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

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\textbf{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\textsuperscript{3}d was achieved for nitrate nitrogen and hydraulic loading of 1.44 g NO\textsubscript{3}-N/d and 11.5 m\textsuperscript{3}/m\textsuperscript{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.

\textit{Keywords}: Denitrification; Packed-bed reactors; Hydrogen production; Electrolysis; Modeling

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