CANS IN CONTACT WITH INFANT FORMULAS: IDENTIFICATION OF POTENTIAL MIGRANTS

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INTRODUCTION

Food packaging may be considered as a source of contamination because their components can be transferred from the packaging into the packed food affecting their safety and quality. This fact is undesirable and had raised many concerns, particularly to vulnerable groups like infants. Since milk and dairy products are the main components of pediatric nutrition, there is a special interest to evaluate this type of matrices [1].

In this work, several infant formulas (growth milk and continuation milk) packed in cans, were analysed. A screening approach based on gas chromatography with mass spectrometry (GC-MS) was applied to simply and rapidly determine the identity of potential migrants in the packaging through the solvent extraction technique. Moreover, as epoxy resins are used as internal surface coating for food cans, the presence of bisphenol A diglycidyl ether (BADGE) and bisphenol F diglycidyl ether (BFDGE) was checked by high-performance liquid chromatography with fluorescence detection (HPLC-FLD). The type of coating material was tentatively identified by IR.

MATERIALS AND METHODS

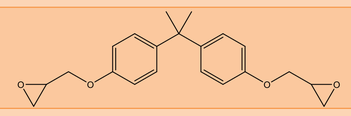
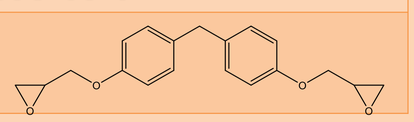
EXTRACTION PROCEDURE

THE CAN

- A known surface of the container was extracted with 250 mL of acetonitrile
- Stored during 24 h at 70ºC

THE LID

- A piece of the lid (of known surface area) was extracted by immersion in 25 mL of acetonitrile
- Stored at 70ºC for 24 h.

Common Name	BADGE	BFDGE
IUPAC Name	2-[[4-[2-[4-(oxiran-2-ylmethoxy)phenyl]propan-2-yl]phenoxy]methyl]oxirane	2-[[4-[[4-(oxiran-2-ylmethoxy)phenyl]methyl]phenoxy]methyl]oxirane
CAS no.	1675-54-3	2095-03-6
2D Structure		

GC-MS METHOD

10 mL of the obtained solutions were evaporated using a stream of nitrogen to 1 mL and an aliquot was filtered prior GC-MS analysis. A method based on GC-MS was applied using a Trace 1300 Series Gas Chromatograph with a Trace ISQ LT mass detector and an AI 1310 autosampler.

Column	ZB-5MS (30 m x 0.25 mm x 0.25 µm)
Carrier gas	Helium 1 mL/min
Injection	Splitless mode
Injection volume	1µL
Tª gradient	40-300ºC
Data acquisition	m/z range of 30-500
Ionization source	Electron impact
Detector Tª	300ºC
Transfer line Tª	300ºC

Table 1: Experimental conditions of GC-MS method.

HPLC-FLD METHOD

9 mL of the solution was removed and made up to 10 mL with Milli-Q water. An aliquot of the solution was filtered through a 0.45 µm PTFE membrane filter and injected into the liquid chromatograph.

Equipment	HPLC Agilent Technologies
Column	KromaPhase 100 C18 (150 mm x 3 mm x 5 µm)
Flow rate	0.6 mL/min
Mobile phase	Milli-Q water and acetonitrile
Volume injection	20µL
Detection	Excitation 225 nm Emission 305 nm

Table 2: Experimental conditions of HPLC method.

RESULTS AND DISCUSSION

The GC-MS method was suitable to identify chemicals of different nature in the packaging. The results obtained, after the comparison of the sample mass spectra with available mass spectral libraries, revealed the presence of several compounds used in the polymer industry. No detectable amounts of BADGE and BFDGE were found in the samples analyzed, with a detection limit of 0.05 mg/L. Further studies will be conducted in order to evaluate the migration into the foodstuffs.

TR	CAS no	Compound Name	Can	Lid	Uses	TC
12.28	1014-60-4	1,3-ditert-butylbenzene (1,3-DTBB)	X	X	Radiolysis product of LLDPE- Irganox 1076	I
13.68	4994-16-5	4-Phenylcyclohexene	X		Byproduct during styrene-butadiene copolymerization	II
14.70	126-86-3	2,4,7,9-tetramethyldec-5-yne-4,7-diol	X		Adhesives NIAS	III
16.11	96-76-4	2,4-ditert-butylphenol (2,4-DTBP)	X	X	Radiolysis product of LLDPE- Irgafos 168	I
17.22	84-66-2	Diethyl phthalate (DEP)	X		Plasticizer	I
17.24	4098-71-9	Isophorone diisocyanate	X		Monomer	III
19.02	24157-81-1	2,6-Diisopropylnaphthalene (DIPN)	X		Impurity from recycled fibres	III
20.54	84-69-5	Diisobutyl phthalate (DIBP)	X	X	Plasticizer	I
21.06	82304-66-3	7,9-ditert-butyl-1-oxaspiro[4.5]deca-6,9-diene-2,8-dione	X	X	Antioxidant degradant	III
21.62	84-74-2	Dibutyl phthalate (DBP)	X	X	Plasticizer	I
22.47	91-76-9	Benzoguanamine		X	Used as a monomer in amino resins	III
24.37	141-02-6	Bis(2-ethylhexyl) fumarate (DEHF)	X		Monomer in adhesives and coatings	I
24.57	77-90-7	Acetyl tributyl citrate (ATBC)		X	Plasticizer	I
25.92	103-23-1	Bis(2-ethylhexyl) adipate (DEHA)	X		Plasticizer	I
26.13	119-47-1	2-tert-butyl-6-[(3-tert-butyl-2-hydroxy-5-methylphenyl)methyl]-4-methylphen (AO 2246)		X	Antioxidant	III
27.19	117-81-7	Bis(2-ethylhexyl) phthalate (DEHP)	X	X	Plasticizer	I
28.22	6197-30-4	Octocrylene	X	X	UV filter	III
29.50	111-02-4	Squalene	X	X	Oxygen-scavenging	I

Table 3: Some of the chemicals identified in the extracts of the food packaging analyzed by GC-MS.

Acknowledgement

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