

Impact Assessment of landfills on Soil and Groundwater Quality in the Southeast of Rabigh city, Kingdom of Saudi Arabia

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Abstract

The landfill influences on the groundwater quality and the soil properties of the coastal city of Rabigh city, Saudi Arabia, were examined in terms of physical and chemical analyses. A total number of 31 samples (14 from groundwater samples and 17 soil samples) were collected to assess the involvement of the heavy metal ions within the vicinity of the study area. The outcomes showed persist groundwater contaminations with Na^+ , Ca^{2+} , Mg^{2+} , Cl^- , SO_4^{2-} . The majority of the chemical cationic contaminations were recorded in order as Na^+ , Ca^{2+} , and Mg^{2+} respectively. While the anionic contaminations were recorded in order as SO_4^{2-} , Cl^- , HCO_3^- , and NO_3^- respectively. The spatial distribution of TDS exposes that the groundwater quality closes to the landfill sites is heavily impacted. According to Gibbs's analysis, the groundwater quality is controlled dominantly by the evaporation factor of the designated study area. Two hydrogeochemical type facies were identified, (NaCl and CaCl). The concentrations of the heavy metals in the groundwater samples were compared to the standard permissible limits of the General Authority for Meteorology and Environmental Protection (GAMEP), and soil samples were compared to the standard permissible limits of the Canadian Council of Ministers of the Environment (CCME). The findings of the current research discovered that the As, Cu, Zn, Mn, Al, and Fe metals were below the permissible limits. The soil's pH ranged from 7 to 9.6 with of 8.7 average pH value suggesting that the soils were strongly alkaline. The high alkalinity of the soils could be related to the occurrence of Sodium Carbonate or Sodium Bicarbonate. The spatial distribution of soil pH reveals that the highest value is located far from landfills, in the upstream part. The uppermost concentration of Chromium and Nickel elements in the soil exceeds the permitted threshold limit, while the uppermost concentrations of As, Cu, Zn, and Mn were below the permitted threshold limit.