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Yusmel González Hernández, Isariebel Quesada-Peñate, Sylvie Schetrite, Marion Alliet, Ulises Javier Jáuregui Haza, et al.. Role of respirometric analysis in the modelling of hospital wastewater treatment by submerged membrane bioreactor. Euromembrane 2015, Sep 2015, Aachen, Germany. pp.0. hal-01215621

HAL Id: hal-01215621

<https://hal.science/hal-01215621>

Submitted on 14 Oct 2015

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Eprints ID : 14287

To cite this version : González Hernández, Yusmel and Quesada-Peñate, Isariebel and Schetrite, Sylvie and Alliet-Gaubert, Marion and Jáuregui Haza, Ulises Javier and Albasi, Claire Role of respirometric analysis in the modelling of hospital wastewater treatment by submerged membrane bioreactor. (2015) In: Euromembrane 2015, 6 September 2015 - 10 September 2015 (Aachen, Germany)

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ROLE OF RESPIROMETRIC ANALYSIS IN THE MODELLING OF HOSPITAL WASTEWATER TREATMENT BY SUBMERGED MEMBRANE BIOREACTOR

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Membrane Bioreactors (MBR) are efficient processes for wastewater treatment since they are compact and deliver a constant quality of treated water even with variable influent composition [1]. More recently they are considered for treating persistent pollutants so-called “emerging contaminants” (pharmaceuticals, pesticides, etc.) that create additional problems due to the effects on the environment and/or their interferences within biological processes [2]. Several studies have demonstrated the capacity of Submerged Membrane Bioreactors (SMBRs) to remove a great variety of pharmaceutical compounds [3]. On the other hand, the efforts for modelling of wastewater treatment systems have always targeted either the biological processes (treatment quality target) as well as the various aspects of engineering (cost and operation). The determination of the biokinetic parameters of these models has been carried out by using systems that treat municipal wastewaters. Considering the simulation of SMBR [4], the purpose of these work is to provide these parameters to adapt an SMBR model for the treatment of hospital wastewater. In a first part, the behavior and activity of the biomass of sludge from two “sources” were studied simultaneously: the first one from a MBR pilot treating hospital wastewater and the other one from a municipal MBR plant (3000 equivalent inhabitants). The biomass oxygen uptake rate measured while the degradation of an equal volume of hospital wastewater added to each system, showed that there was an adaptation of the first one to the pharmaceutical pollutants while the second one showed a reduction of the oxygen uptake rate, which may be a result either of the inhibition of the degradation process or of the death of part of the microorganisms. Respirometry was used to determine the heterotrophic yields, (ratio of the mass of heterotrophic biomass produced by the mass of easily biodegradable substrate consumed) since it is known to be impacted by the nature of the substrate as well as the population of microorganism carrying out the degradation [5]. The obtained results allowed two remarks: First, the influence of the nature of the sludge on the heterotrophic yield coefficient has been confirmed. In our case Y_H is close to 0.72 mgCOD/mgCOD for activated sludge used in the hospital wastewater treatment and 0.67 mgCOD/mgCOD for activated sludge used in the urban wastewater treatment. But this comparison is not rigorous and this is the topic of the second point: indeed respirograms of hospital sludge showed a queue that may be related to consumption of nutriment reserves from bacteria [5, 6]. By the way the heterotrophic yields are then over estimated, but the bacterial consortium resistance behavior face to pollution may be interpreted with this nutriment reserve and lowering of the growth yield. These new coefficients and a modified version of the ASM model considering the nutriment reserves were implemented in the SMBR model.

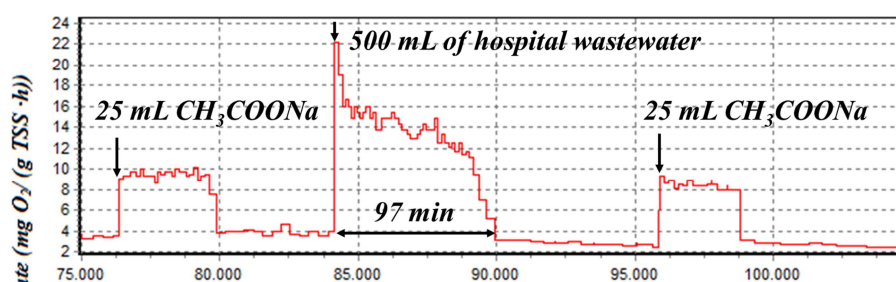
KEYWORDS: submerged membrane bioreactor, hospital wastewater, modelling, heterotrophic yield, respirometry

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Sludge from the MBR of Purpan Hospital (S1)



Sludge from the MBR of the Municipal station of Nailloux (S2)

