

DISTRIBUTION OF HUMIC SUBSTANCES IN A LEACHATE TREATMENT PLANT

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1. Introduction

Dissolved Organic Carbon in landfill leachate is formed by anaerobic and aerobic degradation of organic waste in landfills. A high content of DOC in environment may represent a risk because of its ability to form complexes with heavy metals, their influence on some contaminant's behavior by its participation in redox-process and its capacity for binding hydrophobic organic contaminants. After investigating landfills of varying ages and locations, it had been found that 4 to 44% and 7 to 72% of DOC in Leachate belongs to humic and fulvic acid respectively (Nanny et. al., 2001).

The aim of this research is to investigate the distribution of humic substances in different landfill leachate and analyze their composition. Therefore, the results could give us an idea of the amount of humic substances that is removed during the leachate treatment process and the amount of humic substances that may return to the environment.

2. Materials and Method

The research plan is to extract humic substances from (a) Different landfill leachate samples (MSW + MSWI residue), which include both dissolved part and suspended solids; and (b) Treated leachate sample. The extraction procedure for humic substances was done following the International Humic Substances Society (IHSS)'s method. After the extraction, Elemental Analysis is done for every sample extracted. Figure 1 shows the basic procedure for leachate treatment in a wastewater treatment plant. RLB and RLH are leachates from sites mainly landfilled garbage during 1977-1988 and 1973-1976 respectively. RLF is a leachate from a site landfilled with MSWI ashes and crushed incombustibles since 1988 until now.

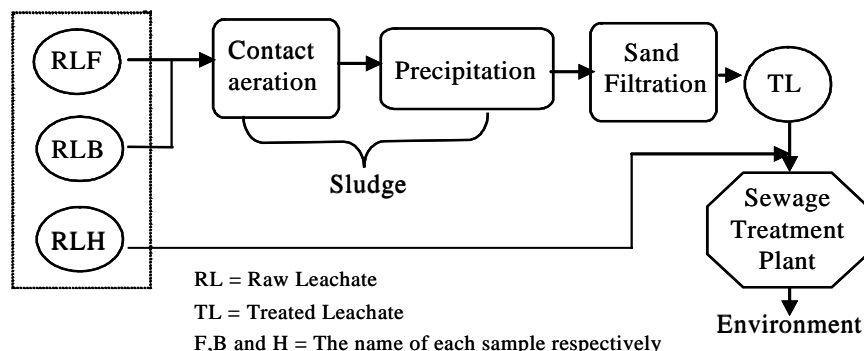


Fig.1 Leachate Treatment Procedure in a Wastewater Treatment Plant

3. Results and Discussions

Figure 2 shows the quantity of humic and fulvic acid extracted for each sample. Then, the concentration is calculated both for humic and fulvic acid, and with a simple addition the concentration of the total humic substances can be calculated.

For almost all of the samples, during the extraction process, most of the humic acid was lost because of its low concentration in the raw leachate samples. Therefore, in order to estimate the content of humic acid, TOC was measured from the HCl wash process wasted sample, then the carbon content for the humic acid can be calculated.

The different content of humic substances can be noticed, if we compare RLB with the other samples. The explanation for this content may be revealed when

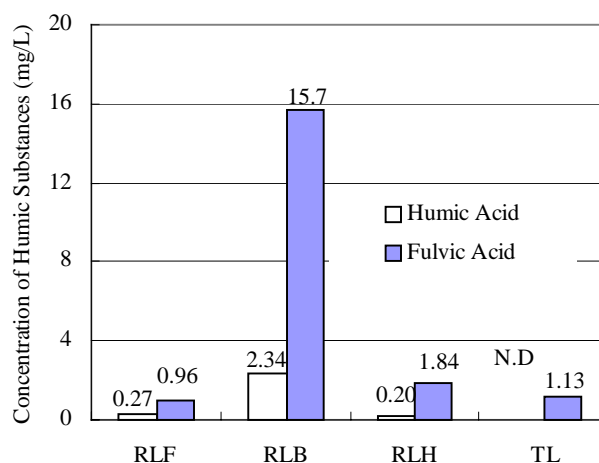


Fig. 2 Concentration of Humic Substances in samples

investigating the origins of each sample. RLB (1977~1988) and RLH (1973~1976) come from older landfills, which are already closed, compared to RLF (1988~Now). Also the characteristics of the landfill should be considered. RLB's landfill is composed of MSW and MSWI ashes, RLH's landfill is composed of just MSW and RLF's landfill is composed of MSWI ashes and crushed incombustibles.

