicroscopically there were revealed extravascular, vascular and particularly intravascular MC disorders, the latter including microvascular blood flow disturbance (characterized by intermittence and quite frequent pendular movements), erythrocytes aggregation in venules, capillaries and arterioles (Kniseli phenomenon, degrees I-II, more rare -III), and sometimes microthromboses. Hypercoagulation (blood fibrinogen level, plasma tolerance to heparin increseas, thrombotest, MA, E levels elevation, R and J decreases), fibrinolysis inhibition as well as heparin and antithrombin - III leve. decr se were revealed.

10 patients with maximum inflammation activity were tested for fibrinogen B with positive result, which, together with intravascular pathology and anticoagulation mechanisms activation proves disseminated intravascular coagulation (DIC)- syndrome to be chronic and requiring drug correction. Besides, hematocrit and blood viscosity values increase, vascular wall permeability disturbance of type I transcapillary metabolism damage, and inadequate reaction to hydrostatic test were revealed.

The above mentioned pathological changes testify to hemorheological disorder and contribute to thrombosis formation pro cess in microvessels.

Development of MC disturbances severity was noted to progress together with the progressing of the disease and inflammation activity, especially in patients with long - lasting case histories. Though clinical symptomaties sig ificantly improve and pathological shifts levels decrease after treatment, their normalization occurs not to be complete.

The Role of Transformations in Erythrocyte Microrheological Properties in Pathogenesis of Chronic Glomerulonephritis

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Membrane stability is one of the criteria of erythrocytes tivity in microcirculation and microrheology.The following functional characteristics of erythrocyte plasmalemma were investigated n patients with chronic glomerulonephritis: form, deformability, orbtional capacity of cell surface for fibrinogen, permeability. ta received indicate the same directed transformations of above numerated properties in all clinical forms and stages of the disase: increased amount of pathologically shaped cells in peripher l blood, reduction in erythrocyte membrane deformability, increasng cell surface sorbtional capacity for fibrinogen. At the same me ery nrodieresis is increasing, and aneamea is developing.

Coagulation potential of blood is increasing simultaneously to hese transformations. All the above mentioned becomes an important ctor for impairment of tissue perfusion, including renal parenhyma, residual neurons. Analysis of involvement of erythrocyte hospholipids and plasma into the development of microrheological l turbances in chronic glomerulonephritis has allowed to work out n integral index, called safety index of erythrocyte phospholipids.

ИЗМЕНЕНИЯ ТЕКУЧИХ СВОЙСТВ КРОВИ У БОЛЬНЫХ ХРОНИЧЕСКИМ БРОНХИТОМ И ИХ КОРРЕКЦИЯ ПРИ ЛАЗЕРНОЙ ТЕРАПИИ

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Под нашим наблюдением находилось 47 больных хроническим бронхитом (ХБ). Первая группа состояла из 30 больных, получавших комплексное лечение с включением курса внутривенной гелий-неоновой лазерной терапии. Вторую группу составили 17 больных ХБ, лечившихся традиционно.

При поступлении у больных ХБ 1 и 2 групп отмечалось значительное по сравнению со здоровыми лицами повышение вязкости крови во всем диапозоне использованных линейных скоростей.

Исследование проводилось на ротационном вискозиметре ВИР-78.

После первого сеанса лазерного облучения в основной группе выявлялась тенденция к снижению вязкости крови, особенно выраженная в области высоких скоростей, где она носила статистически достоверный характер (p < 0,05).

На 15-17 день лечения в 1 группе больных отмечалось достоверное улучшение вязкостных свойств крови: при линейных скоростях, равных 0,01см/с; 0,3см/с и 4,5см/с динамическая вязкость снизилась соответственно на 30%; 24,9% и 15% от исходных значений. У больных 2 группы ее уменьшение составило соответственно 12,5%; 7,9% и 8,5% от первоначального уровня.

Полученные результаты свидетельствуют о корригирующем влиянии лазерной терапии на состояние гемореологии у больных хроническим бронхитом.

СОДЕРЖАНИЕ