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ATA Scientific – Free use of Kinexus Rheometer and $1000 study award Winner, Jul 2013

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Hydraulic study of activated sludge with coagulant addition in Membrane Bioreactors

Most Cities and urban centres in the developed world with increasing populations are faced with the dual challenge of maximising the utility of limited water supplies while minimising the impacts on the environment of increased wastewater discharge. In response more cities are using membrane bioreactors (MBR's) to simultaneously treat and recycle municipal wastewater.

Optimising the performance of MBR's is contingent upon detailed understanding of the rheology of the complex mixture of water, pollutants and microorganisms known as activated sludge which exhibits non-Newtonian properties [1]. It has been demonstrated that the addition of ferric and aluminium salts to the activated MBR to improve phosphorus removal changes rheological properties, altering power consumption for mixing and aeration, flux decline through the membrane and the performance sludge management systems.

The scientific literature is silent of the impact of metal salts on the rheology of activated sludge in MBR's, so the aim of this project is to study the influence of the coagulant addition on the rheological property or viscosity of activated sludge. The results will be used in computational fluid dynamic simulations to optimise the hydraulic performance of MBR and reduce power requirements for mixing and aeration. Activated sludge will be collected from different MBRs with and without coagulant addition. The sludge will be left to settle and the supernatant will be removed to enable the preparation of a series MLSS concentration starting from 16 g/L. 5 dilutions will be made using supernatant to cover a wide range of MLSS concentration from 3 – 16 g/L. The experimental data of viscosity of activated sludge under different shear rate will be collected with a rheometer. The non-Newtonian relationships between shear stress and shear rate will be fitted to the viscosity models shown in Table 1 using Matlab® (Mathworks, Inc) programming. Then the model will be imported to CFD models to simulate the hydraulic performance of MBR.

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