

31-7 Optimization of upflow sludge-blanket reactor for denitrification of ground water with low hardness

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Retention of adequate levels of biomass is an important factor in anaerobic biological unit processes. It has been commonly held that upflow sludge blanket (USB) reactors fed with waters with hardness levels below $400\text{mg CaCO}_3\text{ l}^{-1}$ encounter difficulties due to floating sludge and sludge wash-out. In this work, extended operation of a denitrifying granular sludge USB reactor treating groundwater with a calcium addition to a low hardness of $120\text{mg CaCO}_3\text{ l}^{-1}$, an alkalinity of $180\text{mg CaCO}_3\text{ l}^{-1}$, and influent pH values of 7.9 or higher was accomplished. Generation of mineral precipitation needed for maintenance of a heavy sludge with good settling characteristics was effectuated. Bed biomass concentration increased with increasing granule mineral content. Further assays were conducted to characterize effects of volumetric loading rate (VLR) by varying influent nitrate concentrations (12 to 38mg N l^{-1}) at a fixed flow rate (4 l hr^{-1}). An increase in VLR from 0.5 to $2.0\text{ g N l}^{-1}\text{ d}^{-1}$ resulted in a linear increase in alkalinity production rate and a curvilinear increase in hardness reduction rate (as calcium precipitation) with very little effect on hardness reduction below a VLR of about $1.2\text{ g N l}^{-1}\text{ d}^{-1}$.

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