

Abundance of brominated flame retardants in WEEE plastics and their impact on recycling targets

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Topic

Conflict between recycling goals and human & environmental health protection

Abstract

The global production of plastics has surged in recent years and reached 350 Mio. tons in 2017. The second largest producer of plastics is the EU with 64 million tons per year. At the end of the product life cycle, the increasing production of plastics causes large amounts of plastic wastes that can have serious impacts on the environment when they are not treated properly. Although, the majority of plastic products are recyclable, the recycling rates are still very low compared to other recyclables. For this reason, the EU adopted the Circular Economy Package to stimulate higher recycling rates. Within the waste plastic stream, in the EU the highest recycling rates have been achieved for plastics from packaging with an average of 40 %, while the plastics from waste electrical and electronic equipment (WEEE) end up almost exclusively in the energy recovery or landfills and only 3-5 % are recycled. This difference originates from the recycling landscape for WEEE that is regulated by two EU directives. First, the WEEE Directive (2012/19/EU) imposes different recycling rates for the WEEE device categories ranging mostly between 65 - 75 %. Second, the Directive on the restriction of the use of certain hazardous substances in EEE (RoHS; 2002/95/EC), which limits the abundance of certain hazardous substances in EEE products. In the case of waste plastics from WEEE, these two directives are counteracting and thereby producing a conflicting situation for recycling. Plastics in EEE is often exposed to temperatures stresses and contain for safety reasons different flame retardants, which can be hazardous when disposed improperly. For this reason, the use of brominated flame retardants (BFRs) is limited to 0.1 wt.% by the RoHS directive since 2006. This limitation incentivises plastic recycling companies to separate plastic from the rest of the WEEE waste stream. Even though many plastics parts from WEEE do not exceed the RoHS limit are generally treated as hazardous materials and therefore not recycled.

In our present study, we analysed 9 different device types, comprising categories of IT&T, small and large household appliances, selected by their representativeness in the consumer basket and high plastics share. The devices were dismantled to more than 1000 plastic samples were analysed by handheld X-ray fluorescence (hXRF), which is a non-destructive and rapid method. We show the heterogeneity of BFR concentrations in WEEE device types and their relation for the RoHS limit. The results allow a selection of certain device classes and components capable for recycling.