**Assessment of the application enzymes in wastewater treatment.**

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**1. Introduction**

Water is a basic resource for society, ecosystems and climate. Nevertheless, water is limited, both in quantity and quality terms, where climate change aggravates the situation. The Water Framework Directive (Directive 2000/60/CE) has supposed a radical change in the focus of management of water resources, changing utilitarian view to protective view of resource. Within main pressures which affects superficial subterranean water bodies in the UE, founding waste from urban and industrial wastewater. The control of waste and the protection of recipient mass of water was regulated with the directive 91/271/CEE, today in force, which bind an adequate treatment of all wastes generate by urban congestion regardless size. The Wastewater treatment (WWTP) is considered a crucial step in the safety and qualities of the environment, for that reason, some studies are focused on the improvement of depurative efficiency. One of them could be the addition of hydrolytic enzymes which stimulate the assimilation of organic matter.

The treatment of urban and industrial wastewater is commonly based on biological processes where determinate microorganisms digest organic or inorganic material from them, which uses for their metabolism. Degradation of organic contaminants by microorganisms requires the pass across cellular membrane of these substances. For that reason polymeric substances must be degraded previously by the actuation of hydrolytic extracellular enzymes (Nybroe et al, 1992).

The improvement is expected like in conventional system (activated sludges) as natural or extensive systems (constructed wetlands). Enzyme’s hydrolysis has been applied in industrial effluents with high levels of fat and oils, with low level of biodegradability like alternative for conventional systems (Becker et al, 1999) and for sludge digestion (Aragón et al, 2009) to solubilize organic material reducing sludge production until 30% in pilot scale (Bermúdez et al, 2013). Nevertheless, enzyme catalysis in WWTP is limited by high cost of commercial enzymes. In this sense, previous works have allowed the production of enzymes from organic by-products’ fermentation, like sludge from sewage treatment (Rodríguez-Morgado et al, 2015). The addition of these enzymes could improve the process, obtaining water with better quality, in less time and with a low price.

This study aims at (a) the determination of the optimum conditions for the application of enzymes in the wastewater treatment (b) the assessment of the effects on both intensive (activated sludge) and extensive treatment systems (constructed wetlands) and (c) environmental protection.

**2. Methods**

In a first stage, lab scale pilot plants are employed for the assessment of the application enzymes to biological reactors. Both commercial enzymes and by-products of the sludge fermentation are being tested. Physicochemical and microbiological parameters are monitored. Besides, sludge production and “clogging” phenomena are being studied. Then, the results are being extrapolated to a several real scale treatment plants.

**3. Results and discussion**

Initial results show a slight increase in the treatment efficiency in both systems (larger organic matter removal) after the enzyme dosage. Besides, a reduction in sewage sludge production is observed in the SBR unit. Finally, it is observed a delay in the appearance of the clogging phenomenon in the horizontal flow constructed wetlands.

**4. Conclusions**

As The Water Framework Directive (Directive 2000/60/CE) aims protection of water bodies, that are highly contaminated due to conventional water treatment systems, innovative techniques are being studied. It has been proven that hydrolytic enzymes stimulate organic matter assimilation, so that the efficiency of the treatment increases. This research studies the effect of addition of hydrolytic enzymes in the treatment process. The results show that adding enzymes into the treatment system, supposes a very important improvement in the quality of effluents, providing water protection and a reduction in economic costs.

**References**

[1] Aragón, C. et al. (2009). Comparison of four chemical uncouples for excess sludge reduction. Environmental Technology, 30, 707-714.

[2] Becker P., et al. (1999). The biodegradation of olive oil and the treatment of lipid-rich wool scouring wastewater under aerobic thermophilic conditions. Water Research, Vol 33, Pages 653-660

[3] Bermúdez, G. et al. (2013). Minimización de la producción de biomasa generada en una unidad de lodos activos mediante la adición de material extracelular procedente de una digestión aerobia de lodos. TecnoAqua, nº 2.

[4] Directive 2000/60/EC. The Water Framework.

[5] Directive (91 /271 /CEE). Concerning urban waste water treatment.

[6] Nybroe O. et al. (1992). “Enzyme activities in waste water and activated sludge”. Water Research 26 (5) 579-584.

[7] Rodríguez-Morgado, B. et al. (2015). Effect of pH on the production of hydrolytic enzymes of industrial interest by Bacillus licheniformis using sewage sludge as a low-cost culture medium. Meeting-Abstract. Fermentation Technology. Vol. 3. Núm. 2. Pag. 81-81. 10.4172/2167-7972.s1.003\_021.