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# Mass Transfer and Shear Environment of an Aerated Coaxial Mixer Containing a Shear-Thinning Fluid

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## Extended Abstract

Gas dispersion in shear-sensitive fluids contained in mechanically agitated tanks is a complex process. This is due to the fact that the fluid viscosity greatly varies with the extent of shear rate [1]. As a result, the mixing system efficiency deteriorates under uneven mixing conditions and creation of oxygen depleted zones. In many industries, such as food and pharmaceutical industries, the proper mixing of shear-sensitive fluids is crucial for production of high-quality products [2]. Recently, coaxial mixing systems comprising of a central impeller and an anchor impeller demonstrated promising performance in gas dispersion inside shear-thinning fluids in terms of the mass transfer rate, power consumption, and uniform distribution of the shear rate [3,4]. However, based on an extensive literature review, the relation between the shear environment and the mass transfer rate generated by the coaxial mixer is not well understood. Hence, this study aims to investigate the mass transfer characteristics of a coaxial mixer at different scales containing a non-Newtonian fluid. Through the application of electrical resistance tomography, gassing-in, and computational fluid dynamics (CFD) methods, the gas hold-up, mass transfer coefficient, and shear environment of the coaxial mixers were evaluated, respectively.

In this regard, the impact of the aeration rate, impellers' speed, central impeller type, pumping direction, and rotating mode on the shear environment obtained by the coaxial mixer was analysed. The results of this study showed that the central impeller speed and the rotating mode had significant effects on the mass transfer rate. It was found that both the shear environment and mass transfer obtained in the counter-rotating mode were higher than those attained in the co-rotating mode. The results of this study can be used to optimize mixing conditions for the gas dispersion in shear-sensitive fluids in order to enhance the mass transfer rate at a lower shear environment. Importantly, the data obtained from this study provided valuable insights into the design and scale-up of aerated coaxial mixers, which can be applied in industrial and chemical processing applications.

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