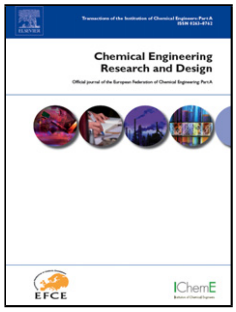


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# Flow Pulsation Plays an Important Role for High-Pressure Homogenization in Laboratory-Scale

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## Highlights:

- HPHs use piston pumps to force fluid through the valve, giving rise to pulsation.
- Pulsations are small for HPHs with 3 or 5 pistons, e.g., production-scale HPHs.
- Laboratory-scale HPHs are often fed by a single-piston pump.
- Singe-piston HPHs show markedly different flow-field.
- The constant-flow assumption is only valid for HPHs with 3 or more pistons.

## Abstract

Most experimental and numerical investigations of high-pressure homogenizers assume that the valve is fed with a constant flowrate. However, technical homogenizers use piston pumps with either 3 or 5 pistons (production- and pilot-scale machines) or a single piston (laboratory-scale machines). This results in flow pulsation. It is still unknown to what extent this influences valve hydrodynamics. Moreover, it is unknown if the difference in the number of pistons has implications for scale-up. This study uses a piston pump model and CFD simulations to elaborate on these questions. It is concluded that the constant flow assumption is justifiable for homogenizers using piston pumps with 3 or 5 pistons (pilot- and production-scale), but that homogenizers run with a single piston (i.e. laboratory-scale machines) will obtain a substantially different flow field. Most notably, the jet extending from the single-piston homogenizer gap will become highly unsteady and smaller drop sizes are expected (when