CHARACTERISTICS OF LEACHATE AND GROUNDWATER POLLUTION AT MUNICIPAL SOLID WASTE LANDFILL SITE GOHAGODA, KANDY

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Introduction

Landfills are sources of pollution of groundwater and soil due to the production of leachate and its migration through refuse. When leachate from landfill enters the groundwater, it tends to form a plume that spread in the direction of the flowing groundwater. A study of composition of landfill leachate and groundwater pollution was conducted at Gohagoda landfill site, which is located at northwest of Kandy City. The filling of Gohagoda disposal yard, takes place at a distance about 70 m downstream of Gohagoda water intake plant. Also there are several dug wells located at close proximity of the landfill which are being used for drinking water and other domestic uses.

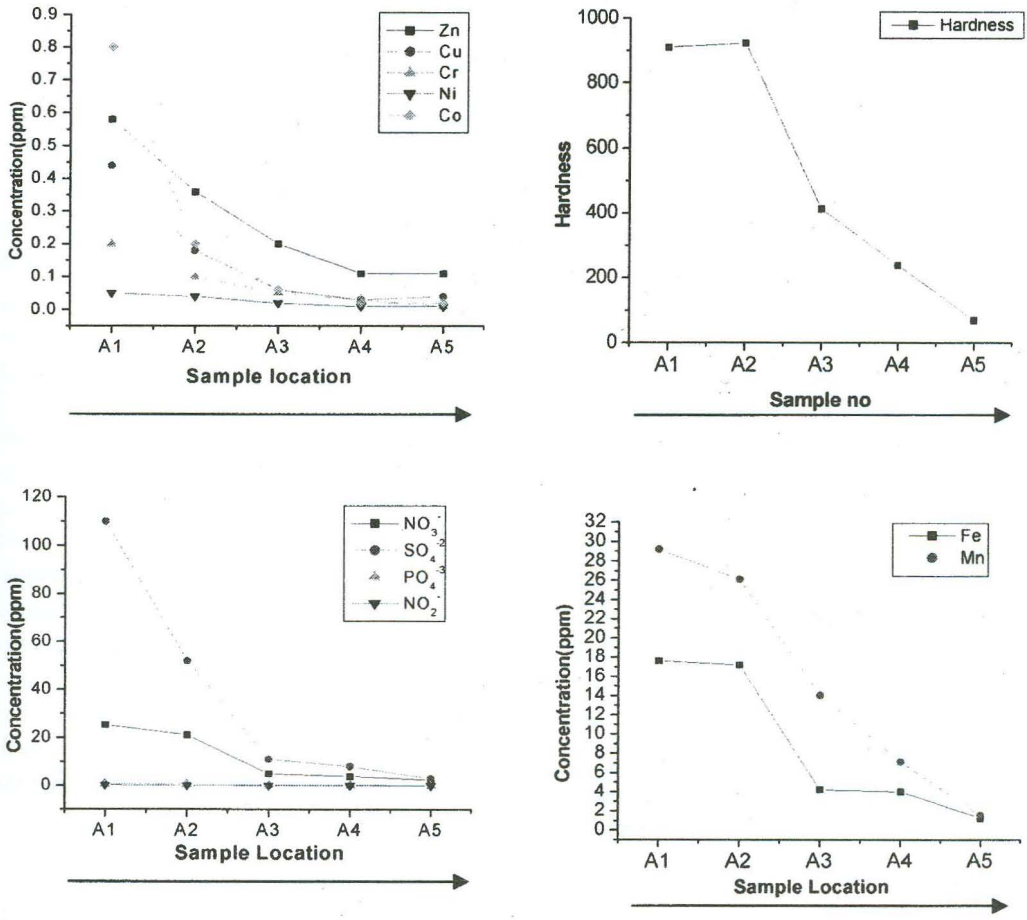
Methodology

The leachate was periodically sampled at nine different locations of the landfill site.Groundwater samples were collected from augur holes at eight different locations. Four water samples were obtained during both wet and dry seasons in order to observe any seasonal variation of the water quality of the nearby dug well. Soil samples were taken at a depth of 20 cm using augur at 6 different locations, from the same locations where the water samples were collected by auguring. Based on the results of this study, leachate and groundwater were physically and chemically characterized and soil samples were chemically characterized. Parameters measured were pH, sulphate, nitrate, nitrites, phosphates, heavy metals (Pb, Zn, Ni, Cr, Co, Fe, Mn, Cu) and major cations (Na, K, Ca, Mg).

