# Advances in the Electro-Biochemical Reactor Design for Denitrification[1]

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**Abstract**: Nitrate is ubiquitous in mining-affected waters, mainly due to the leaching of residual blasting compounds. The discharge standards for nitrogen species vary from site to site, but the regulatory limits are set in place to protect natural waterways and drinking water resources. Nitrite – an intermediary daughter product of denitrification – prevents hemoglobin from carrying oxygen, causing a condition called infant methemoglobinemia, aka the "blue baby syndrome." Unlike the physical and chemical nitrate removal methods, such as ion exchange or reverse osmosis, which concentrate the contaminants, the Electro-Biochemical Reactor (EBR) destroys nitrate, generating harmless nitrogen gas as a by-product. The direct provision of electrons via voltage potential significantly decreases nutrient requirements, minimizes excess biogrowth, and improves denitrification kinetics. This paper presents two case studies of on-site pilot-scale demonstrations of the EBR technology. The influent nitrate-N concentrations of 14.5 mg $L^{-1}$ to 18.0 mg $L^{-1}$ were consistently removed to below the discharge goal of 2 mg $L^{-1}$, with the average effluent concentrations of 0.8 mg $L^{-1}$ and 0.3 mg $L^{-1}$ for sites A and B. The treatment was demonstrated successfully in a one-stage bioreactor with short hydraulic retention times (8-15 minutes). The fast kinetics, low power requirements, low chemical dosing, and no concentrated brine generation have positive implications for future installations at many sites. The EBR process has been demonstrated to be best suited for the treatment of nitrate-bearing mine waters, as well as for potable water applications relying on nitrate-contaminated groundwaters.

**Additional Key Words:** EBR, Nitrate, Bio-treatment.

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