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Enhanced nitrogen removal from sludge reject water by methanol addition using sequencing batch biofilm reactor

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ABSTRACT

Reject water from sludge contributes to the total nitrogen load at municipal wastewater treatment plants (WWTPs) and the development of new processes to treat it is crucial. A laboratory-scale sequencing batch biofilm reactor was investigated to treat reject water for the improved nitrogen removal. Due to the low dissolved organics (120–200 mg L^{-1}) and alkalinity (1,400 mg $CaCO_3$ L^{-1}) in reject water, an additional supply of alkalinity and external carbon for nitrification and denitrification was necessary. For the most optimal improved nitrogen removal, three conditions were tested. When both alkalinity and external carbon source (methanol) were supplied (Case I), nitrification and total nitrogen removal efficiencies were 97 and 91%, respectively. When only alkalinity was supplied (Case II), nitrification efficiency reached 97%, but with low denitrification. When only methanol was provided (Case III), nitrification and total nitrogen removal efficiencies were 89 and 80%, respectively. Nitrogen loss occurred when methanol was added (Cases I, 38.2% and Case III, 30.7%), whereas only nitrification occurred without methanol addition (Case II, 0.7%). The nitrogen loss in Case II, during the 10-min static fill step, may be associated to the occurrence of simultaneous nitrification and denitrification, resulted from the presence of nitrifiers and denitrifiers in the biofilm microenvironments. This process can be successfully applied to the removal of nitrogen from reject water as a separate treatment, saving cost from the alkalinity compensation for nitrification from denitrification as well as saving space in WWTP.

Keywords: Denitrification; Nitrification; Nitrogen removal; Organic carbon; Reject water; Sequencing batch biofilm reactor

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