Multiphysics Simulations of Granular Sludge on the Optimization of Effluent Treatment Plant

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Abstract

Multiphysics Simulations of Physico-chemical and Biological Treatment of wastewater is increasing due to the demand for cost efficient plant design and utilization. Among the many processes, a thorough understanding of the settling behavior of an activated granular sludge in the secondary settler of an Effluent Treatment Plant (ETP) is critical for the plant designers to determine the efficiency of the wastewater treatment. This reduces the costs related to waste sludge dewatering and disposal but also improves the separation of biomass and treated effluent need before the latter is discharged to the surface water. Any failure in the settling tank, either due to sludge bulking or excessive loss of sludge deteriorates the effluent quality that could lead to uncontrolled low sludge ages and a reduction of efficiency in the aeration tanks. We simulated a model of sludge granule falling in water using COMSOL Multiphysics free flow simulation in a moving co-ordinate system coupled to the sludge motion. The effect of particle size and density on the settling time was investigated as shown in Figure 1. The velocity contour plots for a typical particle size and density is Figure 2. The effect of other critical parameters associated with activated granular sludge will be studied and reported subsequently with an aim to showcase the multiphysics modeling and its benefits for efficient and environment friendly water treatment.

Keywords: ETP, activated granular sludge, COMSOL, ODE, ETP Design

Figures used in the abstract

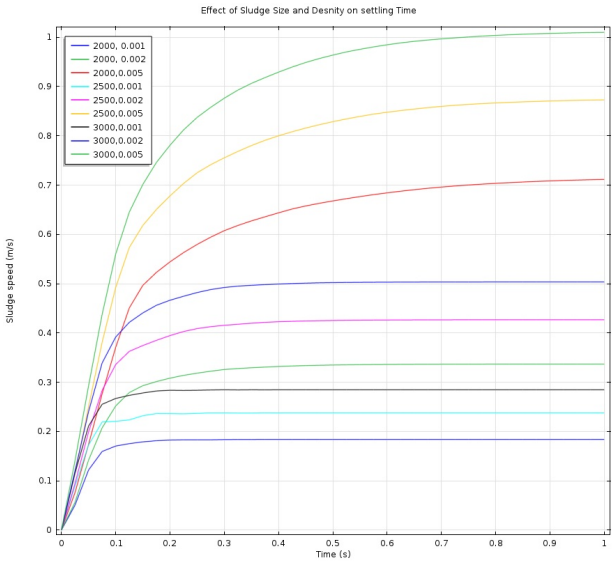

Figure 1: Plot on the effect of sludge density and size on the settling time.

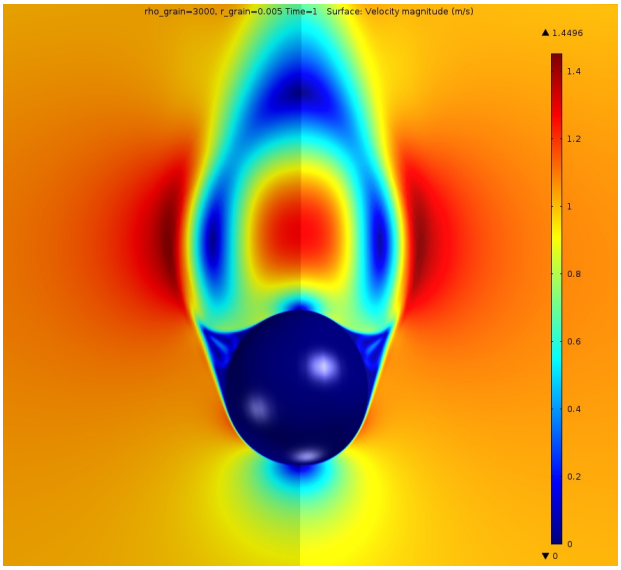

Figure 2: Typical velocity contour plots around the sludge