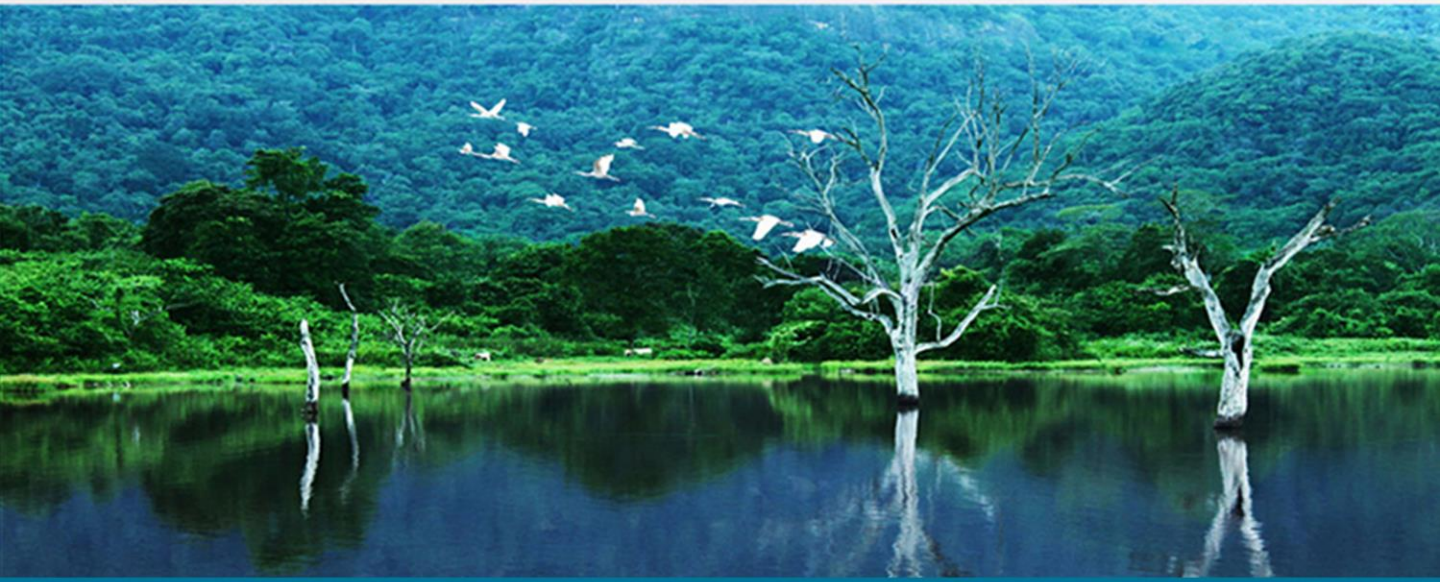
PROCEEDINGS

INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH

2024

CHALLENGES AHEAD



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All begins with water

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WP01

GEOCHEMICAL TRACER TO IDENTIFY NITRATE POLLUTION IN GROUNDWATER IN THE DRY ZONE OF SRI LANKA

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Groundwater serves as a vital water source in the dry zone of Sri Lanka. Typically, deep aquifers remain isolated from anthropogenic activities. However, the infiltration of nitrates into groundwater has emerged as a serious environmental concern in areas with intensive agricultural practices. Owing to its inherent stability, high solubility and ease of migration, nitrate has emerged as a primary pollutant in groundwater. Elevated levels of nitrates not only contribute to the occurrence of methemoglobinemia but also pose mutagenic risks. To ensure a safe water supply and effectively combat nitrate pollution, it is very important to identify the sources of nitrate contamination. This study aims to investigate the variation of nitrate levels in deep aquifers in Netiyagama, Mihintale. The primary objectives were to identify areas of nitrate pollution in groundwater, and to determine the potential sources of organic nitrogen oxidation. To achieve this goal, dual isotope analysis (^{15}N and ^{18}O) method was used and is in progress. A total of 83 water samples were collected from various locations, including surface, shallow and deep-water sources. These samples were analyzed using inductively coupled plasma spectroscopy to quantify major ions. Additionally, nitrogenous species, such as NO_3^-, N_2H_4 and NH_3, were examined to determine the total nitrogen content. Several nitrate hotspots were identified closer to agricultural lands in the spatial map compiled with Inverse Distance-Weighted Interpolation method. The nitrate levels of the groundwater samples ranged from 0.00 mg L^{-1} to 179.78 mg L^{-1}, and the maximum was reported in a tube well located in a preschool. The level was three times higher than the permissible level of SLS standards for drinking water and showed a significant increase with time without direct anthropogenic activity. The water in the area is predominately composed of sodium or potassium types, bicarbonate types, and mixed types due to the interaction between rocks and water. This has been identified through the Piper trilinear method. The pH of the samples ranged from 7.03 to 9.54, indicating that groundwater in this region is alkaline. Based on the geology of the region, the groundwater also exhibits high salinity due to intensive weathering. Furthermore, the water shows a permanent hardness, which results from the weathering of feldspar-rich minerals present in the rocks. This study illustrates the various pathways through which nitrates from anthropogenic sources can migrate into hard rock aquifers, relying on the microbial nitrogen cycle and depending on the soil profile of the area. The cross sections of rock fractures showed a direct connectivity of surface water bodies to deep aquifers in certain locations indicating the possibility of infiltration of nitrogen sources. The findings highlight the significant impact of anthropogenic nitrogen input mainly due to agricultural runoff and fertilizer use, as evidenced by the variations observed in NO_3^-, Cl^- and total dissolved solids contents along the direction of the steepest water flow in the study area.

Keywords: Anthropogenic, Aquifers, Groundwater, Nitrate, Pollution

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