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Microbial removal of nitrate in water

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A bio-sand filter system was employed to purify nitrate contaminated drinking water by biological denitrification. Twenty bacterial strains were isolated from soil samples collected from highly nitrate contaminated agricultural lands in a paddy field from Jayanthipura in Polonnaruwa, a paddy field in Gampaha and animal farm land from Kaduwela. Out of twenty bacteria isolates two Gram's negative and one Gram's positive nitrate degrading bacterial strains were screened as potential bacterial strains for degradation study.

Three nitrate degrading bacteria (*Proteus* sp., *Pseudomonas* sp., and *Bacillus* sp.) were identified to the genus level using biochemical tests (Gram's stain, starch hydrolysis, catalase, urease, methyl red, Vogus proskauer and citrate). Effect of several parameters, such as pH, temperature, different hydraulic retention times (2, 4, 6, 8 days), different nitrate concentrations (15, 30, 45 mg/L) on nitrate removal efficiency was tested. The highest nitrate reduction rate (4.98 mg/L per day) was recorded when *Pseudomonas* sp. was inoculated. The lowest nitrate reduction rate (3.27 mg/L per day) was observed when *Bacillus* sp. was inoculated.

Nitrate reduction in a biofilm was also measured using the identified bacteria strains of *Proteus* sp., *Pseudomonas* sp. and *Bacillus* sp. with mixed biofilm. Biofilms were prepared in a bio-sand filter and nitrate reduction was measured after water filtered through a laboratory scale sand filter. Nitrate concentrations were determined using Brucine method. Coals were placed on the top layer of the sand filter as a substrate for nitrate degrading bacteria.

In the biofilm study the highest nitrate reduction rate (37.1 mg/L per day) was observed with *Pseudomonas* sp. and the lowest was detected as 20.3 mg/L per day with *Proteus* sp.

Keywords: Nitrate, bio-sand filter, hydraulic retention time, bio-film