Results and Discussion

Leachate of the Gohagoda landfill is most likely in methanogenic phase, which has the pH value of 7.9. The average concentration of NO_3^-,SO_4^{-2} PO_4^{-3}, Zn, Cu ,Fe, Mn, Cr, Ni and Co in leachate are respectively 14.5 mg/L, 18.7 mg/L, 6.9 mg/L, 1.7 mg/L ,1.69 mg/L, 15.2 mg/L, 1.14 mg/L,0.11 mg/L ,0.36 mg/L, and 0.26 mg/L. Most parameters in the leachate exceeded the permissible limit required for treated wastewater discharge.

The concentrations of most of the measured parameters of water samples obtained from augur holes closer to the landfill are the highest and exceed the WHO permissible limits. The groundwater quality improves with the increase in distances of the sampling point away from the landfill site (Figure 1). It can be concluded that the leachate has a significant impact on groundwater quality around the Gohagoda landfill site.



Distance increase from the landfill site towards the Mahaweli River

Figure 1. Variation of ground water quality parameters along the profile from the landfill site towards the river (Along the groundwater flow direction)

However, almost all parameters measured in Gohagoda water intake reservoir is within the WHO standards required for the drinking water and does not poses any significant threat to water quality. This is a good indication to conclude that the effect of the existing solid waste disposal site for the upstream intake of Kandy water supply project is almost negligible under existing conditions. Higher concentration of elements and nutrients in the samples collected during rainy days (than during dry season) may be due to the enhanced leaching of material by rain water which facilitates the migration of pollutants towards the groundwater body (Figure 2).

Soils of the study area are contaminated with excess Cu, Fe and Mn. However, there is no definite pattern of the variation of heavy metals in soils along the profile towards the river.

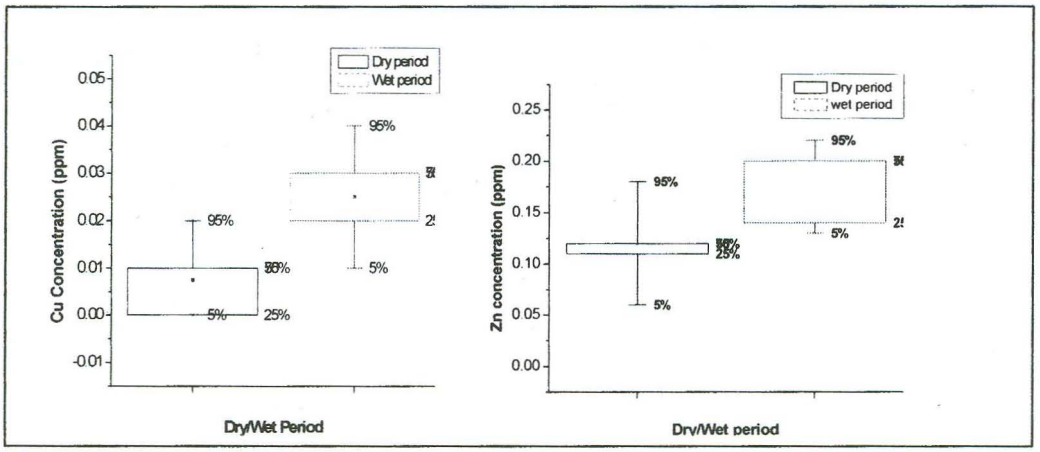


Figure 2. Box plots of Cu and Zn concentration of well water for dry and wet period

Conclusions

As the groundwater samples obtained from the vicinity of the landfill site is seriously affected by the leachate, proper remedial measures should be undertaken at the earliest. Covering the landfill by an impermeable clay layer or impermeable liners made of geotextiles would reduce the amount of rainwater percolate and thereby reduce the amount of leachate generated. However, the leachate seeping should be collected at the bottom area and properly treated before discharging into the stream or river. A leachate collecting tank can be constructed closer to the area where liquid waste disposal tank is located.

Proper monitoring procedure should be implemented to assure the quality of the discharging effluent. Increasing the evapo-transpiration rate by providing vegetation cover above the landfill site also can be recommended to control further groundwater contamination.

References

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