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Numerical Investigation of the Performance of a Vorsyl Separator Using a Euler-Lagrange Approach

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Abstract : This paper presents a Euler-Lagrange model of the water-particles multiphase flows in a Vorsyl separator where particles with different densities are separated. A series of particles with their densities ranging from 760 kg/m³ to 1380 kg/m³ were fed into the Vorsyl separator with water by means of tangential inlet. The simulation showed that the feed materials acquired centrifugal force which allows most portion of the particles with a density less than water to move to the center of the separator, enter the vortex finder and leave the separator through the bottom outlet. While the particles heavier than water move to the wall, reach the throat area and leave the separator through the side outlet. The particles were thus separated and particles collected at the bottom outlet are pure and clean. The influence of particle density on separation efficiency was investigated which demonstrated a positive correlation of the separation efficiency with increasing density difference between medium liquid and the particle. In addition, the influence of the split ratio on the performance was studied which showed that the separation efficiency of the Vorsyl separator can be improved by the increase of split ratio. The simulation also suggested that the Vorsyl separator may not function when the feeding velocity is smaller than a certain critical feeding in velocity. In addition, an increasing feeding velocity gives rise to increased pressure drop, however does not necessarily increase the separation efficiency.

Keywords : Vorsyl separator, separation efficiency, CFD, split ratio
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