HUMIC SUBSTANCES IN LEACHATE FROM MSW AND MSWIR LANDFILLS OF DIFFERENT AGES

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1. Introduction

The variability in the composition of leachates, in which a variety of organic pollutants and heavy metals are included, makes them a potential hazardous for the environment. In landfills disposed with municipal solid waste (MSW) and municipal solid waste incineration residues (MSWIR), humic substances (HSs) are commonly formed and it is known that HSs have the ability to bind with heavy metals, adsorb hydrophobic organic pollutants and migrate out the landfill with the leachate[1),2)].

The leaching behavior of different components from the landfill site is not completely clear due to the several factors that influence the characteristics of leachate such as: the landfill's waste composition, pH, moisture content, age of the landfill, climate and many more. Considering that a complete knowledge of the composition of landfill's leachate and its variation are required in order to assess landfill's stabilization and for the design of an efficient leachate treatment process, this study was focused on clarifying the effect of the landfill's waste composition and age over the leaching out of HSs in a landfill site.

2. Materials and Method

Raw leachates (F, B, H, I and N) were taken in December 2005 and February 2006 from T and S wastewater treatment facility respectively, located both in F city. The composition of the waste landfilled as well as other characteristics of each landfill are shown in Table 1. It can be noticed that leachates N and F are discharged from landfills, which are on operation and are mainly disposed with MSWIR. Leachates B and H are originated in old landfills (17 and 29 years respectively had past since their closure) and are mainly disposed with MSW. Finally, leachate I is discharged from a landfill closed 6 years ago and is mainly disposed with MSW, MSWIR and others such as crushed incombustibles, construction waste, etc.

After sampled, DOC concentration (TOC-V, Shimadzu co.) was analyzed in all raw leachates and HSs were extracted from filtrated leachates and suspended solids (SS) following the isolation procedure of aquatic HSs implemented by the International Humic Substances Society (IHSS), shown in previous study[3)].

3. Results and Discussions

The statistical data of COD in raw leachates taken from T and S facilities[4)] (Figure 1), showed that while leachates from landfills containing mainly MSW (B and H), had an initial high COD concentration in 1995 which gradually decreased with time; leachates from landfills containing MSWIR (I, N and F), had an initial low COD concentration, which remained stable in time due to the landfill's low organic matter content. It can be noticed that leachates from mainly MSW landfills had higher DOC concentration compared with leachates from landfills disposed with MSWIR.

The HSs extraction results (Figure 2) also showed correlation with the statistical COD concentrations. Leachates B and H from landfills with mainly MSW had higher HSs concentrations (13 and 6.2 mg/l respectively) compared with leachates from landfills containing MSWIR

Table 1. Landfills Characteristics

Landfill sites		B	H	I	N	F
Wastes Composition (%)	MSW	70	59	29	3	0
	MSWIR	29	13	26	62	60
	Others	1	28	45	35	40
Landfill period		1977～1988	1973～1976	1975～1999	1996～now	1988～now
Landfill type		Semi-aerobic	Anaerobic	Semi-aerobic	Semi-aerobic	Semi-aerobic

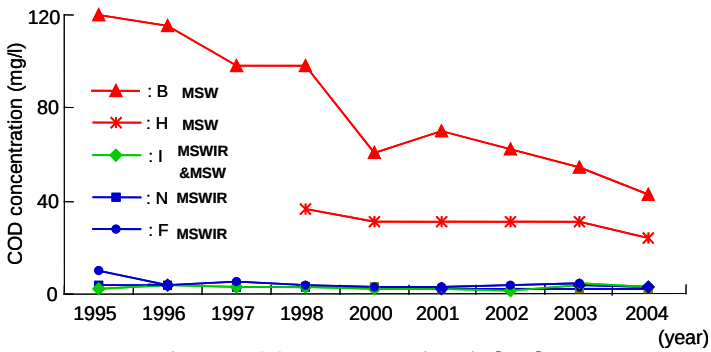

Figure 1. COD concentrations in leachates

Key words: Humic substances, Landfill's leachate, MSW, MSWIR

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(I, N and F), which had lower concentration of HSs (1.5, 0.5 and 3.2 mg/l respectively). Moreover, when leachates with same waste composition were compared, it was noticed that older leachates contained lower HSs concentrations.

The HSs' carbon in DOC of leachates is shown in Figure 3. It can be noticed that although leachates from landfills with mainly MSWIR (N and F), had low concentration of HSs (0.5～1.5 mg/l), this little amount represents 22～23% of the DOC in leachate. In leachates B, H and I, HSs's represents 20.4, 5.3 and 9.4 % of the DOC in leachate.

