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Development of *Bacillus* spp. consortium for one-step “Aerobic Nitrification-Denitrification” in a fluidized-bed reactor

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Abstract

Application of two-step “Autotrophic Nitrification and Anoxic Denitrification” for nutrients removal has found several limitations. This study aimed at isolating indigenous heterotrophic *Bacillus* strains for chemical oxygen demand (COD), ammonium nitrogen (NH₄⁺-N), and phosphate (PO₄³⁻-P) removal using one-step “Aerobic Nitrification-Denitrification”. Thirteen isolates were examined for growth performance, followed by bioremediation and enzymes production. B006, D005, and D014 were selected and shown to be safe for anthrax toxin and enterotoxin. B006 and D005 were identified as *Bacillus cereus*, whereas D014 had similarity to *Bacillus subtilis*. Three isolates were inoculated in a fluidized-bed reactor (FBR), achieving COD, NH₄⁺-N, and PO₄³⁻-P removal efficiencies of 74.42 ± 6.96, 62.66 ± 10.67, and 43.57 ± 10.23%, respectively within 11.3 h. The consortium attained adequate bioremediation capabilities when hydraulic retention time was decreased to only 5.7 h. This study showed environmental value in enhancing biological reactor performance using bio-augmentation, especially in small-scale and low-energy treatment systems.