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Potable water hydrogenotrophic denitrification in packed-bed bioreactors coupled with a solar-electrolysis hydrogen production system

K.A. Karanasios[a], M.K. Michailides[a], I.A. Vasiliadou[a], S. Pavlou[b,c], D.V. Vayenas[a,c]*

[a]*Department of Environmental and Natural Resources Management, University of Ioannina, G. Seferi 2, 30100 Agrinio, Greece*
Tel. +30 26410 74117; Fax +30 26410 74176; email: dvagenas@cc.uoi.gr
[b]*Department of Chemical Engineering, University of Patras, 26504 Patras, Greece*
[c]*Institute of Chemical Engineering and High Temperature Chemical Processes, 26504 Patras, Greece*

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ABSTRACT

The aim of this study was to investigate the performance of bench-scale packed-bed reactors for hydrogenotrophic denitrification with hydrogen produced from electrolysis of water and electric energy provided by a solar cell. Two configurations were used, a single filter and a triple-column reactor, with gravel of different sizes as support media. The effect of hydrogen and carbon dioxide supply on the performance of the two systems of bioreactors under continuous operation was examined. The multi-filter system achieved high performances as it could safely treat polluted water with a low hydrogen and carbon dioxide consumption. A denitrification rate of 2 kg/m^{3}d was acheived for nitrate nitrogen and hydraulic loading of 1.44 g NO_3^--N/d and 11.5 m^3/m^{2}d, respectively. Also, a mathematical model was developed by using growth kinetics expressions for four-nutrient limitation (nitrate, nitrite, hydrogen and carbon dioxide) with inhibition by nitrate. The proposed model is capable of describing accurately enough, hydrogenotrophic denitrification under continuous operation.

Keywords: Denitrification; Packed-bed reactors; Hydrogen production; Electrolysis; Modeling

* Corresponding author.