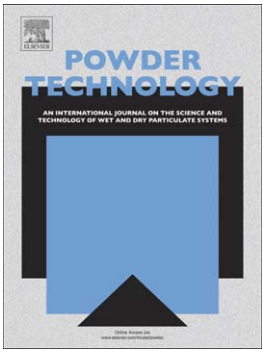

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Newtonian Flow past a Hollow Frustum in Vertical and Inclined Plane: An Experimental Observation for Terminal Velocity and Drag Coefficient

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Abstract

This work included the experimental studies of the Newtonian fluid flow over hollow frustum both in the normal and inclined channel. It encompasses terminal velocity and drag coefficient, C_D data for $0.13 \leq Re \leq 8.41$, $0.19 \leq d_o/D \leq 0.33$, $0.22 \leq d_i/d_o \leq 0.83$ and $40^o \leq \theta \leq 90^o$. The effect of inner diameter to outer diameter ratio, *di/do* and the outer diameter to the flow channel diameter ratio, *do/D* on terminal velocity is reported for the specified range of angle of inclination, θ for several hollow frustums in a series of high viscous Newtonian fluids. The terminal velocity shows an increasing trend with increasing and decreasing *do/D* and *di/do* ratios, respectively. The terminal velocity also increases with increasing the angle of inclination, θ of the flow channel. Predictive equations are developed for the estimation of C_D as a combined function of *Re, di/do, do/D* and θ. The statistical sensitivity analysis shows a large variation of the drag coefficient of the hollow frustum with the Reynolds number than with d_i/d_o and d_o/D ratios. The dependency of $C_D Re$ term on the fluid viscosity and θ are expressed in terms of the developed correlations. Linear variation of C_D with *1/Re* confirms that flow regime is laminar in the present study. The experimental drag coefficients are then predicted excellently through numerical approximation using Reynolds Stress Model (RSM) available in Ansys-15.

Keywords: Hollow frustum, terminal velocity, diameter ratio, drag coefficient, Reynolds number