IDENTIFICATION OF POTENTIAL MIGRANTS IN FOOD PACKAGING AND SUBSEQUENT QUANTIFICATION IN THE CONTAINED FOOD

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INTRODUCTION

In the food packaging industry, plastic materials are commonly used due to their well-known properties such as flexibility and low-cost, among others. These packaging materials can transfer chemical compounds into the food which may affect not only the safety but also the quality of the packaged food.

From the food safety point of view, it is generally accepted that low molecular weight substances (< 1000 Da) are an issue of concern since they can be absorbed through the gastrointestinal tract and could represent a risk for the consumers' health.

In this work, the potential migration of chemicals from the plastic food packaging into the food was investigated. A total of seven samples of fatty dry foods including snacks based on cereals and cookies were selected and analyzed.

MATERIALS AND METHODS

IDENTIFICATION IN THE FOOD PACKAGING

In a first step a GC-MS screening of an extract of the packaging was performed in order to identify potential migrants.

Column	ZB-5MS (30 m x 0,25 mm x 0,25 µm)
Carrier gas	Helium 1 mL/min
Injection	Splitless mode
Injection volume	1 µL
Tª program	Initial temperature: 40 °C/ 2 min 9 °C/ min to 300 °C for 3/ 10 min
Data acquisition	m/z range of 30-500
Mass detector	Electron impact
Detector Tª	300 °C
Transfer line Tª	300 °C
Spectrum library	Wiley 8th & NIST/EPA/NIH 11 Mass spectral library

Table 1: Experimental conditions of GC-MS method.

QUANTIFICATION IN THE CONTAINED FOOD

In the second part of the work, the packaged foods were analyzed by LC-MS using electrospray ionization (ESI) in positive mode.

EXTRACTION PROCEDURE

- 1 g of pooled and homogenized sample + 10 mL of acetonitrile
- Vortex shake 2 min + sonication for 15 min
- Centrifuge for 10 min at -5 °C at 3500 rpm
- Freeze the supernatant of the three sequential extracts together
- Centrifuge for 20 min at -5 °C at 3500 rpm
- Concentration in a rotatory evaporator at 50 °C to 0.5 mL
- Add 0.5 mL of methanol + 50 µL of internal standard (DEP-d)
- LC-MS analysis

Column	Kinetex Biphenyl 100 A (100 mm x 3 mm x 2,6 µm)		
Mobile phase	A: water acidified with 0.1 % formic acid B: methanol acidified with 0.1 % formic acid		
Injection volume	10 µL		
Flow rate	400 µL/min		
Gradient elution	Time (min)	% A	% B
	0.00-1.00	30	70
	10.00-15.00	0	100
	15.50-21.00	30	70
Nebulizer Gas	Nitrogen		
Collision Gas	Argon		
SRM (Collision energy)	BP: 183.1>77.2 (29 V); DEP: 223.1>149.1 (17 V); DBP: 227.2>149.0 (19 V); DEP-d: 227.2>153.1 (17 V); DIBP: 279.2>149.0 (20 V); ERU: 338.4>321.4 (10 V); OCT: 362.2>232.0 (20 V); DNOP: 391.3>149.0 (20 V); DEHP: 391.3>149.0 (24 V); ATBC: 403.2>129.0 (24 V)		

Table 2: Experimental conditions of LC-MS method.

RESULTS AND DISCUSSION

A great variety of substances were detected in the food packaging including phthalates and other plasticizers as acetyl tributyl citrate (ATBC), diethyl phthalate (DEP), diisobutyl phthalate (DIBP), dibutyl phthalate (DBP) and bis(2-ethylhexyl) phthalate (DEHP), di-n-octyl phthalate (DNOP); slip agents as erucamide (ERU); photoinitiators as benzophenone (BP); and UV filters as octocrylene (OCT).

	Regression line (mg/L)	R^2	LOD (mg/L)	Concentration (mg/kg)
DEP	Y=1.759X+0.0247	0.9998	0.005	0.1262-0.8890
BP	Y=12.888X-0.0755	0.9998	0.010	0.0321-1.4621
DIBP	Y=3.5438X+0.2643	0.9981	0.025	<LOD-0.2270
DBP	Y=4.5643X+0.1313	0.9998	0.050	<LOD-0.1272
ATBC	Y=11.296X+0.0417	0.9999	0.0025	0.0331-0.1000
ERU	Y=10.176X+0.2702	0.9999	0.050	0.2746-0.6490
OCT	Y=4.6118X+0.6185	0.9977	0.050	<LOD-0.2347
DEHP	Y=17.025X+1.4562	0.9996	0.050	<LOD-0.0527
DNOP	Y=22.615X+0.2531	0.9999	0.005	<LOD-0.0641

Table 3: Parameters of linearity and sample concentrations.

The proposed method showed an adequate linearity and acceptable recoveries (> 73.2 %).

Benzophenone was found in 43 % of the analyzed samples; among the phthalates DEP was found in almost all samples, whereas DNOP was only found in one sample.

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