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Optimization of hydrodynamic vortex separator for removal of sand particles from storm water by computational fluid dynamics

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ABSTRACT

Storm water treatment has been gradually acknowledged for the removal of pollutants from urban areas using the hydro cyclone separation technique. The separation efficiency of the hydrodynamic vortex separator (HDVS) is a complex phenomenon. With the aim enhance the separation potency of HDVS for storm runoff to get rid of sand particles, the HDVS with different structural configurations was studied by computational fluid dynamics. A steady-state model was created to simulate the HDVS, where the simulation of solid–liquid part flow within the HDVS was conducted by 3-D Eulerian–Eulerian multiphase model and Reynolds stress model combined with the kinetic theory of granular flow. The rate contours, recess, outlet volume fraction of solid phase and particle removal efficiency were specially analyzed. The simulation results showed that the separation efficiency of HDVS had a positive relation to different structural configurations. The optimal design parameters of HDVS were obtained. The great agreement of flow rate and alter the law of separation potency proves that the mentioned multiphase is in-line accustomed to optimize the separation efficiency of hydrodynamic vortex separator.

Keywords: Computational fluid dynamics; Hydrodynamic vortex separator; Kinetic theory of granular flow; Numerical simulation; Reynolds stress model

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