Considering SS as part of leachate, HSs were extracted from SS in order to clarify the content of HSs in the SS of leachate. Figure 4 shows the distribution of HSs in filtrated solution and SS in leachates. It can be noticed that while in leachates B and H from mainly MSW landfills, 8～22% of the HSs extracted was contained in SS (>0.45μm), in leachates I, N and F from landfills containing MSWIR, a significant 36～42% of the HSs were found in the SS. As well as the waste composition, the landfills' age should also be used to explain the higher content of HSs in SS from leachates I, N and F, compared with the contents in leachates B and H; landfills N and F are still on operation and fresh waste is still being disposed.

The present investigation was focused only in two main factors that influence the leaching of HSs in landfills, nevertheless; also other factors might have strong influence over the HSs concentration in leachate such as the rainfall and temperature.

4. Conclusions

The waste composition strongly influence over the concentration of HSs in leachate. Also the landfill's age influences over the concentration of HSs considering that in time the concentration tend to decrease because of the degradation of HSs. In SS, HSs also can be founded, especially in SS from leachates originated in landfills with MSWIR content. When the characteristics of raw leachate are being studied, because of its influence over the concentration of HSs it is important to consider as well the climate conditions such as rainfall and temperature.

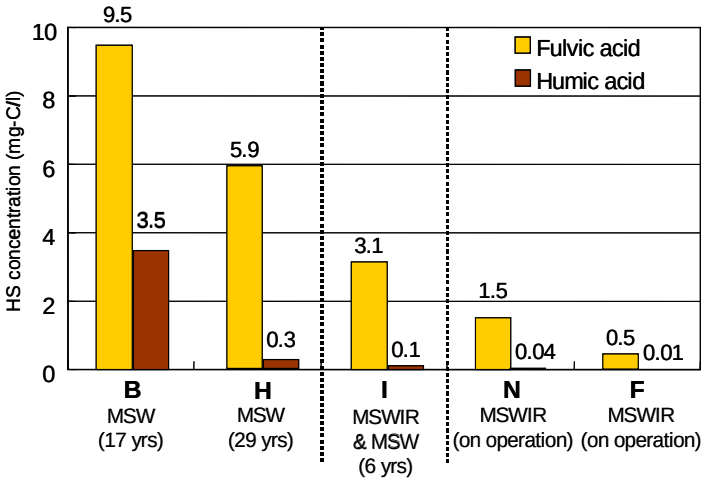

Figure 2. HSs' concentration in leachates

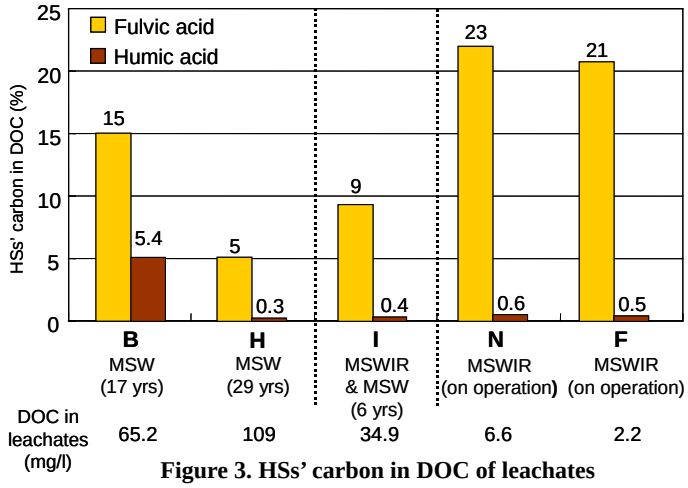

Figure 3. HSs' carbon in DOC of leachates

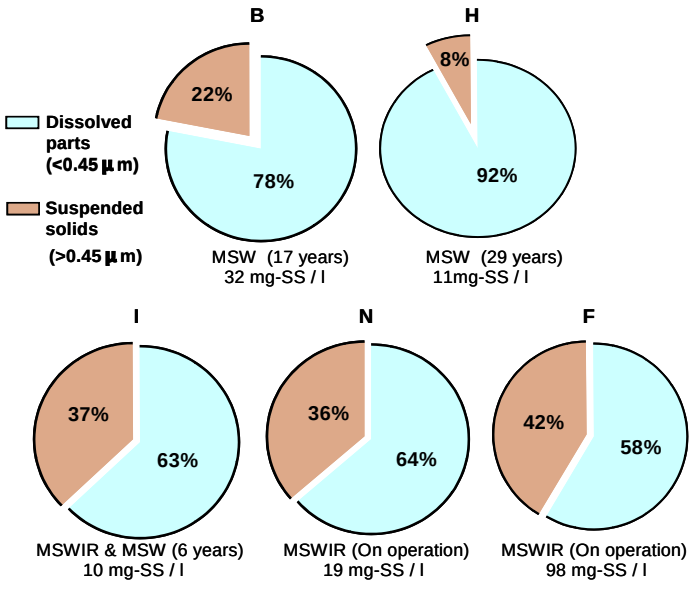

Figure 4. HSs' distribution in leachates

References

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