

Genetic diversity of nitrate reducing bacteria in marine and brackish water nitrifying bacterial consortia generated for activating nitrifying bioreactors in recirculating aquaculture systems

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Abstract

Nitrate reducing potency of 88 bacterial isolates segregated from marine and brackish water nitrifying bacterial consortia (NBC), generated for activation of nitrifying bioreactors, was confirmed by determining the nitrate reducing capability under aerobic conditions as maintained in nitrifying bioreactors. All the isolates had the potential to be used as bio-augmentors for activating nitrate dissimilation in recirculating aquaculture system. The existence of nitrate reducers with nitrifiers in NBC and in the reactor configuration negates the requirement of integrating anoxic denitrifying system for effective removal of NO_3^- -N. Phylogenetic analyses of representative isolates from each cluster of the dendrograms generated based on phenotypic characterization and amplified ribosomal DNA restriction analysis revealed profound diversity of nitrate reducing bacterial flora in the NBC. They were composed of *Streptomyces enissocaeilis*, *Marinobacter* sp., *Pseudomonas* sp., *Microbacterium oxydans*, *Pelagibacterium halotolerans* and *Alcanivorax dieselolei* from marine NBC and *Streptomyces tendae*, *Nesterenkonia* sp., *Bacillus cereus*, *Microbacterium oxydans* and *Brevibacterium* sp. from brackish water NBC. The diversity indices of the consortia were calculated using Mega 5.0, primer 7 and VITCOMIC softwares. Marine NBC exhibited higher Shannon wiener diversity and mean population diversity than brackish water NBC. The study delineated higher species richness and diversity in marine NBC than in its brackish water counterpart, a possible reflection of the higher biodiversity of marine systems, and hence, the former is more promising to be used as start-up cultures for the activation of nitrifying bioreactors after appropriate acclimatization to the desired salinity.

KEYWORDS

amplified ribosomal DNA restriction analysis, diversity index, nitrate reducer, nitrifying bacterial consortia, nitrifying bioreactor