

Effect of bed configuration of immobilized biocatalysts on penicillin G hydrolysis efficiency

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Abstract—The external and internal mass transfer of Penicillin G in the process of its enzymatic hydrolysis to 6-Aminopenicillanic acid under competitive and non-competitive inhibitions have been comparatively analyzed for a bioreactor with mobile bed vs. a stationary basket bioreactor, both with *Penicillin amidase* immobilized in Eupergit C. The Penicillin G mass transfer and hydrolysis enzymatic rates have been analyzed by means of the ratios' values between the oxygen mass transfer coefficients, effectiveness factors, external mass flows and Penicillin G concentrations at the biocatalyst particle surface for the considered bioreactors. 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 Penicillin G and the number of enzymatic hydrolysis cycles, the basket bioreactor is recommended. The mathematical equations proposed are in good concordance with the experimental results, the average deviations varying from $\pm 4.11\%$ for the bioreactor with mobile bed of immobilized *Penicillin amidase* to $\pm 5.03\%$ for the basket bioreactor.

Keywords: Bioreactor, Diffusion, Immobilized Enzymes, Mass Transfer, Penicillin, *Penicillin amidase*