INFLUENCE OF NON-NEWTONIAN BEHAVIOR ON WAX DEPOSITION IN A CHANNEL FLOW

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Wax deposition on the inner walls of pipelines is a serious problem for the petroleum industry, since it can lead to production loss, increased pumping power, elevated remediation costs and even loss of pipelines due to its total blockage. At temperatures below the wax appearance temperature (WAT), the fluid can present non-Newtonian behavior if a minimum weight fraction of wax crystals is achieved. This change in the rheological behavior is due to a gelation process and can contribute to an increase in the wax deposit thickness. Therefore, at the present work the behavior of the flow and its influence in the deposit thickness is numerically investigated considering three different models, namely Bingham, Herschel-Bulkley, and a new model resulting from the combination of Richardson and Herschel-Bulkley models. To evaluate the models, the numerical results are compared with data obtained in well-controlled experiment in a channel flow, employing a simple model waxy oil. The fluid thermal physics properties and rheological parameters were experimentally determined. The finite volume method with a moving mesh adapted to the interface was applied to solve the conservation equations. The results show that taking into account the non-Newtonian behavior in addition to the molecular diffusion mechanism can improve the capability of numerical simulations in predicting the wax deposit thickness.