The Use of CFD to Simulate Turbulent Flows in Laboratory and Full Scale Flocculation Processes

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Introduction

The hydraulic flocculates (Figure 1) are employed in water treatment plants (WTPs), but may present problems during the mixing stage reducing the efficiency of treatment. In this context, modeling of a hydraulic flocculate using COMSOL and a 1:10 scale model of the Maringá-PR Brazil city WTP flocculate was done.

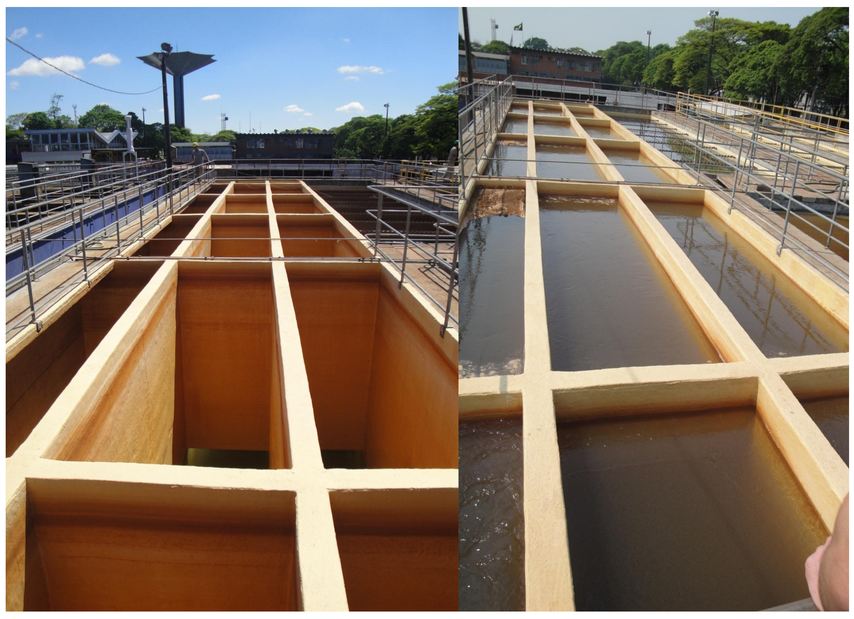

Figure 1. WTP Floculator

Materials and Methods

A solution of NaCl (15gL^{-1}) was added in the inflow flocculate (acrylic model) and samples were collected at chambers 6, 15 and 28. The change in salt concentration was determined using an Atomic Absorption Spectrometer (AAS). The model illustrating the hydraulic flocculate in acrylic and numerical model are shown in figure 2.

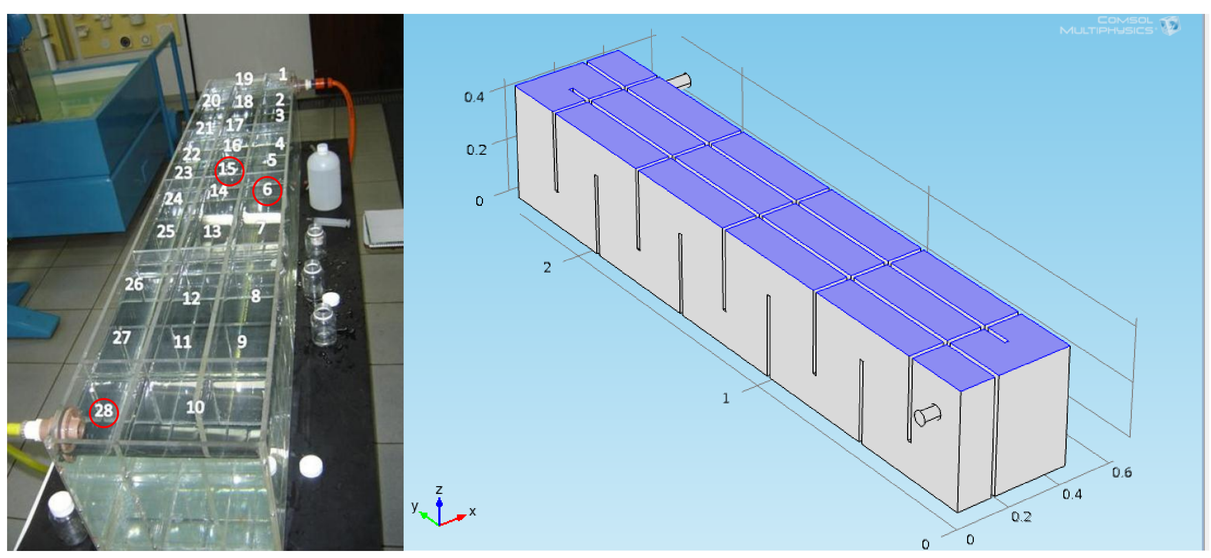

Figure 2. Acrylic and numerical model of WTP

Results

The results for residence time distribution (RTD) from AAS and numerical model are shown in figure 3 and 4. The velocity distribution for different configuration are shown in figure 5 and turbulent dynamic viscosity in figure 6.

