National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Hydrodynamic Studies of the Non-Spherical Particles Settling in Annular and Non-Annular Channels Filled with Newtonian and non-Newtonian Fluids
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Venue	: New Seminar Room, Chemical Engineering Department
Date and Time	: 14 Sep 2024 (11.00 AM)

Abstract : The wall factor (f) and drag coefficient (C_D) of hollow cylinders, hollow frustum, clusters, solid and hollow disks, and solid cylinder, frustum, hemi-cylinder, and hemi-frustum settling in cylindrical annular (A) and non-annular (NA) channels were investigated. For hollow cylindrical particles, f and C_D were estimated in the NA and A channels. The estimated C_D using the Newtonian fluids was $0.782 \le C_D \le 3249.75$ and $39.62 \ge C_D \ge 0.8$ for $0.064 \le Re \le 101.34$ and $1.22 \le Re \le 100.21$. The same was estimated in the range of $0.73721 \le C_D \le 125507$ and $3104 \ge C_D \ge 1.27$ for $0.0017 \le Re \le 64.07$ and $0.054 \le Re \le 47.67$ for the settling the particle in the non-Newtonian fluid. For hollow frustum particles, C_D varied in the range of $0.80 \le C_D \le 15.49$ and $0.82 \le C_D \le 7.12$ for $2.798 \le Re \le 90$ and $5.29 \le Re \le 89.97$ while settling in Newtonian fluids in the NA and A channels, respectively. The same was varied over $0.983 \le C_D \le 1292.47$ and $1.48 \le C_D \le 191.55$ for $0.168 \le Re \le 50$ and $0.1506 \le Re \le 20$ while settling in non-Newtonian fluid. For the cluster particles the terminal velocity of polyhedron particles was higher than the planar and chain-shaped particles. The estimated C_D was varied in the range of $1.66 \le C_D \le 43.30$ and $1.92 \le C_D \le 36.67$ for $0.76 \le Re \le 22.09$ and $0.74 \le Re \le 20.51$ while settling in Newtonian fluids. The same was varied for non-Newtonian fluids over $2.84 \le C_D \le 4002$ and $2.21 \le C_D \le 1638$ for $0.028 \le Re \le 10.14$ and $0.052 \le Re \le 11.6$ for the settling of the particles in the NA and A channels, respectively. For disk/cylinder particles settling in NA and A channels, the terminal velocity and the wall factor increased with the sphericity. The estimated C_D appeared in the range of $1.56 \le C_D \le 503.88$ and $0.851 \le C_D \le 133.65$ for $0.20 \le Re \le 46.75$ and $0.40 \le Re \le 63.44$ for the settling of the disk/cylinder in Newtonian fluids. The same was varied in the range of $1.35 \le C_D \le 31934$ and $0.69 \le C_D \le 1203.91$ for $0.005 \le Re \le 30$ and $0.05 \le Re \le 43.02$ for the settling the particle in the NA and A channels, respectively in the non-Newtonian fluid. For hollow disk particles, the V and f increased with H/d_o (Height/Outer diameter) ratio. The experimental C_D varied over $3.061 \le C_D \le 106.29$ and $3.11 \le C_D \le 34.41$ for $0.463 \le Re \le 16.30$ and $0.81 \le Re \le 16.16$ while settling in the NA and A channels, respectively in Newtonian fluids. The same varied in the range of $6.81 \le C_D \le 57293$ and $6.93 \le C_D \le 12952$ for $0.0042 \le Re \le 6.23$ and $0.011 \le Re \le 6.17$ while settling in the non-Newtonian fluids.