

## CSIR-CFTRI handed over the final report on PET evaluation to PACE

CSIR-CFTRI had conducted a study with respect to 'Evaluation of PET bottles for migration studies for food contact applications' for PET Packaging Association for Clean Environment (PACE), New Delhi and the Final Report was handed over by DG-CSIR in a brief function held at CSIR HQs. Recently.

The study involved the following work components:

### a. Compositional Analysis of PET

Polyethylene terephthalate (PET) is made from PTA, IPA and MEG employing Antimony oxide/trioxide as catalyst. To ascertain the composition of PET bottles, commonly available in India, this analysis was carried out. In this investigation, composition analysis of PET with respect to monomers (constituents of PET), other small molecules (e.g. aldehydes, phthalate), copolymers and heavy metals has been carried out by employing NMR, FT-IR, DSC and ICP-OES techniques using robust analytical protocols.

This composition analysis on the PET bottles revealed the following:

- a) PET bottles are made of copolymers of polyethylene terephthalate and polyethylene iso-phthalate having a ratio of 100:1.
- b) Free monomer and oligomers were not detected by NMR spectral technique (detection limit of 400 MHz NMR: 1ppm).
- c) Phthalates, BPA and aldehydes were not detected by NMR spectral technique (detection limit of 400 MHz NMR: 1ppm).
- d) Metal analysis results carried using AOAC-985.01-1988 method indicated that antimony occurs in the range 33.2–124 mg / kg in PET.
- e) Other metals studied were below their detection limits (LOD = 0.001 mg/kg), thus below the permissible limits.

### b. Migration Analysis from PET

In this study, experiments on migration were carried out according to EU10/2011. Accordingly, various simulants were employed for extractions under different temperature and time conditions as prescribed therein. The simulants were analysed after diligent baseline checks and using scientifically established analytical protocols.

The results clearly indicated that the migration, if any:

- a) of heavy metals (antimony, arsenic, barium, cadmium, chromium, cobalt, lead, mercury, selenium and zinc) was below their detection limits (BDL) of 0.001 mg/kg.
- b) Phthalates (Benzyl Butyl phthalate, Dibutyl phthalate, Di-2- (ethylhexyl) phthalate, Diisodecyl phthalate, Diisononyl phthalate, Di-n-octyl phthalate) were found to be below the detection limits. The detection limits for BBP, DBP, DEHP, DIDP, DINP and DNOP were 3, 0.3, 0.5, 5, 5, and 0.5 mg/kg respectively.
- c) Free monomers (terephthalic acid & isophthalic acid, ethylene glycol), and Bisphenol-A were also found to be below their detection limits. The detection limits for TPA, IPA, EG & BPA were 1.0, 1.0, 2.0 and 0.02 mg/kg respectively

### c. Endocrine disruption due to PET packaging

There is a widespread belief that consumption of contents stored to PET bottles may cause adverse effects including general toxicity and disruption of endocrine systems. The overall

aim of this work component is to assess the implications of contents (water) stored in PET bottles. To investigate whether PET bottles contribute to Endocrine Disruption, water stored in PET bottles (alongside water stored in glass bottles as a reference) was administered to experimental male and female rats for 30 days and 60 days and effects on their blood hormone levels were measured by enzyme linked immunosorbent assay (ELISA). The experimental male and female rats exhibited comparable blood hormone levels when given water stored in PET bottles and glass bottles under same test conditions. Thus, water stored in PET bottles did not cause any Endocrine Disruption activity.

However, the results observed in the laboratory animal models need to be measured with utmost care while extrapolating to human subjects.

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