Determination of Some Hazardous Elements in Plastic Materials by EDXRF Spectrometry

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Polyethylene is a type of plastic heavily used in packaging sector. It is followed by polyethylene terephthalate, polypropylene, polystyrene and polyvinyl chloride, respectively. Additives are incorporated into plastics to alter and improve the basic mechanical, physical or chemical properties and quality of plastics. Metals and nonmetals are added to plastic materials with additive compounds such as described above. Owing to these substances, many properties are given to the plastic. For example, catalysts in plastic production, flame retardants, antimicrobial reagents, plasticizers, heat stabilizers including Pb and Cd, dyes and pigments can be given. There is some legislation related with these substances in products. A new one of them is published by Turkey Environmental and Forest Ministry in 24 June 2007 in official newspaper (issue: 26562). This legislation name is Waste Packaging Control Regulation. Initially, this legislation has restricted the sum of Cr (VI), Cd, Pb, and Hg to below 250 ppm in packaging material for two years since publication date. After three years, this limit will be reduced to 100 ppm. Increasing production of plastic materials and new legislation require to improvement of the accuracy and precision of analytical methods applied to the plastic material research.

In our study, Cr, Cd, Hg and Pb were determined by Energy Dispersive X-Ray Fluorescence Spectrometer (EDXRF) in the polyethylene (PE) bags which are different colors and daily used. Homogenization problems are solved by means of xylene which is suitable organic solvent for PE. Calibration curves also prepared using xylene solvent in order to match matrix effects. The detection limits obtains for development analytical produce were 1 mg kg⁻¹ for Cd, Hg and Pb, 2 mg kg⁻¹ for Cr. The validation studies were performed either using by analysis of ERM-EC 681 polyethylene reference material or Atomic Absorption Spectrometer (AAS) results. Different sample preparation steps were compared with using recovery values.