

Component 1: Testing the composition of the PET bottles

STUDIES ON THE COMPOSITION OF PET BOTTLES

EXECUTIVE SUMMARY

Polyethylene terephthalate (PET) is widely employed packaging material for drinking water and other applications. 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 isophthalate having a ratio of 100:1.*
- b) Free monomers 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.*

Component 2: Testing the leaching tendency of PET bottles

MEASUREMENT OF LEACHATES FROM PET BOTTLES INTO STANDARD SIMULANTS

EXECUTIVE SUMMARY

In this component of the project, experiments on migration were carried out according to Regulation (EU) No. 10/2011. 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 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- (ethyl hexyl) 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) Bisphenol-A was below its detection limit of 0.02 mg/kg.*
- d) Free monomers (terephthalic acid & isophthalic acid and Ethylene Glycol) were also found to be below their detection limits. The detection limits for TPA, IPA and EG were 1.0, 1.0 and 2.0 mg/kg respectively.*

THUS, ALL SPECIFIC MIGRATIONS OF HEAVY METALS (INCLUDING ANTIMONY), PHTHALATES, BPA AND MONOMERS WERE NOT ONLY BELOW THEIR PERMISSIBLE LIMITS (AS PER EU 10/2011) BUT EVEN BELOW THEIR DETECTION LIMITS.

Component 3: Testing the endocrine disruption potential of PET bottles

**STUDIES ON THE ENDOCRINE DISRUPTION ACTIVITY
FROM PET BOTTLES**

EXECUTIVE SUMMARY

Endocrine disruption results in the dysregulation of hormones leading to potential health complications. 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), a sensitive immunological assay used Internationally.

The results are summarized below:

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.