Water Tech - Conference of Water & Innovation, Amsterdam, Netherlands, Nov 3-4, 2011

Effect of salinity in the activity of denitrifying biofilms supported on poly ε-caprolactone

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Groundwater quality is impaired in many world countries by high concentrations of nitrate from anthropogenic activities and intrusion of saline water in coastal areas. The nitrate can be reduced using heterothrophic denitrification. Groundwater is naturally limited in organic carbon and to overcome this limitation, a poly-ε-caprolactone based biofilm carrier that serves simultaneously as a biofilm carrier and as a source of organic carbon was used in the present work. The specific objective was to evaluate the effect of the salt concentration in the activity of denitrifying biofilms in a packed bed reactor.

Complete nitrate removal was achieved in the packed bed reactor fed with 50 mg/L $N\text{-}NO^{3-}$ and without salt addition operated at an hydraulic retention time of 7.6 h, pH 7, and 20 °C. However, in the presence of 2-6 g/L salt, the concentrations of nitrate in the effluent increased to circa 10 mg/L and circa 15 mg/L $N\text{-}NO^{3-}$ for 8 g/L concentrations of salt. The increase in salt concentration affected negatively the activity of denitrifying bacteria as well as its bacterial community.

The proposed biotechnology based on PCL biofilm carriers is robust, easy to operate, and did not contaminate the water with noxious intermediates (nitrite, N_2O) and soluble organic carbon.