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INVESTIGATION ON CONTAMINATION OF SURFACE AND SUB SURFACE WATER SOURCES DUE TO SOLID WASTE DUMPING AT GOHAGODA, KANDY

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INTRODUCTION

Solid Waste Management and disposal is an alarming problem encountered by many of the urban and industrial areas in developing economies in Sri Lanka and has become one of the primary environmental issues. Inadequate waste management and disposal practices combined with the climatic influence such as high rainfalls result in increasing the environmental problems especially for water resources.

Open dumping of solid wastes is practiced extensively in Sri Lanka because it is cheap and requires less attention. Despite the degradation of valuable land resources and creation of long-term environmental and human health problems, uncontrolled open dumping is still prevalent in most part of the country, which indeed desperately needs an immediate action due to the associated harmful impacts.

Open dumping of solid waste can cause detrimental impacts to groundwater, surface water, soil and air. Runoff from a dumping area can contaminate surface water bodies nearby. Waste contact liquid from municipal solid waste is considered as leachates and can be generated from the dumping area. Therefore this study was aimed to investigate surface water pollution due to Gohagoda open dump site.

LOCATION AND THE DESCRIPTION OF THE SITE

The Municipal Solid Wastes (MSW) generates from City Kandy, is presently dumped in the Gohagoda Solid Waste dumpsite, by the Mahaweli River, the main water source for the city. The Gohagoda landfill (dumpsite), which use at present is about 32 acres in extent, however only about 16 acres have been used recently. Surface area of the landfill is about 4 acres and a few numbers of workers are employed for the maintenance work by the Kandy Municiapl Council (Jayanath, 2003). In years 2002 - 2003, the landfill was modified using a development grant awarded from JICA (Japan International Cooperation Agency), to increase its capacity allowing dumping for a few more years (Werellagama & Samarakoon, 2007).

Figure 1- Generated Leachate

Gohagoda dumping site causes water pollution and also cause accumulation and slower water flow in many drainage channels and provides breeding places for disease vectors such as rats and mosquitoes.

Apart of that, during rainy periods, the runoff water takes solid waste from those dumping locations and adds pollutants to natural water bodies such as Mahaweli River. The rotten waste

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produces leachates, which eventually pollute the groundwater and surrounding surface water bodies. Generated leachate shown in the Figure 1.

Landfill leachates generally characterized as a water-based solution of four groups of contaminants such as dissolved organic matter, inorganic macro components, heavy metals and organic compounds such as halogenated organics. Most of the above are toxic and cannot be removed by using general treatments. The annual average rainfall of the Gohagoda dumping site is around 2500 mm. Though the main rainfall season is South-West monsoon, during the Inter-monsoonal seasons, thunderstorm showers are frequent in this area which increases production of leachate. Therefore, the situation gets worse, since leachate goes along a drain and mixes with water in Mahaweli River, which is resource of Greater Kandy Water Supply System.

METHODOLOGY

The topography of the area was identified by using contour maps and places are selected for boreholes. The water table around the site was monitored by using selected boreholes and shallow or deep wells. The rainfall and temperature variations of the area were recorded from the Department of Metrology.

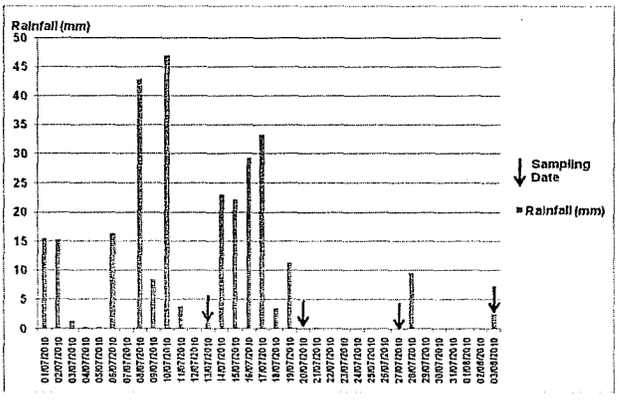

Figure 2. Rainfall during months June and July 2010 at Gohagoda, Kandy

SAMPLING LOCATIONS

Ground water was collected from the shallow wells around the area surface water and leachate was collected from various places at the dump site area. Table 1 shows details of sampling location. Samples were collected weekly during the month July. Notations W, R, L and TW are used to indicate well, river, leachate and tube well respectively.

Temperature, pH, Total Dissolved Solids, Conductivity and Dissolved Oxygen were measured in-situ. Laboratory tests were carried out for Nitrate, Nitrite, Phosphate, and Sulphate by using Spectrophotometer (HACH DR/2010).

RESULTS AND DISCUSSION

Current rainfall from July to August 2010 and arrows indicate the dates of sampling as shown in the Figure 2. Figure 3 shows those concentrations of selected water quality parameters (nitrite, nitrate, conductivity and phosphate) of surface water and shallow wells near dumping site. With the rainfall intensity the concentrations of nitrate, nitrite phosphate and conductivity increases and therefore it can be envisaged that the rainfall affects to the changes of water or leachate quality.

