SCHOOL OF DOCTORAL STUDIES IN ENVIRONMENTAL ENGINEERING - XVII Cycle

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Experimental assessment and modeling of substrates removal in MBBR

Abstract of the doctoral thesis

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This thesis presents the results of an experimentation carried out on a Moving Bed Biofilm Reactor pilot plant.

The novel aspects of this experimentation are at different level.

First of all, the configuration of the pilot plant is based on a two stage aerobic MBBR with a predenitrification tank which is a coarse media fixed bed filter. In this way the particulate fraction of the influent can be retained and hydrolyzed.

Besides the pre-denitrification, which receives the recirculation bulk collected after nitrification tank, also the settling compartment has been substituted by a coarse media fixed bed, stating the expected low solids concentration from the aerobic tank.

Except of the traditional monitoring techniques, the application of respirometric batch tests have been experimented, with the development of a new respirometer model, equipped with a system for external recirculation of bulk liquid to measure dissolved oxygen concentration. The tests concerned both carbon and nitrogen substrates oxidation, on both the aerobic tank.

The results of batch respirometric tests stressed the fact that the examined biomass applies the storage strategy in a very evident way. This fact suggested to test, as novel application, the simulation of the biofilm kinetics with a mathematical model based on Activated Sludge Model no. 3.

The original ASM 3 has been modified to take into account some recent observations, as the direct growth on readily biodegradable substrate and the expression of yields by the way of a metabolic model.

To look for a better understanding of the mechanisms influencing a biofilm, the attached biomass has been also manually detached and analyzed with chemical analysis and by respirometry.

The estimation of typical ASM 3 parameters by the way of this original comparison allowed to assess the influence of biofilm structure on biological activity and to underline the differences in carbon substrate removal of the same biomass in form of both suspended and attached biomass.