Environmental Engineering and Management Journal *August 2014, Vol.13, No. 8, 1939-1944*
http://omicron.ch.tuiasi.ro/EEMJ/

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BIODEGRADATION OF THE HERBICIDE LINURON IN A PLUG-FLOW PACKED-BED BIOFILM CHANNEL EQUIPPED WITH TOP AERATION MODULES

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Abstract

A lab-scale packed-bed biofilm channel reactor that operates as a plug-flow system equipped with top aeration modules was constructed and evaluated. To assess the reactor performance a microbial community able to degrade linuron was used. Changing the fluid flow rates and the linuron concentrations in the inflowing medium the volumetric loading rates of linuron ($B_{V,L}$) were gradually increased from 0.29 to 14.93 mg/Lh. During the operation of the reactor, an airflow rate of 0.15 ± 0.05 L/min was maintained in each aeration module. In these working conditions, dissolved oxygen concentrations (OD) of about 5 mg/L were obtained in the aeration modules. For all $B_{V,L}$ values tested, the microbial community colonized the support and removed the linuron with efficiencies of about 100%. The highest removal efficiency measuring the chemical oxygen demand (COD) was about 84%, and no accumulation of aromatic intermediates was detected by HPLC analysis.
The results showed that the oxygen consumption rate was proportional to $B_{V,L}$. The dissolved oxygen was not entirely consumed in the bioreactor indicating that, even at the highest loading rates, the microbial community was not limited by oxygen. The use of top aeration modules was successful, and their place in a packed bed biofilm channel allowed enough dissolved oxygen at the beginning of each stage, and along the whole reactor. It is appropriate to mention that no reports of linuron removal in bioreactors could be found in the literature.

Keywords: biodegradation, biofilm, linuron, plug-flow

Received: February, 2014; Revised final: August, 2014; Accepted: August, 2014

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