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Characterization of Shear and Extensional Rheology of Fibre Suspensions Prior to Atomization

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Abstract : Spray drying of fruit juices from liquid to powder is desirable as the powders are easier to handle, especially for storage and transportation. In this project, pomace fibres will be used as a drying aid during spray drying, replacing the commonly used maltodextrins. The main attraction of this drying aid is that the pomace fibres are originally derived from the fruit itself. However, the addition of micro-sized fibres to fruit juices is expected to affect the rheology and subsequent atomization behaviour during the spray drying process. This study focuses on the determination and characterization of the rheology of juice-fibre suspensions specifically inside a spray dryer nozzle. Results show that the juice-fibre suspensions exhibit shear thinning behaviour with a significant extensional viscosity. The shear and extensional viscosities depend on several factors which include fibre fraction, shape, size and aspect ratio. A commercial capillary rheometer is used to characterize the shear behaviour while a portable extensional rheometer has been designed and built to study the extensional behaviour. Methods and equipment will be presented along with the rheology results. Rheology or behaviour of the juice-fibre suspensions provides an insight into the limitations that will be faced during atomization, and in the future, this finding will assist in choosing the best nozzle design that can overcome the limitations introduced by the fibre particles thus resulting in successful spray drying of juice-fibre suspensions.

Keywords : extensional rheology, fibre suspensions, portable extensional rheometer, shear rheology
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