Contamination levels of selected parameters in leachates, shallow wells and Mahaveli River is given in Table 1. The contamination levels are given with reference to the desirable level of the permissible potable water quality stipulated by SLS 614-1 (1983). The results clearly showed that the most of the instances, the water quality has contaminated with the said pollutants. Hence, this study provided evidence of generation of leachates by percolating rainwater contain run-off of organic and inorganic compounds resulting in the contamination of soil, surface, and groundwater.

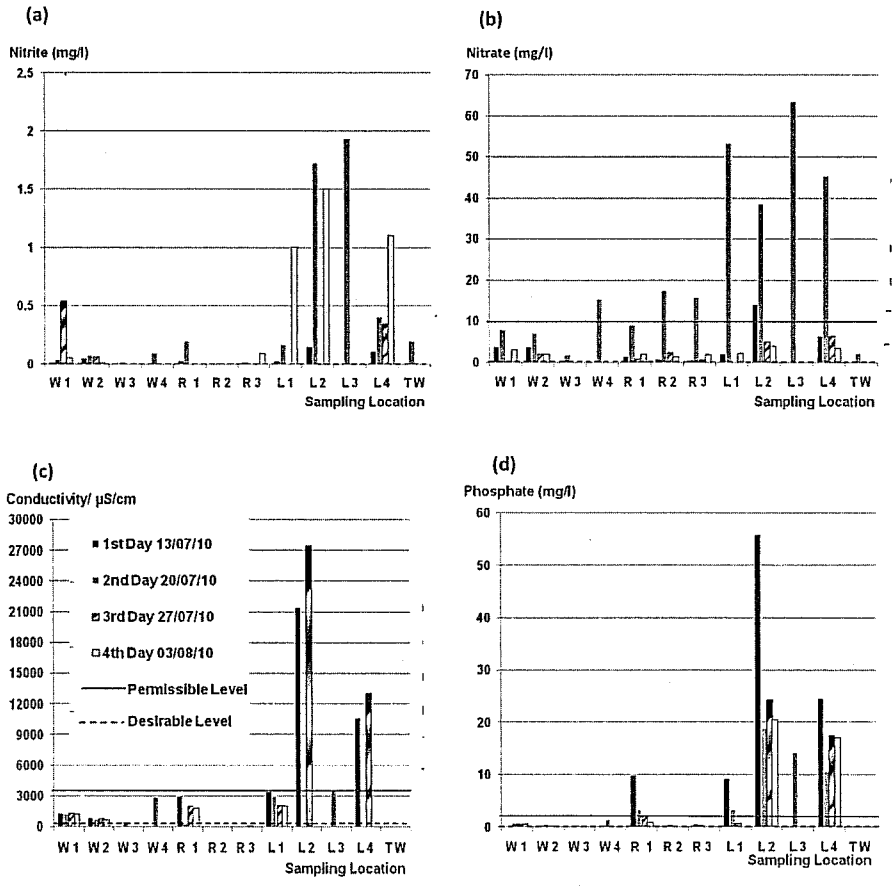

Figure 3. Concentrations of selected water quality parameters of surface and subsurface water near dumping site (a) Nitrite; (b) Nitrate; (c) Conductivity; (d) Phosphate *(W-well, R- River, L-Leachate, TW-Tube well)*

Soil contamination through direct contact of waste or leachates or uncontrolled release of methane by anaerobic decomposition of waste, and spreading of diseases by different vectors like birds, insects and rodents are also a serious issue presently.

Parameter	Contamination Level		
	Leachate (L)	Well (W)	River (R)
pH	Low	Low	Low
Conductivity	High	Medium	Low
TDS	High	Medium	Low
Colour	High	High	High
Nitrate	High	High	High
Nitrite	High	High	Medium
Sulphate	Low	Low	Low
Phosphate	High	Medium	Medium

High - Higher than the permissible level
Medium - Higher than desirable level and lower than permissible level
Low - Lower than desirable level

Table 1 – Contamination levels of selected water quality parameters

Groundwater pollution originating from open dumping is badly affected to the aquifers and unable to use this water for people who live around this area. There are few septic tanks to unload gully suckers of the area. The capacity of septic tanks available at the site is insufficient and at present they are being dumped directly to the dumping site. Hence the sewage is discharged directly to the dumping site. These excess of sewage is discharged directly to the surface water and part of it infiltrate into the groundwater.

Further, toxicity to aquatic life and cows may be related either to acute or chronic effects on the organisms themselves or to humans by biological accumulation *through food chains.*

Considering the above facts, it is envisaged that the Gohagoda dumping site needed an urgent rectification to protect surrounding surface and groundwater resource in order to protect public in the city of Kandy.

CONCLUSIONS

According to the test results it can be concluded that the water and leachate around the Gohagoda dump site area is highly contaminated. Hence leachate treatment is very essential to minimize the contamination of water around the area. Therefore hydrological design for leachate treatment is very essential to minimize the contamination of water around the area.

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