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Quantification of solids and analysis of isolated fractions of humic substances at Gohagoda landfill leachate, Kandy

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Abstract

Unplanned Municipal Solid Waste (MSW) dumping is a serious problem in Sri Lanka especially because it contributes to water pollution as contamination by leachate. Humic Substances (HS) are highly toxic compounds and precursors of numerous chlorination by-products. To understand the role of HSs in water chemistry, it is necessary to isolate sufficient amounts of fractionated DOC. Limited data availability on DOC and suspended solids aggravates many difficulties in environmental studies. Present study was focused on quantification of solids and analysis of DOC fractions at landfill leachate in Gohagoda, Kandy.

Collected leachate samples from four locations (one sample per each as GS1, GS2, GS3 and GS4) of the drainage channel were analyzed for TS, TSS, VS, VSS, TDS, SS and TOC. They were collected once per two weeks basis for a period of three months. A leachate sample (GS5) was obtained from the main dumpsite for analysis of DOC based on the Walkley and Black method. Humic acid (HA), fulvic acid (FA) and hydrophilic fraction (Hyd) were separated, purified and characterized using both general and advanced techniques.

Parameters of TS, VS, TDS, SS, TOC and DOC showed high concentrations closer to the dumpsite however values were decreasing towards Mahaweli River in downstream. This indicates dilution, settling and degradation of organic material spatially. In HS, Hyd accounted for about 58% while FA and HA constituted about 26% and 16% respectively. Results from CHN analysis showed higher oxygen, O/C, H/C, N/C and lower carbon, hydrogen contents in Hyd than others. These results obtained as high inorganic salt content in Hyd. FT-IR characterization proved that more acidic groups and aromatic character present in FA and HA than Hyd. However, Acid base titration yielded similar concentrations of strong acidic groups for HA and FA fractions. E_4/E_6 ratio was highest in FA as lowest molecular weight compared with HA and Hyd. The situation of Gohagoda leachate reveals that it constitutes high DOC and solids which causes a threat to the nearby water source of Mahaweli River.

Keywords: Municipal Solid Waste, Dissolved Organic Carbon, Humic Substances, Total Organic Carbon