MECHANISTIC MODELLING OF THE RHEOLOGICAL BEHAVIOR OF SUSPENSIONS ACCOUNTING FOR PARTICLE SIZE DISTRIBUTION DYNAMICS

Introduction

Most engineering processes -from wastewater through pharmaceuticals to cement and concrete- feature particles immersed in a continuous phase. The presence of these particles directly impacts rheology, which affects process mixing and flowability properties and hence process performance and cost. Current empirical models are mostly based on particle concentration, whereas evidence exists that particle size is a key property. This disagreement between engineering practice and reality leads to suboptimal performance of current designs as well as expanded environmental impacts. Therefore, the development of adequate models with strong predictive capabilities is of the utmost importance.

Methodology

Macroscopic rheological characteristics (e.g. viscosity) of a suspension can be deduced if the dynamic evolution of its Particle Size Distribution (PSD) can be obtained. The use of population balance models (PBM) in conjunction with simultaneous rheological and PSD data can be used to construct state-of-the art models capable of describing the flow of engineering relevant suspensions under a wide range of experimental conditions.

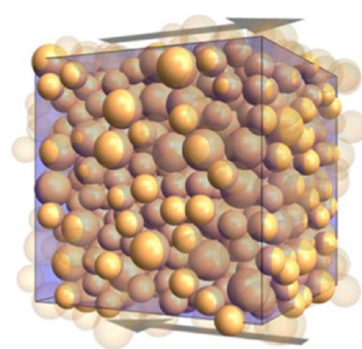

Figure 1 – Particles have a significant impact on the flow behavior of suspensions.

Objectives of the thesis

This study aims to implement mechanistic models in order to extend the knowledge on rheology of engineering suspensions based on a model system and novel experimental data.

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