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| Thesis Title | Nitrate Reduction in Anaerobic Upflow Filter with Denitrification Methanogenesis and Ammonification |
| Thesis Credits | 12 |
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## Abstract

The potential of nitrate removal in the system carries out denitrification (nitrate-→ nitrogen gas) methanogenesis (methane production) and ammonification (nitrate-→ammonia) was investigated in 4 laboratory scale anaerobic upflow filters (biofilters). Each of biofilter with effective volume of 16 liters was filled with polyethylene media of which sureface area was 190 $m^2/m^3$. Synthetic wastewater containing glucose as the sole source of carbon was used. The experiment was divided into 3 parts to evaluate the effects of COD/$NO_3^-$-N ratio, concentration of COD and $NO_3^-$-N and hydraulic loading rate on nitrate removal mechanism.

The results showed that at $NO_3^-$-N concentration of 100 mg/l and hydraulic retention time of 12 hours, all of the tests with COD/$NO_3^-$-N ratio not greater than 4.0, the activities of methanogenesis and ammonification were very low comparing with denitrification that consumed 56-58% COD. Methane and ammonia were found at significant concentration only at high COD/ $NO_3^-$-N ratio when denitrification was completed. Increasing COD/$NO_3^-$-N ratio from 4.0 to 5.5, the conentration of methane was increased from 0.3% to 12.0% vol. and ammonia concentration was increased from 0.39 to 5.87 mg/l. With the same COD/ $NO_3^-$-N ratio but difference of $NO_3^-$-N concentration of 50, 100, and 150 mg/l, the reduction pathway was affected that is, at COD/$NO_3^-$-N ratio of 6.1, increasing nitrate concentration from 50 to 150 mg/l resulted to the increase of COD consumption by methanogenesis from 2% to 5% but remaining constant at 4% by ammonification. Hydraulic retention time was varied between 12 and 1.5

hours by varying hydraulic loading rate between 1.92 and 14.64 $m^3/m^2.d$. Increasing hydraulic loading rate, NOx removal efficiency was decreased. At hydraulic loading rate of 14.64 $m^3/m^2.d$, NOx removal efficiency was the lowest and effluent NOx concentration was about 2 times higher than the others. Changing of hydraulic loading rate did not significantly affect concentration of methane and ammonia. The greater surface area of the reactor, the higher removal efficiency at the same retention time.

In addition, it was found that ammonification can be taken place either with or without ammonia in substrate. The maximum NOx removal rate in batch test is 2.02 gN/gVSS.d which is 7 times higher than using methanol as carbon source.

Keywords : Anaerobic Upflow Filter / Biofilter / Nitrate Removal / Denitrification / Methanogenesis / Ammonification