

Determination of Some Phthalic Acid Esters in Saliva Simulant by Gas Chromatography Mass Spectrometry After Activated Carbon Enrichment

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Phthalic acid esters (PAEs), commonly known as phthalates, are low molecular weight synthetic organic molecules added to the polymer resin in order to improve its properties such as flexibility, extensibility and processability. PAEs have widespread use a variety of household and consumer products such as; PVC, toys, personal care products. Due to both their low molecular weight and only physically bonding in polymer matrix, PAEs leach out from materials and pollute their surrounding environment. The migration of phthalates from consumer products, especially, toys for children and childcare articles, has received considerable attention in recent years. The exposure of children to PAEs from these products could occur by ingestion, by dermal contact or both. These compounds and/or their metabolites are of interest because of their possible roles as carcinogens, endocrine disruptors, peroxisome proliferation, mutagenic activity and infertility [1]. For these purposes, the PAEs contents of the plastic toys and direct food packaging materials must not exceed the total concentration, specific migration limits (SMLs) and tolerable daily intakes (TDIs) specified by regulations [2]. Taking into account all these considerations, it is necessary to development of sensitive and reliable analytical methods to analyze not only total amounts of PAEs in materials, but also migration of phthalates from materials.

In our study; determination of six phthalate esters were achieved in saliva simulant by GC-MS after activated carbon enrichment. PAEs were dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP), butyl benzyl phthalate (BBP), bis (2-ethylhexyl) phthalate (DEHP), di n-octyl phthalate (DnOP). Central composite experimental design was introduced to optimize the extraction parameters such as pH, absorption time and activated carbon amount. Optimum conditions were found 2, 30 min, 0.08 g for pH, absorption time and activated carbon amount. The method detection limits were found to be 6.7, 10.1, 12.9, 24.9, 14.6, 22.3 $\mu\text{g kg}^{-1}$ for DMP, DEP, DBP, BBP, DEHP and DnOP, respectively. Horizontal agitation method was applied to extraction of PAEs to saliva simulant for 2 hours at 37°C. The optimized method was applied to the analysis of different kinds of toys and bis-2-ethylhexyl phthalate was the sole analyte detected in these samples. In addition; possible PAEs hydrolyses was monitored by ultraviolet-visible spectrometry (UV-Vis) at 230 nm wavelength for different pH.

References

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- [2] EC, Commission Directive 2002/72/EC of 6 August 2002 relating to plastic materials and articles intended to come into contact with foodstuffs, Off. J. Eur. Union L 220 (2002) 18–58. Last amended by Commission Directive 2007/19/EC on 30 March 2007.