Extension of Analytical Turbulent Diffusion Model for Particle Dispersion and Deposition in a Horizontal Pipe: Comparison with CFD simulation

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ABSTRACT

A 2D analytical turbulent diffusion model for particle dispersion and deposition at different heights across the pipe flow and circumferential deposition has been developed for solid-liquid flow following the turbulence diffusion model for gas-solid done by (Mols and Oliemans 1998). Simultaneously a comprehensive 3D numerical investigation has been carried out to study same as above with the help of multiphase mixture model available in Fluent 6.1 (2001). In both studies different particles sizes and densities was used. The deposition was studied as a function of particle diameter, density and velocity of fluid. The deposition of particles, along the periphery of the wall and at different depths was also investigated. Both studies showed that the deposition of heavier particles at the bottom of the pipe wall was found to be higher at lower velocities and lower at higher velocities. The lighter particles were found mostly suspended with homogeneous distribution. Smaller particles were also suspended with marginal higher concentration near the bottom of the wall. This marginal higher concentration of the smaller particles was found to be slightly pronounced for lower velocity. The larger particles clearly showed deposition near the bottom of the wall. These analogies of particles have been well discussed with the ratio between free flight velocity and the gravitational settling velocity.

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