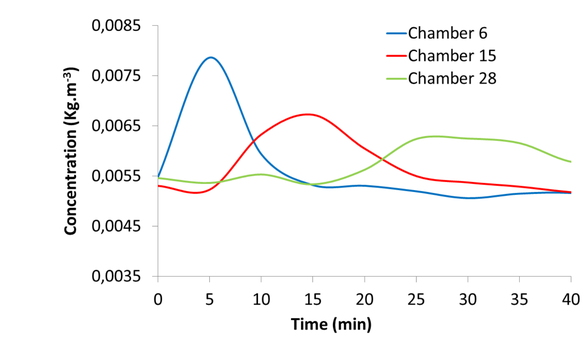

Figure 3. Residence time distribution for acrylic model obtained from AAS

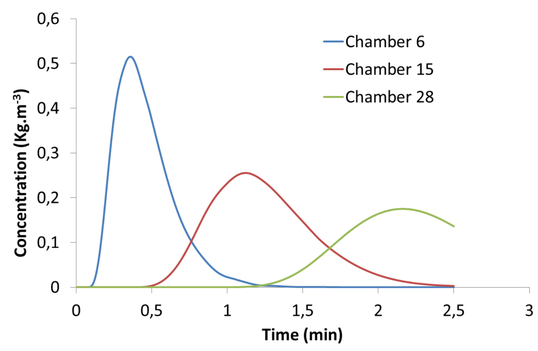

Figure 4. Residence time distribution obtained from 2D numerical model

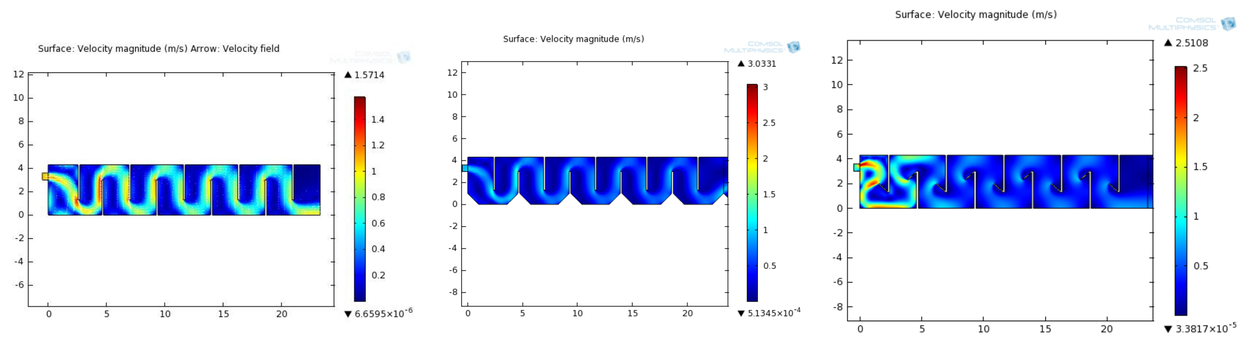

Figure 5. Velocity distribution for different configuration

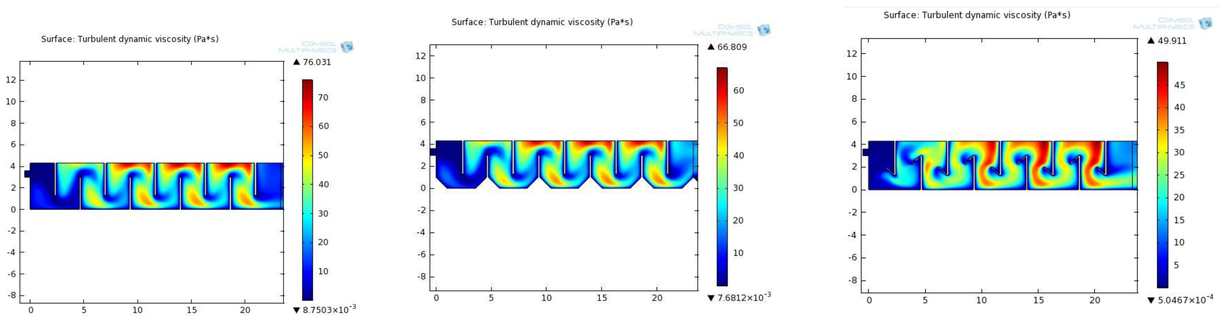

Figure 6. Turbulent dynamic viscosity for different configuration

Conclusions

These results may support geometric changes in the WTP flocculate which will result in the reduction of chemical dosage, energy and sludge production. New 3D numerical simulations should be performed to validate the numerical model RTD.

References

Residence Time in a Turbulent Reactor - Residence Time in a Turbulent Reactor SOLVED WITH COMSOL MULTIPHYSICS 3.5a - Model Gallery.

Acknowledgments

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