EVALUATION OF N_2O FORMATION FROM ANAEROBIC AMMONIUM OXIDATION (ANAMMOX) AT DIFFERENT INFLUENT AMMONIA TO NITRITE RATIOS

MR. TRAIRAT MUANGTHONG-ON
ID: 52910603

A THESIS SUBMITTED AS A PART OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF ENGINEERING
IN ENVIRONMENTAL TECHNOLOGY AND MANAGEMENT

THE JOINT GRADUATE SCHOOL OF ENERGY AND ENVIRONMENT
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2ND SEMESTER 2010

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Topic: Evaluation of N_2O Formation from Anaerobic Ammonium Oxidation (Anammox) at Different Influent Ammonia to Nitrite Ratios

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ABSTRACT

An improper treatment design to remove nitrogen could cause negative effects to atmospheric environment by emission of nitrous oxide (N_2O). With a conventional biological denitrification process under the condition of a low influent COD/N ratio or electron donor to electron acceptor ratio, N_2O can be detected. However, recently, an autotrophic denitrificaiton process named ANAMMOX has been applied for nitrogen removal from wastewater containing high NH_4^+ but low carbon content. Anammox bacteria are able to use ammonia as electron donor and nitrite as electron acceptor under anaerobic condition. This study investigated the N_2O production by Anammox process operated in SBR reactors with HRT of 4 days by varying influent ammonia to nitrite ratios or electron donor to electron acceptor ratios at 0.5:1, 0.75:1, and 1:1. The influent ammonia concentration also varied to 50, 75 and 100 mgN/L. There are eight experiments in this study. Three are triplicate runs of R1(100) and the other are R0.75(100), R0.75(75), R0.5(100), R0.5(75) and R0.5(50). Comparing the average detected N_2O gas in reactor headspace at feed ammonia concentration of 100 mgN/L that are 1.05, 2.04 and 200.55 ppm in R1(100), R0.75(100) and R0.5(100) respectively indicated that N_2O production increases when electron donor in solution is limited. The results also show the significant higher substrate consumption mole ratio (ΔNO_2-N/ΔNH_4-N) than Anammox stoichiometric one (1.32) when applying lower influent ammonia to nitrite ratio especially at high influent ammonia of that ratio. The nitrite was completely removed except in the experiment of R0.5(100) due to the excess nitrite at 200 mgN/L in the influent.

Keywords: N_2O (nitrous oxide), Anammox, Sequencing Batch Reactor (SBR), ammonia, nitrite, influent ammonia to nitrite ratio

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