

## Environmental Technology

# Diffusional effects on anaerobic biodegradation of pyridine in a stationary basket bioreactor with immobilized *Bacillus* spp. cells

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### Abstract

The effects of external and internal diffusions of pyridine on its biodegradation rate in a bioreactor with stationary basket bed of immobilized *Bacillus* spp. cells have been analyzed for various biocatalyst diameters and thicknesses of basket bed, considering the adapted Haldane kinetic model for substrate inhibition. Due to the very low values of pyridine mass flow inside the biocatalyst particles, the "biological inactive region" appeared, mainly near the particles centre. This region is extended up to 38.5% from the overall volume of each studied size of the biocatalysts, being increased at higher biocatalyst size and basket bed width.

Compared to the system containing free *Bacillus* spp. cells, the basket configuration of packed bed led to the reduction of biodegradation rate for up to 82 times, similar to the mobile bed or column packed bed. The cumulated analysis of the influences of the studied factors allowed concluding that the optimum diameter of biocatalysts is 3 mm.

*Keywords: Bacillus* spp.; basket bioreactor; biodegradation; mass transfer; pyridine.