HIGH PERFORMANCE BIOLOGICAL PROCESSES FOR ODOUR ABATEMENT IN WASTEWATER TREATMENT PLANTS

Principal Investigator: Raúl Muñoz Torre & Raquel Lebrero
PhD Student: José M. Estrada

Due to the stricter environmental regulations, the encroachment of residential areas on Wastewater Treatment Plants (WWTPs), and the increasing public expectations on private water company duties, the number of public odour complaints has substantially increased during the last decades. More than half the complaints received by environmental regulatory agencies worldwide concern malodours. In this context, odorous emissions from WWTPs, mainly composed of sulphurous compounds (H_2S, mercaptans) and Volatile Organic Compounds (VOCs), are ranked among the most unpleasant ones. Therefore, the minimization and abatement of unpleasant odour emissions is becoming one of the major challenges for WWTPs utilities worldwide, increasingly concerned about their public image (Fig. 1).

Figure 1. Aerial view of a WWTP

Despite the paramount technological breakthroughs carried out during the last two decades, odour treatment systems are still limited by the high operation cost of physical/chemical methods, by the low odour abatement efficiency when hydrophobic odorants are the main responsible for odour nuisance and by the high land requirements when implementing low-cost technological solutions such as biofiltration units.

This project aims to develop a low-cost high-performance generation of bioreactors for odour abatement with a reduced footprint (minimum reactor volume requirements). This goal will be addressed by two different approaches:

A) Activated sludge odour diffusion (AS) systems based on the high gas-liquid mass transfer coefficients achieved via malodorous air diffusion in the existing WWTPs aeration tanks. This constitutes a competitive advantage when compared to other odour abatement technologies, especially in plants with severe land availability problems. However, the experience with these systems in the field of odour treatment is rather scarce and little information is available in literature regarding the efficiency of AS systems in the degradation of hydrophobic odorants or the influence of odour diffusion on microbial communities. A laboratory scale plant (Fig. 2) is being used to systematically compare a conventional biofilter and an AS system in terms of odour removal efficiency and dynamics of microbial population and to study the influence of operational parameters (odorants concentrations, odorous emission residence time) on their performance and stability.

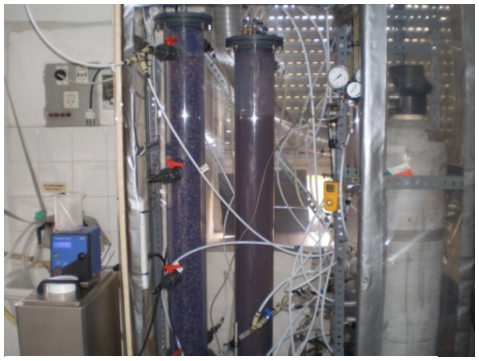

Figure 2. Laboratory scale pilot plant

B) Two-liquid-phase biotrickling filters based on the combination of the high H_2S removal efficiencies of biotrickling filters at low gas residence times and the hydrophobic VOCs mass transfer enhancement mediated by the addition of a secondary organic liquid phase (enhancements of up to 1500 % have been recorded during alpha-pinene biodegradation in two-liquid phase systems).

In addition, this project is expected to provide new insights on the kinetics of VOC biodegradation at trace level concentrations.

More information available at:

http://etuva.blogspot.com.es/

Relevant publications

Lebrero R, Rodriguez E, Perez R, Garcia-Encina PA, Muñoz R (in press) Abatement of odorant compounds in one- and two-phase biotrickling filters under steady state conditions. Applied Microbiology and Biotechnology.

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Estrada JM, Rodriguez E, Quijano G, Muñoz R (2012) Influence of VOC concentration on the diversity and biodegradation performance of microbial communities. Bioprocess and Biosystems Engineering 35:1477-1488.

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Lebrero R, Rodriguez EM, García-Encina PA, Muñoz R (2011) A comparative assessment of biofiltration and activated sludge diffusion for odour abatement. Journal of Hazardous Materials 190:622-630.

Lebrero R, Bouchy L, Stuetz R, Muñoz R (2011) Odour assessment and management in wastewater treatment plants – a review. Critical Reviews in Environmental Science and Technology 41:915-950.

Muñoz R, Sivret E, Parcsi G, Lebrero, R, Wang X, Suffet, M, Stuetz RM (2010) Monitoring techniques for odour abatement assessment: a review. Water Research 44:519-5149.

Lebrero R, Rodriguez E, Martín M, García-Encina PA, Muñoz R (2010). H_2S and VOCs abatement robustness in biofilters and air diffusion bioreactors: a comparative study. Water Research 44:3905-3914.