

## COMPARATIVE ANALYSIS OF LIPIDS BIODEGRADATION WITH IMMOBILIZED *Bacillus spp.* CELLS IN A BIOREACTOR WITH MOBILE BED vs. BASKET BIOREACTOR

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The olive oil represents about 3% from the worldwide production of vegetable oils, but due to high organic content (lipids 0.2-1%, carboxylic acids 0.5-1.5%, sugars 1-8%, polyphenols and pectins 1-1.5%, tannins, polyalcohols, etc.), the wastewaters resulted from olive oil mills are important pollutants, about 30 million tons of wastewaters are produced per year in the world. The biological processes are the most environmentally compatible and least expensive methods for wastewater treatment. The immobilization of whole cells for the degradation of diferent compounds in wastewater can provide several advantages: high activity, yield, operational stability and possible reuse. Considering this, the aim of this paper is the comparative investigation of the lipids biodegradation from olive mill wastewaters using two different bioreactors containing immobilized mixture of *Bacillus spp.* (*Bacillus subtilis*, *Bacillus megaterium*, *Bacillus licheniformis* and *Bacillus ortoliquefaciens* in equal ratios): one bioreactor with mobile bed of biocatalyst and the other with packed bed of basket conformation.

In order to investigate if the immobilized bacterial cells can be used for several biodegradation cycles, efficiency, reusability, and stability of immobilized cells were investigated in both cases. Moreover, the efficiency of lipids biodegradation has been analyzed in direct corelation with the rate of their external and internal diffusion related to the biocatalyst particle by means of the ratios between the mass transfer coefficients, effectiveness factors, extent of inactive regions, Biot numbers).

The results indicated that the bioreactor with mobile bed is more efficient especially for biocatalyst particles with diameter under 1.5 mm. For larger particles the performances of the two bioreactors become similar. Moreover, taking into consideration the external mass flow of lipids and the number of enzymatic hydrolysis cycles, the basket bioreactor is recommended.

The mathematical equations proposed for describing the diffusional processes are in good concordance with the experimental results, the average deviations varying from  $\pm 5.06$  % for the bioreactor with mobile bed of immobilized *Bacillus spp.* cells to  $\pm 5.33$  % for the basket bioreactor.

**Keywords:** lipids, wastewater, *Bacillus*, bioreactor, diffusion, immobilized cells, effectiveness factor.