Removal of nitrates from processing wastewater by cryoconcentration combined with biological denitrification

Roman Marecik\textsuperscript{a}, Radosław Dembczyński\textsuperscript{a}, Wojciech Juzwa\textsuperscript{a}, Łukasz Chrzanowski\textsuperscript{b}, Paweł Cyplik\textsuperscript{a,*}

\textsuperscript{a}Department of Biotechnology and Food Microbiology, Poznań University of Life Sciences, Wojska Polskiego 48, 60-627 Poznań, Poland. Tel. +48 61 8466025; Fax: +48 61 8466003; email: pcyplik@wp.pl
\textsuperscript{b}Institute of Chemical Technology and Engineering, Poznań University of Technology, Pl. M. Skłodowskiej-Curie 2, 60-965 Poznań, Poland

Received 6 July 2013; Accepted 8 February 2014

\section*{ABSTRACT}

In this study, the treatment of wastewater with a high nitrate content was investigated using the method of cryoconcentration on a pilot scale. The initial nitrate concentration in the treated wastewater was at 1,500 mg N/l. During 40 h of cryoconcentration of the wastewater, 176.6 kg of ice was produced, corresponding to a total process efficiency of 4.42 kg/h of ice. The crystallization temperature decreased from \(-0.5^\circ\)C to \(-9^\circ\)C during the process. The final concentration of nitrates in the concentrated product was at 37 g N/l, and the conductivity was at 158 mS/cm. The conductivity of the water obtained by melting the ice ranged from 0.98 to 1.4 mS/cm. Concentrates with initial nitrate concentrations of 3, 6, and 9 g N/l were then subjected to microbial denitrification. The values of the specific nitrate reduction rates ranged from 43.1 to 49 mg N/gVSS h.

\textit{Keywords: Cryoconcentration; Denitrification; Nitrates}

\textsuperscript{*}Corresponding author.