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Waste incineration ash could prove a valuable resource

Italian researchers have demonstrated low-cost techniques which may transform fly ash produced by Municipal Solid Waste Incineration from hazardous landfill into potentially the world's fifth largest raw material resource. The initial results have prompted European Commission funding for a demonstration project under LIFE+[1].

Municipal Solid Waste Incineration (MSWI) reduces the volume and weight of society's waste, generating electricity as a useful product. As with power generation by coal burning, the process results in fly ash (airborne ash, as opposed to bottom ash left in the burner).

MSWI ash composition varies with the waste input, but contains valuable earth elements, such as silica, aluminium, iron, calcium, as well as bromine and chlorine salts. It also contains heavy metals (principally lead and zinc, but also cadmium, chromium, copper, mercury and nickel) making it a hazardous waste material. Fly ash could also be used to improve the qualities of cement. However, the possibility of metals leaching into the environment and of corrosion from the high salt content means that fly ash is currently not used and it is largely sent to landfill.

For use as a resource, the hazardous elements in fly ash must be made safe. Possible treatments include diluting with blast furnace slag, washing, solidification with binders, or thermal treatment and vitrification (turning it into glass). However, none can be a 'final' treatment and all generate more waste.

The new research explored the use of colloidal silica to convert fly ash into a safe substance. Samples of ash from a range of sites in France and Italy were suspended for one hour in wetted silica solutions before being dried into a powder known as COSMOS. Leaching tests were then carried out on both raw ash and COSMOS samples.

Leaching of zinc was far lower from COSMOS and no lead leaching could be detected. Vanadium, arsenic and selenium were also effectively made safe. The soluble salts could be washed out from COSMOS (after metal stabilisation) which means both the salts and the COSMOS would become available as secondary resources.

MSWI ash is pH 12 and contains large amounts of electrolytes (chlorides, metals and calcium compounds including sulphates), which create favourable conditions for conversion into COSMOS that can be effectively and safely reused, for example, to make cement. It would also reduce the exploitation of natural resources. The process could also be used to treat coal fly ash produced by coal-fired power stations.

In addition, carbon dioxide is sequestered during COSMOS production. The researchers suggest that, as an added benefit, this could have implications for trading in carbon credits.

1. LIFE+ 2008 project ENV/IT/000424: www.cosmos.csmt.eu

Source: Bontempi, E., Zacco, A., Borgese, L., *et al* (2010) A new method for municipal solid waste incinerator (MSWI) fly ash inertization, based on colloidal silica. *Journal of Environmental Monitoring.* 12: 2093-2099.

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