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Geophysical and hydrophysical evaluation of groundwater around the Igbenre Ekotedo dumpsite Ota, Southwest Nigeria, using correlation and regression analysis

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#### Abstract

A study involving geophysical survey and groundwater analysis was carried out at the Igbenre Ekotedo dumpsite in Ota, Southwest Nigeria. The aim was to monitor and track the depth of leachate contamination around the dumpsite. A proposed simple multiple linear regression (MLR) model of groundwater total dissolved solids (TDS) was also developed. This was achieved by correlating the observed TDS of groundwater samples collected within and around the vicinity of the dumpsites with multiple terrain conductivity data derived from a geophysical method. The results of the electrical resistivity tomography (ERT) obtained along four profile lines in August 2014, and a time-lapse survey in December 2015 delineated leachate plumes as low-resistivity zones ranging between 0.54 and 12.5  $\Omega$  m around the dumpsite, with good correlation between the wet and dry season models. The results also showed that leachate from the decomposed refuse materials has polluted the subsurface under the dumpsite from the surface to a depth of about 45 m, and by extension contaminating groundwater aquifer around the area. Results from the electromagnetic (EM-34) experiment and groundwater TDS parameters from seven (7) boreholes around the vicinity of the EM profiles showed a strong positive correlation. Therefore, a simple multiple linear regression (MLR) TDS model that relates the TDS data obtained from boreholes to the geophysical parameters obtained from the EM-34 data (HD 20, HD 40, and VD 40) was developed for the purpose of efficient groundwater resources monitoring and management around the dumpsite and their communities. The predictive power of the developed MLR TDS model was also appraised to determine the feasibility of using the TDS model to predict and estimate groundwater TDS around the study area. The developed TDS model can be reliably deployed for groundwater TDS estimation and monitoring around the study area where there are no boreholes, but with only terrain conductivity data. However, where there are borehole and hand-dug wells, terrain conductivity data around the area alone can be applied to the model to determine TDS concentration in groundwater, thus reducing the time and cost of determining and monitoring both parameters independently.

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