Behavior of Intermediate Baffle in Sedimentation Basins

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Sedimentation is one of the most common processes to remove inorganic settleable solids from water. In fact it is one of the major processes to treat domestic and industrial effluents. Having in mind the importance of this process it will be clear that the proper and reliable operation of sedimentation tanks is a very important requirement to achieve the lowest outflow concentration.

In addition various studies indicated that in order to remove suspended solids economically, solids must be removed in least possible time and in a very effective way. It must be noted that researchers indicated that the investment costs of settling facilities is up to one-fourth to one-third of the total cost of a treatment plant construction.

Flow field in a sedimentation basin plays a very important role in sedimentation and must be conducive to sedimentation and provide necessary conditions for the proper settling of particles. In fact, hydrodynamics of the flow in a sedimentation tank is one of the great important factors that influence the removal efficiency.

There have been some investigations on the flow field in the literature but there is relatively few detailed experimental measurement of velocity field. In a prototype tests, considering the mentioned reasons it would be necessary to have a clear knowledge about the structure of flow in primary and secondary sedimentation basins. As a matter of fact by having a complete understanding of hydraulics of sedimentation tanks it is possible to find new solutions to modify their flow field to achieve a better performance of these facilities.

In this work, the presence of a baffle and its effect on the hydrodynamics of the flow field in a secondary settling tank has been investigated numerically. The mass, momentum and diffusion equations are solved simultaneously in the fixed Cartesian directions, on a non-staggered grid using finite-volume scheme. The velocity-pressure coupling is handled by SIMPLEC method. The k-ε model was applied to account for the influence of the Reynolds stresses in the time-averaged momentum equations. The numerical calculation agrees well with experiments. Results also depict the ability of this method in predicting the velocity profiles and flow structure. In addition, the optimum position of the baffle to achieve the best performance of the tank was determined by applying the above mentioned numerical scheme.

Finally, the effect of intermediate baffle on the velocity and concentration profile in different locations is compared with the case that there is no baffle in the channel. Also the friction coefficient of the bed was discussed. Results show that intermediate baffle can improve the removal efficiency of sedimentation basins.

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