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Removal of emerging organic contaminants in a poplar vegetation filter

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Abstract

Vegetation filters (VFs), a type of land application system, are a robust technology based on natural treatment mechanisms for the removal of wastewater contaminants. Their capacity to attenuate emerging organic contaminants (EOCs) has not yet been evaluated. The present study reports the results of a 2-year EOC monitoring carried out using a poplar VF receiving wastewater primarily treated by an Imhoff tank. The compounds selected included analgesics, a β -adrenergic blocker, stimulants, an anticonvulsant, an anti-depressant, an anti-inflammatory, an antibiotic and analgesic and stimulant metabolites. EOCs were analysed in the Imhoff tank effluent, in the infiltrated water at a depth of 90 cm and in the groundwater at a depth of 10 m. The results demonstrated that EOC attenuation was more significant in the first 90 cm than in the rest of the soil profile. The removal efficiency for all of the selected EOCs was higher than 90% with the exception of ketoprofen, which may pose a higher threat of groundwater contamination. The observed attenuation correlated with the hydrophobicity and charge state of the EOCs. The higher persistence of the metabolites 4-AAA and 4-FAA shows that progression in the degradation pathway does not always imply a mitigation of contamination.

Keywords: Vegetation filter; emerging organic contaminants; wastewater treatment; unsaturated zone; groundwater

1 Introduction

In Spain, more than 2.7 million people live in municipalities with less than 2,000 inhabitants [1]. The technical and economic limitations of small and scattered populations compose the effective implementation of conventional wastewater treatments. Non-conventional treatments such as nature-based wastewater purification systems have been reported as feasible solutions for these communities, which have limited access to sewage networks [2]. The main advantages of these treatments are their low cost for implementation, limited energy use and reduced operation and maintenance requirements [3].

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