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Science for Environment Policy

Faster screening of plastic waste for harmful chemicals

A more efficient method for sorting plastic electronics waste containing harmful chemicals is proposed by a new study. The method combines two analytical techniques that together can quickly and accurately detect levels of flame retardants in plastics used by the electronics industry.

The European Restriction of Hazardous Substances (RoHS) Directive (2011/65/EU)[1], adopted in 2003 and revised in 2011, identifies bromine-containing chemicals in electrical waste as health hazards. These chemicals are added as flame retardants to a variety of products, from insulation foams and paints to plastics used in electrical items.

If products are burned or sent to landfill as part of normal waste disposal, bromine can be released into the environment. Bromine gas is toxic to humans and other animals. Although the long-term impacts of low-level exposure are uncertain, they may include effects on motor function – the coordinated control of nerves and muscles during movement.

As a consequence of the RoHS and Waste Electrical & Electronic Equipment (WEEE) (2012/19/EU)[2] Directives, recyclable plastic products containing more than 0.1% bromine-containing flame retardants by weight have to be separated from other wastes intended for recycling. However, some studies suggest that bromine levels in plastic electronics waste are above this limit.

Separation processes involve analytical methods which detect the chemical fingerprints of bromine compounds. For this study, researchers tested a new way of detecting bromine compounds in plastics. The results show that two techniques, Raman spectroscopy and X-ray spectroscopy, can be combined to quickly and cost-effectively measure concentrations of bromine-containing flame retardants.

To test their detection methods, the researchers analysed real plastic wastes from two different recycling plants. Their aim was to check whether the plants had successfully separated out plastic waste that contained bromine compounds at levels above the 0.1% limit. They calibrated their tests using reference materials – samples of plastic containing accurately measured quantities of bromine compounds.

Chemical fingerprints from analysis of the reference samples showed that X-ray spectroscopy alone could be used to estimate bromine concentrations, although with a degree of uncertainty. When the authors analysed levels in real plastic waste from the recycling plants they found that samples from one plant contained bromine levels of 0.06%, below the limit. However, levels in samples from the other plant were about ten times higher and over the limit. This suggests that the first plant had a more efficient sorting process, although the details of this process could not be revealed for confidentiality reasons.

However, because levels at the first plant were quite close to the limit the authors used the second technique – Raman spectroscopy – to improve the accuracy of their method. They say the results indicate that the combined method performed well, and that it could make a positive contribution to plastic waste management.

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Contact:
rosa.taurino@unimore.it

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1.http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/restriction-of-hazardous-substances/index_en.htm

2. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012L0019