Response of Antibiotic Resistant Bacteria During Anammox Treatment of Pretreated Municipal Wastewater and Landfill Leachate

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This study investigated the reduction of antibiotic resistant bacteria (ARB) concentrations during anaerobic ammonium oxidation (anammox) treatment of wastewater in Belo Horizonte, BR. Anammox, an emerging cost-efficient solution for the removal of nitrogen from wastewater, shows promise for use in decentralized settings as it reduces the economic burden and overall required footprint for water treatment. The full scope of capabilities of anammox reactors, including their ability to reduce the environmental proliferation of "superbugs," has yet to be conclusively studied. This study hypothesized that anammox treatment contributes to ARB removal from wastewater, supporting the use of anammox reactors as appropriate treatment alternatives.

Samples of influent and treated effluent were taken from three reactors treating various types of wastewater, including 1) 2L continuous flow fixed bed reactor (CFR), and 2) 2L sequencing batch reactor (SBR), both receiving anaerobically pre-treated domestic wastewater from a decentralized anaerobic treatment plant and 3) 10L SBR receiving landfill leachate diluted with the anaerobically pretreated wastewater. The samples were introduced to petri dishes, each containing antibiotics or anti-microbial substances, including: amoxicillin, azithromycin, cephalexin, meropenem, triazole (trimethoprim + sulfamethoxazole), and Microban-24, at their minimum inhibitory concentrations, with one set of unamended plates as a control. Bacterial colonies demonstrating resistance to the various substances were counted after 2 days of incubation at 37°C. The resulting removal of ARB was compared between the three reactors, and correlated with their operation conditions during the experiment, including: pH, temperature, ammonia removal efficiency.

Preliminary findings of this study show that the greatest overall ARB reductions of 0.87±0.64-log removal were observed in the 2L SBR, followed by the 2L CFR, and lastly, the 10L SBR. Low reduction of 0.55±0.31-log removal in the 10L SBR may be attributed to additional toxic substances found in landfill leachate. Additionally, bacteria resistant to meropenem demonstrated the least reduction and lowest consistency over the study period. Overall, this study demonstrated that ARB reduction occurred within all three reactors and in response to exposure to all inhibitory substances.

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