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Examination of the naturally occurring clay in Pannala area for the removal of nitrates and polycyclic aromatic hydrocarbons from drinking water

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Nitrate is one of the most common groundwater contaminants in rural areas. Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous compounds found in the environment. This study was conducted to investigate the nitrate and polycyclic aromatic hydrocarbon adsorption capacity of naturally occurring clay in the Pannala area because clay plays an important role in the environment by acting as a natural adsorbent of pollutants *via* taking up cations and anions either through ion exchange or adsorption or both. Clay samples were obtained from six different sites of the clay deposit. The samples, which were significantly similar in pH, salinity, moisture content and organic matter content, were combined together and further studies were done. Batch adsorption procedure was used in the experiment. X-Ray Diffraction (XRD) analysis was done to identify clay minerals in these clay samples.

The variation of the adsorption capacity of nitrates with pH, initial concentration and equilibration time were determined. The analysis of nitrate was carried out by spectrophotometric method which showed that clay has the highest adsorption capacity value of $3.68 (\pm 0.16)$ mg/g for NO_3^- at 200 mg/L of initial concentration of 500 cm³ water with 3 days of equilibration time when 5.00 g of clay was used. Analysis of polycyclic aromatic hydrocarbons was carried out using HPLC with an UV detector. This was determined in a C18 column using naphthalene as the reference compound, and methanol as the mobile phase. The highest adsorption capacity for PAHs was $0.24 (\pm 0.06)$ mg/g at 20 mg/L of initial concentration of 500 cm³ water with 2 days of equilibration time when 50.00 g of clay was used. The adsorption capacity of nitrates varied with initial concentration, equilibration time and pH of the sample while the adsorption capacity of PAHs varied with equilibration time and pH of the sample only. Hence, it is evident that naturally occurring clay in the Pannala area adsorbs nitrates and PAHs in considerable amounts. According to the XRD analysis, clay samples contain clay minerals of montmorillonite, illite and hematite.

Keywords: Natural adsorbent, nitrate, PAH