

Theoretical Investigation of Effects of Reynolds Number and Morphology on Localized Drag on Spheres, Spheroids, Rods and Segment of Helixes

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Diverse morphological shapes of cyanobacteria (blue green algae) have been observed in the natural environment; *Synechocystis* sp is found to be spherical, whereas *Arthrospira* is either a rod in a stationary phase or a helix in a logarithmic growth phase. Effects of Reynolds number and shapes on the localized drag exerted on solid objects with different geometrical shapes resembling the shapes of cyanobacteria including spheres, spheroids and segments of helixes are investigated by solving the Navier-Stokes equation using finite element method. Computed results indicate that, for the range of the Reynolds number of 0.001 - 10, the effect of Reynolds number on the localized drag on freely suspending spheres, spheroids and segments of helixes is small. If the effect of the inertia term is neglected, earlier calculations based on point force solution demonstrate that the localized hydrodynamic drag exerted on helixes is higher than the localized hydrodynamic drag exerted on long straight rods, indicating that morphology is a key factor determining the localized hydrodynamic shear drag on elongated bodies.

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