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Lab-Scale Performance Evaluation of Vertical Flow Reed Beds for the Treatment of Chlorobenzene Contaminated Groundwater

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Author(s)

Gerard Merlin, Nathalie Cottin

ABSTRACT

Chlorinated Benzenes (CBs) that were released into the environment contaminate groundwater at many existing and former industrial sites. A research program was initiated to investigate the ecoremediation of CBs contaminated groundwater using subsurface flow constructed wetlands. Four lab-scale experiments were performed to evaluate re- moval efficiency with different operation conditions. The first experiment was achieved with two different solid-state materials: a peat and a lava stone (pozzolana). In order to stimulate biological activity, organic matter coming from an aged Vertical Flow Constructed Wetlands (VFCW) was added to the media. Mass balance was determined to assess the fate of these pollutants in this system. The biofiltres of the second experiment were constructed with the same materials but bioaugmentation was realized by adding organic matter of VFCW or by bacteria inoculums. Peat and pozzolana biofiltres planted with *Phragmites australis* constituted the third experiment to evaluate the effect of plants. Bioaugmen- tation was constituted by the addition of OM coming from aged VFCW. Compost mixed with pozzolana was the solid-state material of the fourth experiment. Columns were made of two stages. The first stage was unplanted and the second stage was planted with *Phragmites*. Peat has been replaced by compost, a renewable material. Lab-scale biofil- tres remove CBs with an efficiency of 70% - 99%, depending on studied media and conditions. Greater efficiency was observed with bioaugmented media. Volatilization was very low (<0.2%) and the detection of chlorides in water indi- cated the occurrence of biodegradation. The experiments have shown that organic solid-state materials (compost or peat) are useful for groundwater remediation, with higher treatment efficiency than pozzolana material. Bioaugmentation increased biological activity. Clogging of biofiltres have been observed and can be reduced by the presence of plants or by a resting period of 14 - 21 days (requiring alternative feedings on several filters).

KEYWORDS

Organochlorine; Constructed Wetlands; Phytoremediation; Bioaugmentation; Micropollutants

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