CENTRE OF BIOLOGICAL ENGINEERING
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INSTITUTE FOR BIOTECHNOLOGY AND BIOENGINEERING

Poly (ε-caprolactone) as biofilm support and carbonsource for groundwater denitrification

Alexandrina L. Rodrigues, António G. Brito, Regina Nogueira

IBB-Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal

Groundwater is widely used as a drinking water source in most countries of the world. However, groundwater nitrate contamination has steadily been increasing over the years as a consequence of anthropogenic activities. Elevated nitrate concentrations in drinking water sources can cause diseases such as methahemoglobinemia and stomach cancer.

Traditional physical and chemical processes such as reverse osmosis, ion exchange, electrodialysis and chemical denitrification have been used for nitrate removal from water but despite their effectiveness, they are very expensive. Therefore, it is crucial to explore alternative strategies to remove nitrate of groundwater.

The use of biological denitrification to convert nitrate to harmless N_2 gas and nitrous oxide represent a good alternative treatment process for the remediation of groundwater contaminated with nitrate due to the elevated specificity of denitrifying bacteria, low cost and high denitrification efficiency. Typically, contaminated groundwater with nitrate is severely limited in organic carbon and the addition of an external soluble carbon source (e.g. acetic acid, sucrose, ethanol and methanol) is the usual procedure to achieve nitrogen removal. Nevertheless, the costs associated and the risk of additional contamination of the environment involved in this procedure demand the development of innovative treatment strategies. In this context, the application of biodegradable polymers (solid carbon sources) has been gaining importance in groundwater denitrification process. Solid carbon sources serve not only as sources of reducing power for denitrification but also as solid matrices for biofilms development. Moreover, in contrast to conventional processes, the use of this kind of carbon sources has no potential risks of release of excess dissolved organic carbon with the resultant deterioration of water quality.

The aim of the present work was to investigate the feasibility and efficiency of nitrate removal from groundwater by biological denitrification in column laboratory reactors packed with supports of poly (ε-caprolactone) (PCL). The maximum denitrification rate attained with PCL was 4.38 mg/L.h $N\text{-}NO^-_3$ at velocity of 0.08 m/h, at 20 °C and pH 7.0.