

عنوان مقاله:

Enhancement of Liquid-Solid Two-Phase Flow Through a Vertical Swirling Pipe

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خلاصه مقاله:

In order to improve the transportation efficiency and safety of the vertical hydraulic transport pipe, a new type of pipeline transport system with helical blade is proposed in this paper. Based on CFD-DEM coupling method, the liquid-solid two-phase flow characteristics are analyzed for the swirling pipes and no blade pipe. The study focuses on the effect of the different helix angles of helical blade pipes in terms of the distributions of fluid velocity, the fluid vorticity, the total pressure, the particle's local concentration, the drag force and kinetic energy of particles. Subsequently, the transport efficiency is measured based on the starting speed of particles and the particle concentration, and the safety of the particle transportation is evaluated based on the flow structure and the kinetic energy of particles. It is found that the tangential velocities of the swirling pipes are clearly larger than that of the case of no blade pipe, and the swirling number decreases as the increasing of helix angle of helical blades within swirling pipe. As the decreasing of helix angle, the vorticity magnitude increases sequentially, and the vortex core structure of the flow field is gradually enriched. Meanwhile, the total pressures for the swirling pipes decrease rapidly after the fluid enters the helical blades region, reflecting the difference energy efficiency of the swirling pipes. Furthermore, the swirling pipe accelerates the starting speed of the particle, and then increases the particle concentration in the pipe while making the particle spatial flow structure better and the particle kinetic energy larger. In general, the swirling pipe makes the particle transportation more efficient and safe.

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