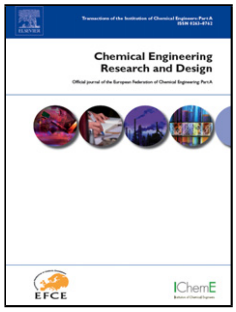

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Experimental and numerical investigation on the blade angle of axial-flow swirling generator and drainage structure for supersonic separators with diversion cone

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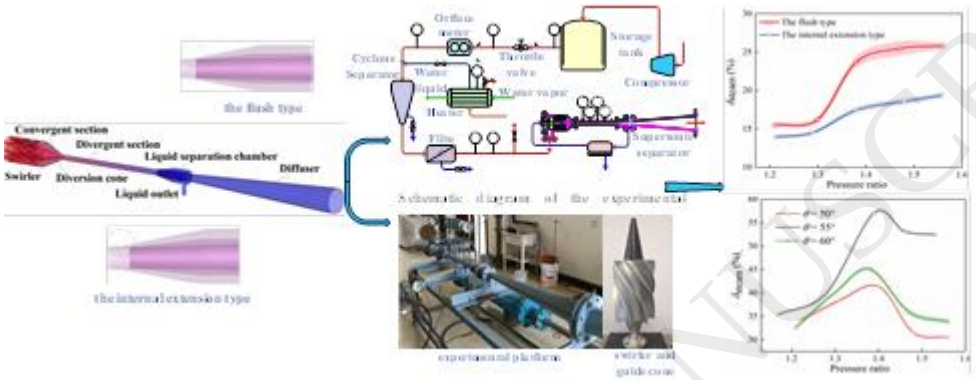
Graphical abstract



Highlights

- The effects of swirler and drainage structure are studied by test and simulation.
- The separation efficiency firstly increases and then decreases as outlet angle add.
- The flush type drainage port is more conducive to fluid separation.
- The smaller obliquity of discharge cavity can reduce the effect on supersonic flow.
- The separation efficiency gradually flattens out as increase of pressure ratio.

ABSTRACT: The effect of axial-flow swirling generator and drainage structure with diversion cone on separation performance is very important to supersonic separators. But there is in the absence of experimental studies on separation characteristics of above-mentioned structure. In this paper, both experimental and numerical methods are utilized to investigate the influences of swirling generator and drainage structure. Good agreements are achieved between experimental data and high-order numerical simulation. The results demonstrate that the rotation strength decreases as the outlet angle of the swirler increases. The rotational flow causes the inconsistency of the radial distribution of the fluid in the nozzle and the inconsistency is more noticeable with the increase of rotation intensity. So the blade angle of swirling generator should be determined to find the balance between the expansion characteristic and swirling flow. Comparing two types of drainage structures, the internal extension structure has seriously damaged the supersonic flow in the nozzle, while the flush type drainage port has less influence on fluid. And the smaller outlet