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New incineration-waste clean-up method brings resource and carbon benefits

Ash from waste incineration can be made safer simply by mixing it with rice husks, water and other forms of waste ash at temperatures under 100 °C, according to new research. Once dried, the end product not only locks away toxic metals lead and zinc, but also stores carbon. Furthermore, it can be used in the polymer industry to lower costs, improve polymer properties and reduce the use of natural resources.

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Municipal Solid Waste Incineration (MSWI) produces fine particles of ash, known as fly ash. This hazardous waste is generally landfilled and the search is on to find more sustainable ways of managing this waste.

The new technology for managing fly ash proposed by this Italian study is inexpensive, highly available and effective at detoxifying MSWI, its developers claim. They say it could help meet the objectives of the EU's Waste Framework Directive, which prioritises re-using and recycling waste materials over disposal. The technology was developed under the EU LIFE+ project, COSMOS-RICE[1].

In their method, MSWI fly ash is stirred for an hour with water and a small amount of rice husk ash. Rice husk, a waste product of low commercial value, is a natural source of silica, a material known to stabilise metal contaminants, i.e. it fixes them into a safe form. Globally, around 130 million tons of rice husks are produced – and then burnt – each year.

Some flue gas desulphurisation residue (gathered by filters in industrial flues to improve air quality) and fly ash from coal burning are also added to the mix, to improve the final product's strength and carbon storage.

Importantly, no raw materials are needed; all ingredients (except the water) are waste products. Furthermore, the rice husk ash is added directly; silica does not need to be extracted from husk ash as a pure ingredient for this stabilisation process, as in earlier trials. Avoiding the extraction step is major progress as the process is energy-intensive and requires toxic chemicals.

The mixture is then dried out at room temperature to form a solid substance which can be used to make construction materials, such as plaster and tiles. The researchers experimented with the temperature of mixing and the length of drying time to see how these factors affected the material. They found that the material was best at stabilising lead and zinc when it had been mixed at 80-100 °C and dried for about one month, compared with lower temperatures and shorter drying periods.

They also created a liquid solution from salts washed out of the material to assess how much zinc and lead the solution contained. When produced under the best stabilising conditions, the solution contained around 0.1-0.2 micrograms of zinc per litre (mg/L) and no lead. In contrast, concentrations in the solution from untreated fly ash are around 17.5 mg/L of zinc and 134 mg/L of lead.

Furthermore, stabilisation sequesters around 100 g of CO_2 per kg of fly ash. This helps reduce the process's carbon footprint, the researchers say.

1.COSMOS-RICE (ENV/IT/256) is supported by LIFE+, the EU's financial instrument for supporting environmental and nature conservation projects.