

On the performance of static mixers

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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 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].

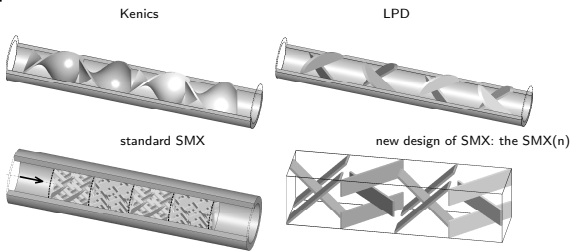


Figure 1: Different motionless mixers: the new design series of the most efficient SMX(n) mixer with $(n, N_p, N_x)=(n=1, 2n-1=1, 3n=3)$ shown here in their rectangular configuration [1].

Qualitative comparison

Figure 2 reveals qualitative profiles for different designs.

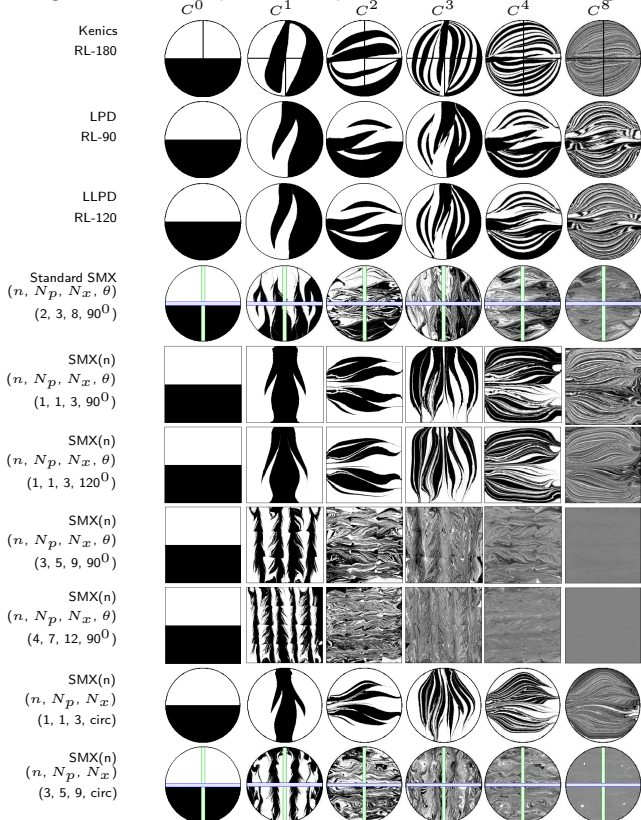


Figure 2: Mixing profiles for different industrial mixers.

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).

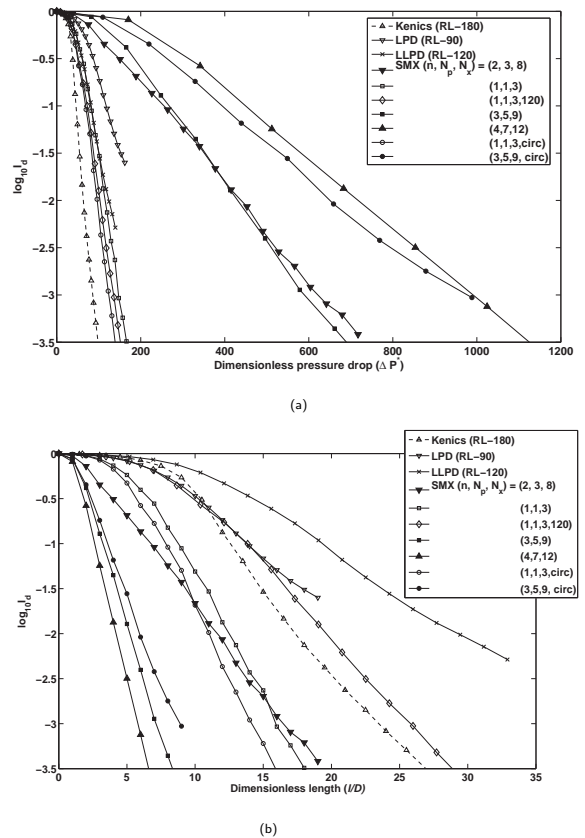


Figure 3: Quantitative comparison of mixing performance of various static mixers using cross-sectional flux-weighted intensity of segregation versus (a) dimensionless pressure drop ΔP^* and (b) dimensionless length (l/D) . If $I_d=1$, no mixing at all, if $I_d=0$, complete mixing.

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 SMX(n) $(n, N_p, N_x)=(1, 1, 3)$.
2. The SMX(n) $(n, N_p, N_x)=(4, 7, 12)$ is the most compact mixer, shortly followed by the (3, 5, 9) versions.

References:

[1] M. K. SINGH, P. D. ANDERSON, AND H. E. H. MEIJER, *Macromolecular Rapid Com.*, DOI:10.1002/marc.200800710, (2008).
[2] M. K. SINGH, *PhD thesis*, Eindhoven University of Technology, (2008).