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FCT FACULDADE DE CIÊNCIAS E TECNOLOGIA UNIVERSIDADE NOVA DE LISBOA

Chemistry Department

Biological phosphorus removal process

Biochemical and Process Engineering Group

bpeg biochemical and process engineering group

requimte rede de química e tecnologia

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Master in Chemical and Biochemical Engineering (2006 – 2008)

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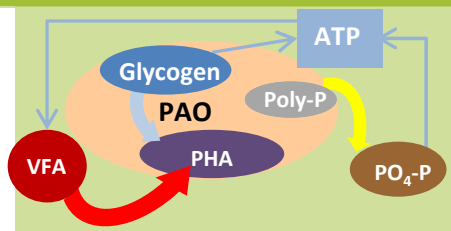
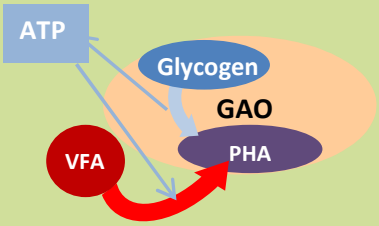
Scientific Articles: 5

Objectives

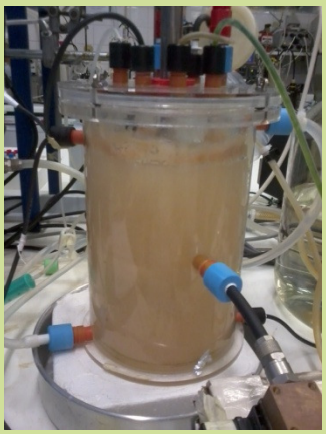
The main objective of this work is to improve the efficiency and sustainability of biological phosphorus removal processes. The project focuses on optimising phosphorus removal by polyphosphate accumulating organisms (PAOs) and minimising the growth and proliferation of glycogen accumulating organisms (GAOs). The carbon source and dissolved oxygen concentration are manipulated to determine their impact on the process. Knowledge concerning the carbon and oxygen substrates affinity will likely lead to new control strategies that will enable the optimisation of enhanced biological phosphorus process sustainability.





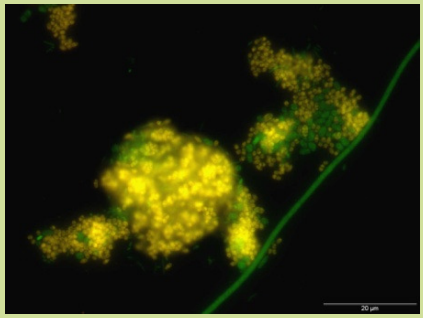
Methodology

Two reactors with 2L of working volume were operated to obtain enriched cultures of PAOs and GAOs. The reactors were seeded with sludge from a local WWTP (Beirolas, Lisbon) and fed, under anaerobic conditions, with a synthetic medium containing acetate (HAc) and propionate (HPr) as carbon sources (75-25% HAc-HPr for the PAO reactor and 100% HAc for the GAO reactor). The pH was controlled at 7.5 for PAOs and 7.0 for GAOs. The temperature was controlled at 20ºC and dissolved oxygen at 2 mg/L in both reactors. Each cycle consisted of 6 hours, with 2 hours of anaerobic period, 3 hours of aerobic period and 1 hour of settle/decant period.



Expected Results

The results obtained in this work showed that PAOs prefer propionate over acetate at low substrate feeding levels, and propionate seems to be a more efficient carbon source for phosphorus removal. This work also showed that the dissolved oxygen (DO) concentration is a factor that affects the competition between PAOs and GAOs in enhanced biological phosphorus removal processes (EBPR). PAO activity showed only a slight dependence on DO concentration, while GAOs activity showed a much higher dependence on DO concentration. This fact represents an advantage to PAOs over GAOs in EBPR systems with low aeration. Metabolic models of the PAO-GAO competition at different DO levels will be formulated in order to determine the critical DO concentration that promotes the proliferation of PAOs over GAOs, which will be highly useful to improve the operation of EBPR systems.



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