ISOLATION AND IDENTIFICATION OF A NITRITE-OXIDIZING STRAIN AS A BIOAUGMENTATION STRATEGY FOR RECOVERING NITRATATION PROCESSES

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Nitrogen is a pollutant present in effluents from sectors such as agribusiness, livestock, and meat-packing plants, which, when not treated or managed correctly, affect the environment and human health. The biological process of nitrification/denitrification is widely employed in wastewater treatment due to its efficiency and operational practicality. In nitrification, ammonium oxidizing bacteria (AOB) oxidize ammonium to nitrite (nitritation), and subsequently, nitrite-oxidizing bacteria (NOB) convert nitrite to nitrate (nitratation). In the absence of oxygen, nitrite (NO2-) and nitrate (NO3-) can be reduced to nitrogen gas by denitrifying bacteria (denitrification). However, challenges such as microbial imbalances, substrate inhibition, competition, and operational limitations (lack of energy, oxygen transfer) can reduce the overall efficiency of the process and impede the rapid recovery of the reactors in full-scale plants. Thus, using bioaugmentation techniques that use specialized cultures from selected microorganisms with a high degradation potential can be a good strategy for restoring the process after shocks. This study aimed to isolate a NOB strain using sludge from a full-scale nitrification/denitrification system treating swine wastewater as inoculum. To favor nitrite-oxidizing strains, an enrichment of the inoculum was performed. The culture enrichment was carried out in a shaker at a controlled temperature (25°C) and agitation (150 rpm). A synthetic medium based on sodium nitrite at different concentrations in duplicate (100, 300, and 1000 mg of NaNO2 L-1) was utilized to feed the system, and the nitrite input and nitrate output were analyzed for process monitoring. The results indicated that swine wastewater treatment systems are promising sources for nitrite-oxidizing bacteria isolation, enabling the isolation of the strain belonging to the genus Nitrobacter. Optimal growth of the Nitrobacter strain was observed at concentrations ranging from 100 to 300 mgNaNO2 L-1, which can be justified by the inhibitory effect promoted by the high concentrations of nitrite in the medium. In this concentration range, the nitrite removal was around 96%, indicating satisfactory process development. Although isolation of bacterial strains related to the nitratation process in a solid medium is not usual, it is a crucial tool for understanding the physiological characteristics of bacteria and their correct application. In conclusion, this study demonstrates the successful isolation of a NOB strain. This isolation offers the selection of better strains, being an essential ally for the bioaugmentation process.