

Evaluation of toxic compounds effects on aerobic granule activity

A. F. Duque¹, Pronk, M.², M.K. de Kreuk², M.F. Carvalho¹, P.M.L. Castro¹ and M.C.M. van Loosdrecht²

¹ CBQF/ Escola Superior de Biotecnologia – Portuguese Catholic University, Rua Dr. António Bernardino de Almeida, 4200-072 Porto, Portugal

² Department of Biotechnology, Delft University of Technology, Julianalaan 67, 2628BC Delft, The Netherlands

Aerobic granule formation is used as a novel technology for the biological treatment of wastewaters. Aerobic granular sludge presents several advantages towards activated sludge, such as excellent settling properties, high biomass retention, ability to deal with high organic loading rates and to perform simultaneously diverse biological processes, such as COD, N and P removal. Researchers have focussed mainly in the biological processes in domestic wastewater treatment. However, these studies are not directly applicable to industrial wastewaters due to their specific composition. Several industries are dealing with a high concentration of salt, pH and other toxic compounds, like fluorophenols, in their wastewater. Xenobiotics can inhibit the biological processes of the plants treating these industrial wastewaters. Preliminary studies reported in the literature have shown that granules seem to be more resistant to toxic effects of phenol than flocculated sludge, mainly because of the compact and shielding structure of the granules.

In this work, the short term effects of salt, pH and 2-fluorophenol (2FP) on the conversion processes of nitrification and phosphate removal by aerobic granules were investigated and compared to activated sludge systems. Experiments were conducted in batch mode with granular sludge and crushed granules, obtained from a pilot plant in The Netherlands, and with activated sludge, obtained from a wastewater treatment plant (WWTP) also located in The Netherlands. Ammonium consumption, nitrite and nitrate production and phosphate removal were measured along the 2 h experiments. Overall, the results showed that granular sludge is less affected by toxic compounds than activated sludge. Measurements of the oxygen uptake rate (OUR) inside the granules and studies on the change of granules morphology are ongoing.

Keywords: Granular sludge; Activated Sludge; Toxicity; 2-fluorophenol; pH; Salinity

Acknowledgements:

A.F. Duque and M.F. Carvalho wish to acknowledge a research grant from Fundação para a Ciência e Tecnologia (FCT), Portugal (Ref. SFRH/BD/30771/2006 and SFRH/BPD/44670/2008, respectively) and Fundo Social Europeu (III Quadro Comunitário de Apoio). This work was supported by the EU project INNOWATECH – Contract-No. 036882.