Investigation on the carbonation-humification of incineration residue and its effect on the leaching behavior of pollutants

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The ideal method for treating or disposing of incineration residue is to restore it to the natural environment by stabilization, reduction and degradation of inorganic and organic pollutants. The stabilization of pollutants means having no potential to spread, which involves the fixation of metals by carbonation and clay formation, and the stabilization of organic material by humification as shown in Fig. 1. The authors call this the *carbonation-humification process*, to distinguish it from simple carbonation by aging. As inorganic and organic substances may attach to the mineralogical structure through this process, the leachability of pollutants are expected to decrease.

In this study, we investigated the possibility of *carbonation-humification* of incineration residue through observations of the microstructure by SEM, and through extraction and identification of humic substances. We also confirmed its effect on the leaching behavior of pollutants by several leaching tests. The samples used in this study were incineration residues excavated from lysimeters 5 to 7 years from filling. The lysimeters were filled with (1) only fly ash, (2) only bottom ash,

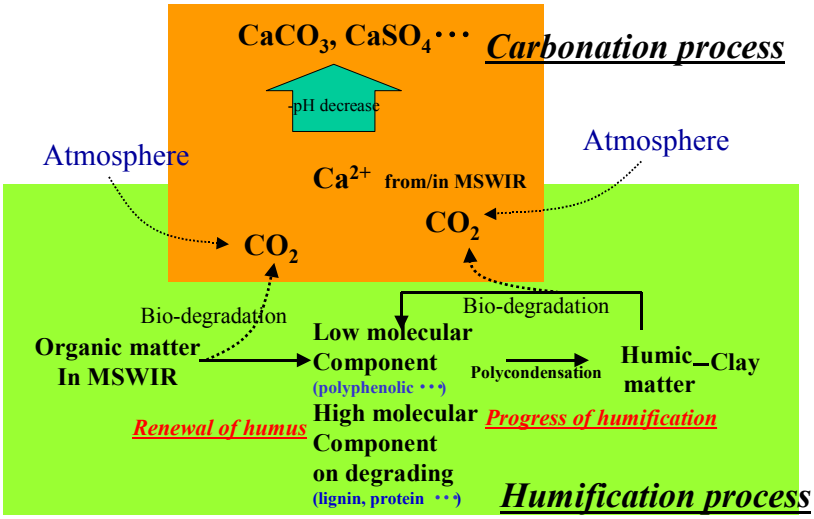

Fig. 1. Image of *Carbonation-Humification Process*

(3) mixtures of fly ash and bottom ash, and (4) mixtures of fly ash, bottom ash and 5% compost of municipal solid waste. We sampled in different layers of all lysimeters, and conducted all the experiments mentioned above.

From the results of extraction and qualification of humic substances, the top layers, which were from the surface to a depth of 50-70 cm, had no odor of incineration, and contained some roots of weeds, and so the layers contained a lot of humic substances compared with the other layers judging from the color and optical characteristics of extracts. Especially, humification of the lysimeter filled with a little compost had progressed through all layers, not only the top layer. Thus, some quantity of organic matter such as compost appeared to have accelerated the humification of incineration residues.

We also observed changes around a particle of samples by SEM and EDS. The small particles filled with compost was surrounded with organic-rich matter, while that without compost was surrounded with calcium-rich matter resulted from incineration residue. This provided evidence of *carbonation-humification* on the sample with compost.

From the result of leaching tests, the leaching concentrations of Ca, Cl, Na, and K from top layers of lysimeters contained compost of 5% were very low comparing to those from the other layers. However, Pb and dioxins were leached somewhat highly from the layers, differently to the expectation that the leachability might decrease with progression of the carbonation-humification. As one of the reasons, at this stage, we guessed the dissolved organic matter such as dissolved humic matter formed in the process of humification had enhanced the leachability of dioxins.

In the long run, we will apply all of the results in this study to accelerated mineralization technology (AMT), which is a new kind of technology for utilizing incineration residue and simultaneously prolonging the life of landfill sites.

Questions

Is the result contradictory to the initial research design? Is there any method to reduce the leachability of pollutants from relatively advanced *carbonation -humification* layer?

Is there any possibility that HOPs are leached again for humification progressed in landfills for long time later?

How about the stability of pollutants in residues not containing compost?