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DEVELOPMENT OF A SELECTION SYSTEM BASED ON HYPERSPECTRAL IMAGING FOR PLASTIC WASTE WITH BROMINATED FLAME RETARDANTS

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Abstract

Brominated flame retardants (BFRs) are used in different types of products such as plastic, textiles and electronic circuits with the aim to increase fire resistance and to avoid or to delay the propagation of accidental combustion. However, high concentrations of bromine in waste from electrical and electronic equipment (WEEE) hinder the possibility of their use as secondary raw materials. Furthermore, the possibility that BFRs can be released during mechanical recycling processes, imposes the need for *ad hoc* separation processes through an appropriate selection system.
In order to adopt solutions based on the circular economy, it is necessary to develop an efficient strategy for selecting plastic waste containing BFRs from waste flow addressed to recycling. In this perspective, the use of a rapid and non-destructive technique, such as hyperspectral imaging (HSI), represents a powerful solution for the identification and to perform quality control of plastics waste. The study aims to develop a new methodology based on HSI in the short-wave infrared range (SWIR: 1000-2500 nm) coupled with chemometrics and X-ray fluorescence analysis in order to discriminate plastic waste with BFRs into two classes (low Br <2000 mg/kg and high Br> 2000 mg/kg) in agreement with the limits recommended by technical specification for WEEE. The promising results achieved suggest that this methodology may be applicable for the separation of plastics containing BFRs in recycling plants.

Keywords: hierarchical PLS-DA analysis, Plastic recycling, SWIR hyperspectral imaging, X-ray fluorescence

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