On the performance of static mixers

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Introduction

The performance of various static mixers, the Kenics mixer, the Ross Low-Pressure Drop (LPD) and Low-Low-Pressure Drop (LLPD) mixer, the standard Sulzer SMX mixer, and the recently developed new designs of the SMX in our group, known as \( \text{SMX}(n) \) [1] (see Fig 1), is compared using both energy consumption, measured in terms of the dimensionless pressure drop, and compactness, measured as the dimensionless length, as criteria [2].

Qualitative comparison

Figure 2 reveals qualitative profiles for different designs.

![Figure 2: Mixing profiles for different industrial mixers.](image)

Quantitative comparison

Figure 3 (a) and (b) show a quantitative comparison using energy consumption (measured in terms of dimensionless pressure drop) and compactness (measured in terms of dimensionless length).

![Figure 3: Quantitative comparison of mixing performance of various static mixers using cross-sectional flux-weighted intensity of segregation versus (a) dimensionless pressure drop \( \Delta P^* \) and (b) dimensionless length \( l/D \). If \( I_d=1 \), no mixing at all, if \( I_d=0 \), complete mixing.](image)

Conclusions

1. The Kenics is the most energy efficient motionless mixer, shortly followed by the LPD and the simplest versions of the new design series, the \( \text{SMX}(n) (n, N_p, N_x) = (1, 1, 3) \).
2. The \( \text{SMX}(n) (n, N_p, N_x) = (4, 7, 12) \) is the most compact mixer, shortly followed by the \((3, 5, 9)\) versions.

References:
