Simulating the effect of shear strain rate on the colloidal stability in an emulsion polymerisation reactor using computational fluid dynamics

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Abstract
In this work computational fluid dynamics (CFD) is evaluated as a tool to study the colloidal stability in latices of varying solid content. The Dougherty-Kreiger equation was used to predict the zero-shear viscosity for emulsions with solid content of 12 and 24 vol%. For simulations involving emulsions with higher solid content a shear thinning behaviour according to the Carreau-Yasuda model was used. Computational fluid dynamics were then exploited to solve the flow field for two reactor designs so that the colloidal stability could be studied at all points of the reactor. The results depended on both the volume fraction of solids and reactor design. CFD is able to identify regions of low colloidal stability and gives much more detailed information than a colloidal stability estimate based on the average reactor conditions, making it very useful for the design and control of emulsion polymerisation reactors.

Keywords: Colloidal stability, coagulation, polymers, CFD, kinetic model

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