# TEMPLATES FOR 2-D PROTEIN CRYSTALLIZATION DEVELOPED ON KNOWLEDGE OF RHEOLOGICAL PROPETIES OF POLYMER DISPERSIONS

**N.M. Zadymova, G.P. Yampolskaya**

Lomonosov Moscow State University, Chemical faculty, Department of Colloid Chemistry

Yampolskaya@colloid.chem.msu.ru

Despite of undoubted importance and essential successes the protein crystallization within homogeneous media remains as a labour-consuming, empirical process. Meanwhile protein crystals are necessary for the X-ray analysis, the unique knowledge source about space structures of protein molecules and protein functionalities. Possibilities of 2-D (surface) protein crystallization are intensively investigated with the aim to replace bulk processes. The first problem is to find suitable templates. Many efforts are directed to develop surfaces on which heterogeneous protein crystallization can be realized. In this work polymer and biopolymer nanodispersed films were prepared starting from two types of dispersions (complex emulsions containing a surfactant, hydrophobic and hydrophilic polymers and biopolymer dispersions of glycoprotein mucin). It was established that a film quality providing desirable surface properties of templates (surface energy, wetting, roughness) depends on rheological properties of dispersions, used for the film casting. Rheological properties were measured by means of rheometer RheoStress (Haake). More than 50 o/w complex emulsions of different compositions (nonionic surfactant and HPC were dissolved in water and hydrophobic polymer SIS was dissolved in a hydrocarbon) have studied. The role of each the component in emulsions has been established according to rheological data, in particular surfactants act as stabilizers, HPC shows not only stabilizing (flocculation) effects, but thickens the continuous phase and thus strongly modifies emulsion rheological property. A desirable amplification non-Newtonian flow can be achieved simply by an increase in HPC concentration. Structured complex emulsions with the initial shear viscosity exceeded on two order the viscosity of these with destroyed structures show a suitable film casting ability. Rheological responses of such emulsions on applied constant shear stress (region of linear viscoelasticity) recorded as the deformation development allowed to describe their structures by the Burgers model. Flow curves of aqueous mucin dispersions (3-4% mucin, pH 2.3, with and no addition 0.4 M NaCl) correspond to the Bingham plastic behavior. Under dynamic (oscillation) measurements (linear viscoelastic regime) up to frequency 6.28 $rad.s^{-1}$ mucin dispersions behave as a weak gel: $G' > G''$ with plateau on dependencies $G'$ on frequency and tangent of the phase angle $tg\delta = G''/ G' > 0.1$. The reaction of weak and ordinary gels on large deformations is different: ordinary gels are ruptured at large deformations and weak gels flow without ruptures. In all cases templates were prepared by spreading dispersions on the hydrophobic polymer film (support) and drying under definite conditions. Template surfaces have been estimated by AFM method. The protein crystallization (protein is added in dispersion) on the template surface proceeds during film drying. The formation of protein nanocrystals have been observed by AFM method. Templates prepared from complex emulsions were used for lysozyme crystallization and from mucin dispersions for five globular proteins of different molecular masses, including lysozyme. Additionally another approach (drop method) for protein crystallization on mucin template was used. A drop of the protein solution was plotted on the surface of templates, prepared from dispersions without added proteins. Crystallization can proceeds under drop evaporation. Some explanations of crystallization mechanisms are given.