Combined use of hydrogeochemical and dual isotopes of water (δ^2H and δ^{18}O) and nitrate (δ^{15}N and δ^{18}O) to determine groundwater nitrate pollution

CYNTHIA NONTERAH[1] AND ABDUL AZIZ SANKOH[2]

[1]Ghana Atomic Energy Commission
[2]Fourah Bay College, University of Sierra Leone,
Presenting Author: mslaar@yahoo.com

Groundwater nitrate contamination has become a trending environmental issue worldwide. Identifying sources of anthropogenic nitrate pollution in groundwater is a first step to developing strategic ways of controlling nitrate pollution. Here, we combined the dual isotopes of water (δ^2H and δ^{18}O) and NO_3^- (δ^{15}N and δ^{18}O) and hydrogeochemical data with a Bayesian isotope mixing model (SIMMR) to identify the nitrate sources in groundwater in two waste dumpsites in West Africa. Bi-plot analysis of δ^{15}N versus $O^{18}O-$ showed that the in the dumpsites was mainly from soil organic-N and manure & sewage which confirms the dominance of denitrification and ammonia volatilization. The SIMMR (δ^{15}N versus δ^{18}O– analysis further revealed that, soil organic nitrogen (SON) contributed majority (43.6%) of to the groundwater at the Granvillebrook dumpsite. Manure/leachate (MAL) contributed 31% whiles domestic wastewater (DW) contributed 17% of the groundwater . MAL (32.2%), SON (28.0%) and DW (26.3%) contributed a significant proportion of to the groundwaters in the Kingtom groundwater system. The SIMMR (^{15}N and DO) showed that MAL had the highest contribution (61.1%) of , followed by SON (23.8%) and DW (15.1%) to the groundwater system of the Granvillebrook dumpsite. DW (55.0%), SON (29.1%) and MAL (15.9%) contributed the highest to the groundwaters of the Kingtom groundwaters. The study confirms the feasibility of using the SIMMR model to quantify groundwater sources. It is concluded that N in the dumpsites was mainly from soil organic-N and manure & sewage which confirms the dominance of denitrification and ammonia volatilization.