Figure 3 shows the distribution of humic substances in the dissolved part and suspended solids in RLB. In the dissolved part, humic and fulvic acid represents 13 and 87% respectively of the total humic substances. In the suspended solids humic and fulvic acid represents 76.5 and 23.5% respectively of the total humic substances.

Previous analysis provided information about the total organic carbon (TOC) of the raw samples and the carbon content for the humic and fulvic acid extracted. With this information we calculated the contribution (%) of humic substances to the total organic carbon in each raw leachate. The results presented in figure 4 shows us that the humic substances from RLF, RLB and RLH represents 12.9%, 5.8%, 9.8% respectively of their total organic carbon.

Comparing the results with the content of humic substances in some lakes and rivers in Japan investigated by other researchers, we can say that the content of humic substances extracted from the treated leachate are similar to the results shown by Amano et al., (2004) for the content of humic substances of some rivers in Japan (from 0.17 to 1.57 mg/L), but differs from the content of humic substances in the lake Biwa shown by Kodama et. al., (2003) (from 0.143 to 0.177 mg/L).

4. Conclusions

Comparing the results obtained with literature data, humic substances contribution to the total organic carbon in RLB and RLH respectively, is low, taking in consideration their landfill ages. Although RLF's landfill is still operating, compared to RLH and RLB's landfills which are already closed, the concentration of humic substances in RLF is low compared to RLH and RLB, because of its composition. Comparing liquid part and suspended solids of leachate, the content of humic acid in liquid part is lower than the fulvic acid, but in suspended solids the content of humic acid is higher than the fulvic acid. Humic substances in treated leachate stills remains after the treatment process. Content of humic substances in treated leachate are in the same range to content of humic substances of rivers in Japan, but this contents are high if we compared it with the content of humic substances of lake Biwa in Japan.

References

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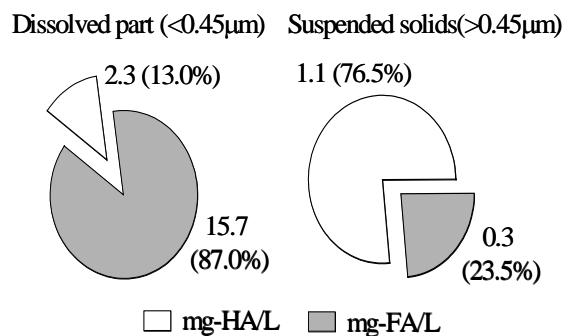


Fig. 3 Distribution of HS in dissolved part and suspended solids in RLB

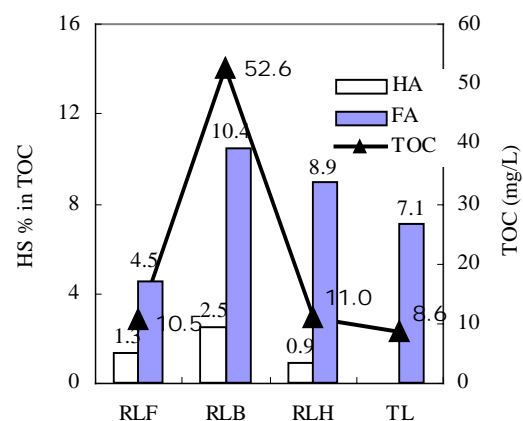


Fig. 4 Contribution of Humic Substances to TOC in Leachate