



# Epoxidized soybean oil (ESBO) analyzed by PiCA Method

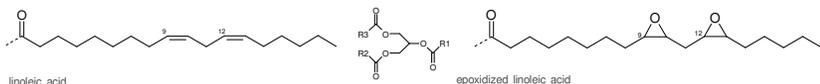
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Epoxidized soybean oil -**ESBO**- (CAS Nr. 8013-07-8) [Fig.1] is usually used as a plasticiser and scavenger of hydrochloric acid at thermal treatment of PVC. Up to 40 % ESBO is contained e.g. in the gaskets of lids or can coatings [Fig.2]. ESBO as a fatsoluble substance migrates into high fat containing food and oil. In the Commission Regulation (EU) No 10/2011

the specific migration limit (SML) of ESBO is 60 ppm (30 ppm for Babyfood) [1]. In 1999 the Scientific Committee on Food (SCF) determined a tolerable daily intake (TDI) of 1 mg/kg body weight, which was confirmed 2004 by the European Food Safety Authority (EFSA) [2,3]



linoleic acid  
Fig. 1

epoxidized linoleic acid



Fig. 2

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The analysis of ESBO is based on transmethylation and 1,3-dioxolan formation. The appropriate component fatty acid composition of ESBO is

50% diepoxidized, 26% monoepoxidized and 11% triepoxidized components [4]. We also use an internal standard which is synthesized at PiCA.

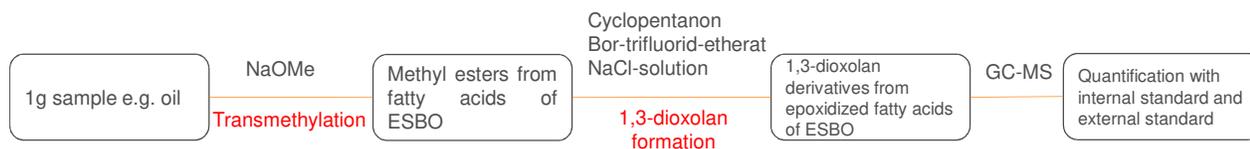


Fig. 3

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The SML of 60 mg/kg is often exceeded in food products that are stored in glass jars. They are usually sealed with gaskets made of PVC. In table 1 you see the overview of the last three years of ESBO analysis at PiCA. None of the oil samples exceeded the SML of 60 mg/kg in the last three years at our laboratory. Jar food is more often contaminated with ESBO. In the past three years 2.6% of food samples exceeded the SML. These samples were high fat products such as pesto, food pickled in oil, rillettes and hazelnut butter.

The highest amount we analyzed was 520 mg/kg ESBO in hazelnut butter. 17% of the food samples showed results between 1.3-59 mg/kg ESBO. The material samples show contents in percentage range. The highest amount was 30% in a gasket from a lid, which is used for jar food packaging. Unfortunately we had no samples of baby food to analyze ESBO and therefore no data of potential exceedances.

	total 2016	ESBO exceeded SML	total 2017	ESBO exceeded SML	Jan-Aug 2018	ESBO exceeded SML
	<b>533</b>		<b>623</b>		<b>247</b>	
oil	47	0	65	0	49	0
food	458	11	503	8	173	11
material	17	(3)	41	(4)	10	(1)
migrate (oil)	10	0	12	1	10	2
migrate (EtOH, Hac, Iso-octan)	1	0	2	1	5	0

the number in () means there is no limitation for ESBO in material

Table 1



Fig. 4



Fig. 5

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We analyze ESBO in a wide range of products. The migration of ESBO depends on how the product is packaged. The lids of the oil bottles are very small and so the contact is also small where ESBO can migrate [Fig.4]. The area of the jar food lid is significantly bigger [Fig.5]. In that case there is a higher probability that ESBO migrates into the food.

The ESBO amount in food has been relatively constant in the past few years. The TDI value is based on a toxicological assessment performed by the British Industrial Biological Research Association (BIBRA) in the late 1997. But there is still not enough analytical and toxicological data of ESBO derivatives.

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[1] Article 11 (1), FCM substance 532 of COMMISSION REGULATION (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food

[2] [http://www.efsa.europa.eu/sites/default/files/scientific\\_output/files/main\\_documents/64.pdf](http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/64.pdf)

[3] <https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2009.1391>

[4] Bueno-Ferrer, Carmen & Jimenez, Alfonso & Garrigós, Maria. (2010). Migration analysis of epoxidized soybean oil and other plasticizers in commercial lids for food packaging by gas chromatography-mass spectrometry. Food additives & contaminants. Part A, Chemistry, analysis, control, exposure & risk assessment. 27. 1469-77 1080/19440049.2010.502129