




# Method development for determination of migrated phthalate acid esters from polyethylene terephthalate (PET) packaging into traditional Iranian drinking beverage (Doogh) samples: a novel approach of MSPE-GC/MS technique

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## Abstract

In the current study, a novel magnetic solid phase extraction (MSPE) technique combined with a gas chromatography/mass spectroscopy (GC/MS) was developed to determine the phthalate ester content of bottled Doogh samples. Doogh is a yogurt-based drinking beverage, which is frequently consumed in Middle East and Balkans. It is produced by stirring yogurt in Chern separation machine and consists of substances such as water, yogurt, and salt in addition to aqueous extracts of native herbs. The magnetic multi-walled carbon nanotubes (MWCNT-Fe<sub>3</sub>O<sub>4</sub>) were used as adsorbents of phthalate acid esters (PAEs) due to a superior adsorption capability of hydrophobic compounds. In this context, the quantity of the extractable migrated phthalate esters (dibutyl phthalate (DBP), dimethyl phthalate (DMP), butyl benzyl phthalate (BBP), diethyl phthalate (DEP), di-N-octyl phthalate (DNOP), and bis (2-ethylhexyl) phthalate (DEHP)) from polyethylene terephthalate (PET) bottles into Doogh samples was measured. The correlation between the concentration of migrated PAEs and some factors such as the type of Doogh (gaseous and without gas), difference in brand (five brands), volume (1500 and 300 mL), and the storage time also was investigated. The migration level into Doogh samples was increased by incorporating of gas as well as increasing the volume of PET bottles. Also, with elaborating of storage time, the migration of some phthalates such as DEHP (the mean from 2419.85 ng L<sup>-1</sup> in the first week to 2716.15 ng L<sup>-1</sup> in the second month), DEP, and total phthalate was increased. However, no significant difference in concentrations of migrated phthalate esters among different examined brands was noted. Finally, the concentration of migrated PAEs from bottle into all the examined Doogh samples was below the defined standards by EPA; 6 µg/L for DEHP in drinking water.

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