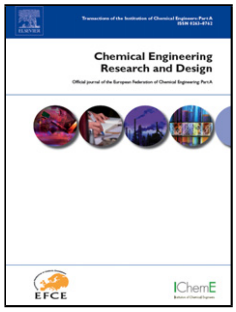

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Influence of Additive to Bulk Viscosity Ratio on Inline Blending in Laminar Flow

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Highlights

- Laminar flow static mixer L_{mix}/D measured with both high and low μ_a/μ_b
- Strong influence of μ_a/μ_b on L_{mix}/D outside a narrow range around μ_a/μ_b=1.
- Increase in L_{mix}/D when μ_a/μ_b<1 always due to the presence additive striations.
- In laminar flow there was no clear relationship between Q/q and L_{mix} /D.

Abstract

The use of continuous, inline systems to dose, mix, sample and control injected additives is common in the process industries. However, published information describing the effect of additive (μ_a) and bulk (μ_b) viscosity differences on inline blending performance is sparse. In this paper, experimental results on the determination of mixing length (L_{mix}/D) when dosing additives both more and less viscous than the bulk flow using the Chemineer Kenics KM are described.

L_{mix}/D measurements were made by visually observing the dispersion and blending of a coloured additive stream using both DN20 and DN50 Chemineer Kenics KM of 24 and 36 1.5 pitch ratio elements, respectively. L_{mix}/D reproducibility was found to be within ±1.5 (±1 Kenics element).

In the laminar flow regime (Re_{mixer}<10), the effect of additive and bulk viscosity on L_{mix}/D was characterised using the viscosity ratio μ_a/μ_b as opposed to the modified Reynolds number, Re^*. The laminar flow L_{mix}/D results demonstrated a strong influence of μ_a/μ_b outside a fairly narrow range around μ_a/μ_b=1. The increase in L_{mix}/D when μ_a/μ_b <1 (dilution of viscous bulk) was always due to the presence of single or multiple strands of low viscosity additive (striations) which broke through L_{mix}/D=54 under some conditions.