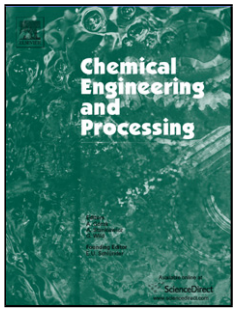

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Numerical simulation of supersonic separator with axial or tangential outlet in reflow channel

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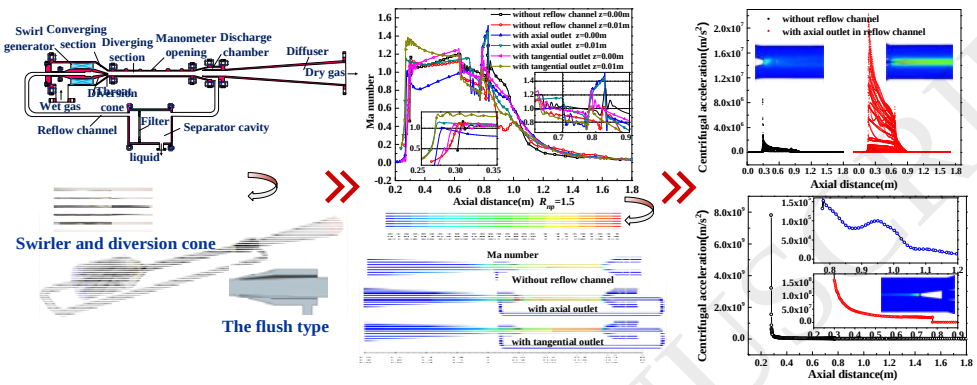
Graphical abstract



Highlights

- A novel supersonic separator with axial and tangential outlet in reflow channel has a better refrigeration and separation performance.
- The supersonic separator can obtain the better performance for axial reflow outlet with R_{np}=1.5 and for tangential reflow outlet with R_{np}=2.0.
- The structure with axial reflow outlet enlarges the supersonic region and has a better ability to resist flow fluctuation and backmixing under the same condition (R_{np}=1.5).
- The increasing pressure ratio can improve the fluid expansion characteristics and the reflow impetus for the novel supersonic separator.

A novel supersonic separator with reflow channel that has axial outlet or tangential outlet has been designed. The fluid can be drawn into the nozzle by the differential pressure between the discharge clearance on the wall and the throat zone near the centerline. Axial and radial distribution of the main parameters and the effect of pressure ratio were investigated with Reynolds Stress Mode (RSM) turbulence