

Food Packaging: Testing Methods and Applications (ACS Symposium Series)

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ORIGINAL PAPER

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Studies on the usability of recycled PET for food packaging applications

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Abstract The need of and opportunities for recycling of plastics for food packaging have been recognized, and a lot of work to find meaningful and cost-effective solutions to this issue is in progress. The safety of recycled plastics for food contact use is largely dictated by the ability of post-consumer contaminants to absorb into recycled materials and later diffuse from recycled plastics into the food. The objective of the present study was to establish a suitable analytical approach to identifying and quantifying any chemical substances that derive from the earlier use and remain in the polyethylene terephthalate (PET). A simple gas chromatographic technique using flame ionization detection was developed to allow quantification of solvent extractable compounds in a series of recycled PET samples. Identification of the nature and extent of contaminants in the PET samples was also attempted using GC/MS analysis.

Keywords Recycled polyethylene terephthalate · Food packaging materials · Gas chromatography analysis · Contaminants

Introduction

Under the influence of environmental considerations, plastics' recycling is a growing economic activity. The need to open up new channels for discarded packages has stimulated the recycling of plastics to produce new packaging materials. Such technical processes are being developed for the most widely used polymers: polyolefins, polystyrene, polyvinyl chloride and polyethylene terephthalate (PET) [1].

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Plastic food packaging materials manufactured from waste food packaging raise concerns about safety and organoleptic quality. The contamination problems for recycled plastics from contact with non-food products affect plastic containers [2, 3].

Considerable progress has been made from a scientific point of view in the understanding and physico-mathematical modeling of diffusion processes of adventitious hazardous compounds from a recycled plastic in direct contact with food. The central question concerning the reuse of recycled plastics for food packaging is the lack of knowledge about the components present in the recycled materials such as pesticides or household products, which could migrate from the package into the food [2, 4, 5, 6].

There exist neither in the US nor in Europe any regulations or directives for the use of recycled plastic materials for food packaging. In the last few years the FDA has developed an informal guidance document entitled "Points to consider for the use of recycled plastics in food packaging: chemistry considerations". The guideline separates post-consumer contaminants into four broad groups based on volatility and polarity. By this guideline polymers should not impart more than 0.5 ppb of any contaminant to the food supply. This critical cutoff has come to be known as the "threshold of regulation" [5, 7]. In the EU, only article 2 of the framework directive 89/109/EEC can be applied which requires very generally that the consumer's health must not be endangered.

PET is widely used for packaging of beverages, as it is more resistant than other types of plastics to CO₂ permeation losses. It is a low diffusivity plastic (i.e. it doesn't allow severe penetration of organic compounds into the plastic) and is the most promising polymer for reuse as a food packaging material. In 1993, 450 million pounds of post-consumer PET bottles including 40% of all carbonated soft-drink bottles were recycled in the USA. The 1993 recycling rate of plastic packaging was 6.9% with PET at 28% [8, 9].

Concerning PET recycling two main processes are currently applied:

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