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HEAVY METAL MOBILITY IN INCINERATOR ASH COASTAL LANDFILL

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In Japan, coastal areas are being utilized as landfill sites due to limited inland space. The landfill sites located in coastal areas commonly use natural marine clay layers as bottom liners. Heavy metals possess biological toxicity, therefore ensuring their containment within the landfill liner is crucial. The conditions that propitiate the natural attenuations process of heavy metals in landfill clay liners depends on factors such as the pH, Eh, Total Organic Carbon (TOC), microbial activities, and certainly, on the waste material that generates the leachate. These factors can change in the long term affecting the containment and attenuation process of heavy metals within the landfill.

A comprehensive evaluation of the environmental impact of heavy metals from landfill sites will require a deep understanding of the attenuation functions of the waste layers. The characteristics of the leachate coming into the clay layer will depend on the performance of the waste layer. Consequently understanding the effects of pH, Eh, TOC and microbial activity on the heavy metal mobility in the incinerator ash layer is of great significance.

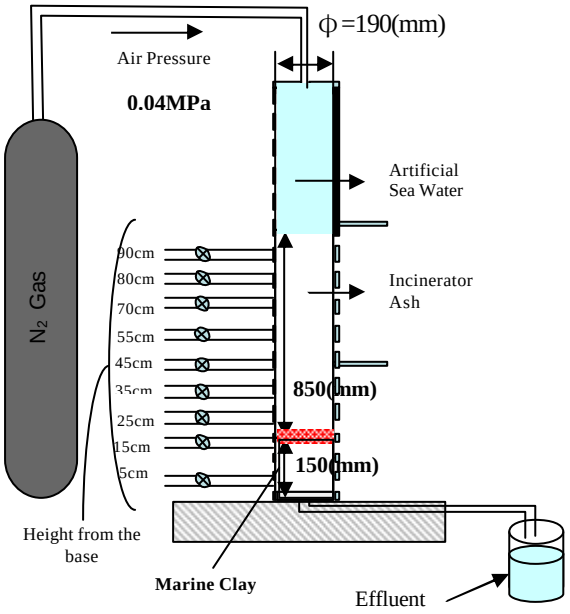

Figure 1. Scheme of experimental set up.

This study investigates the mobility of heavy metals, in particular Zinc, in the incinerator ash layer of a coastal landfill site. A big column test was carried out during 345 days to evaluate the relationship between pH, Eh, TOC and microbial activities with the mobility of heavy metals within the incinerator ash layer (Figure 1). To study the Zinc mobility, artificial sea water was run through the column. The Zn concentration in the influent solution was enhanced and $NH_4H_2PO_4$ and Na_2S0_4 were added to favor reduced conditions.

Along the waste layer, conditions varied through time, from the surface to the bottom. At the surface level pH values below 7 were reached, while at the bottom, alkaline conditions remained through the experiment (Figure 2). Eh dropped dramatically during the first month but then slowly, started increasing along the waste layer. The increase took place at a faster pace at the top than at the bottom of the layer.

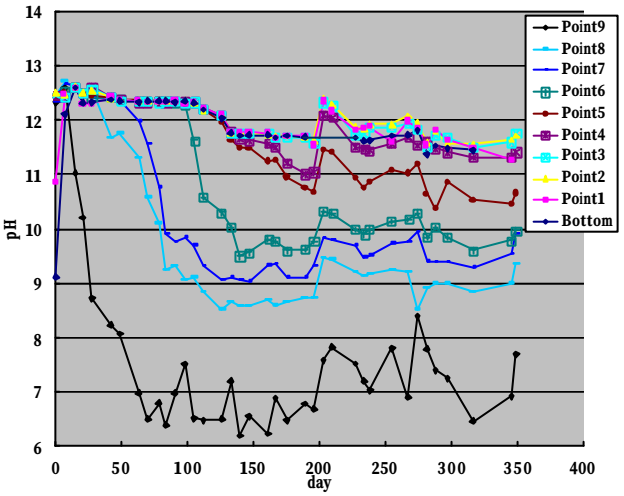

Figure 2. pH variations in big column test.

It was observed that solubilization of Zn was influenced directly by pH since concentration of Zn^{+2} in the effluent were only detected when pH was around or below 7.

Test result show that the mobility of heavy metals is mainly control by pH and Eh, and that the microorganisms play a minor role in the process. The increase in sulfide concentration might favor the heavy metal precipitation. After 7 months the values of pH and Eh stabilized at levels where Zn^{+2} were not detected, however those values are close to the limits where solubilization is expected. Consequently slight changes in the conditions of a coastal landfill might trigger solubilization of heavy metals.