Subsurface Water Quality Around Waste Disposal Sites Located In A Structurally Deformed Granitic Terrain in Hyderabad City, India

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In many countries, public concern over the deterioration of groundwater quality from inorganic contamination has developed significantly in recent years. This concern has focused increasingly on anthropogenic sources as the potential cause of the problem, predominantly in structurally deformed areas. Waste disposal sites are one of the major sources of elevated levels of inorganic components in the subsurface water. Hydrogeochemical studies in and around solid waste disposal sites located in structurally deformed granitic terrain in Hyderabad city, India was carried out to assess the geochemistry and quality of subsurface water. Three waste disposal sites under study – Jawahar Nagar, Autonagar and Dundigal in and around Hyderabad city are a part of the peninsular gneissic complex. The area around these sites are covered by underlain granite, which is a part of large granitic batholiths having exposures covering an area over 5000 km^2 belonging to the Archaean age. Mineralogically, these rock consists of quartz (21%-42%), potash feldspar (34%-60%), plagioclase (2%-30) with biotite (1%-22%) forming the chief accessory. Epidote and pyroxene are frequently observed in such terrain [1]. Major ions in the groundwater samples were precisely determined by ion chromatography to identify the suitability of water for drinking and irrigation purpose. The analytical result reveals that pH of groundwater is slightly acidic to alkaline. High concentrations of major ion (F^-, Na^+, Mg^{2+}, Ca^{2+}) in bore wells in and around study area can be attributed to differential mineral weathering of pyroxenes, plagioclase feldspars, and apatite present in the granites of the study area and dissolution /precipitation reactions along fractures and joints, while NO_3^- in bore wells around dumpsite can be attributed to consequence of the oxidation of ammonia and similar sources from leachate emanating from waste. As such, the US Environmental Protection Agency (US EPA) has established a maximum contaminant level (MCL) of 10 mg/l NO_3^- N [2]. An anomalous level of fluoride is observed in fractured hard rock zone composed of minerals like biotite, fluorapatite, fluorite, cryolite and fluoride-replaceable hydroxyl ions such as Ferro-magnesium silicates, contributing high concentration of fluoride in groundwater, which turn out to be the geogenic source of high fluoride concentration in groundwater from granitic terrain apart from leachate emanating from waste disposal sites in the study area. The possible solution to reduce the levels of fluoride in groundwater is by swill out the aquifers with fresh water. Allowing rainwater to percolate in the subsurface is one of the effective methods to dilute the fluoride in groundwater.

Keywords: Groundwater quality; Solid waste; Geochemistry; Granitic terrain; Minerals; Hyderabad.

References

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