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Removal of nitrate from drinking water using a bio-sand filter

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Water is the basic need for mankind. For a healthy nation, clean water is of utmost importance. In Sri Lanka, most of the rural communities are dependent on the ground water resources, However due to extensive agricultural practices, poor sanitary disposal methods and industrial wastewater discharges, most of the groundwater sources have been polluted by nitrates. High concentration of nitrates in drinking water causes health risks such as methemoglobinemia in infants. NO_3-N cannot be removed by the typical water treatment methods. Removal of NO_3-N is very expensive and therefore it is necessary to introduce a low cost and easily maintenained method for removal of NO_3-N from groundwater for community applications.

Biological removal of NO_3-N from drinking water was studied in a biofilter. In this study, a full scale model for denitrifcation was developed on the sand column to remove NO_3-N from contaminated ground water. Two "bio-sand filter" experimental set-ups consisting of cylindrical PVC biological reactor with 31 cm of inner diameter and 130 cm of height and square concrete reactor with 24 cm width and 80 cm height were used. Both reactors were operated in down flow mode with river sand and sea sand to test the effectiveness of sand usage.

The filtration rates have an impact on NO_3-N removal through the bio-film introduced at 10 cm depth from the surface of the reactors. Biofilter was designed for two phases of operations with NO_3-N concentrations of 15 mg/l and 30 mg/l while keeping the filtration rates varied from 0.001, 0.005, 0.008, and 0.01m/h respectively. The fatty acid was used as the sole carbon source for denitrifyers and the maximum NO_3-N removal efficiency was recorded as 100% at slower filtration rate. Although when filtration rate increases, the nitrate removal efficiency decreases. However, for all filter operations NO_3-N concentrations were lower than the permissible level ie.,10mg/l specified by the SLS for potable water quality. The result of comparative study with sea sand filter performance was not within expected limits. Hence the innovated bio-sand filter with river sand is the best solution for removing NO_3-N from ground water. That low cost innovated bio-filter constructed with available material in Sri Lanka is the best solution for the removal of NO_3-N as a community base water purification system.

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