Migration testing of sealing gaskets in twist off closures – Feasibility study into the use of solid simulants in comparison to conventional simulants and baby food

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Introduction

Migration testing of sealing gaskets in metal closures for glass jars using oil or alternative solvent simulants leads to exaggerated values compared to low and medium fatty foods because of the strong interaction of the simulants with the gasket material. Such conventional testing results often in exceeding the overall migration limit and the specific one of epoxidized soybean oil (ESBO). Therefore, transitionally the limits have been increased (EC Regulation No. 372/2007). Up to now a suitable method for migration testing of sealing gasket material for those low and medium fatty food types is lacking. In a feasibility study [1] the migration of different simulants was compared to a baby food. The focus of this study was especially on solid simulants which do not interact with the gasket material e.g. the official food simulant Tenax® and a LDPE film, which was proposed by Piringer and Bransch for testing multilayer structures [2]. In addition solid phase extraction discs (SPE) have been investigated within the study.

Material and Methods

Specific migration of epoxidized soybean oil (ESBO) out of a test film made of commercial plastisized PVC gasket material was tested using solid simulants like Tenax® (modified polyphenylene oxide), LDPE film and two types of extraction disks (oil & grease, C18, Phenomenex, USA). The results were compared to specific migration into oil, *iso*-octane, 95% ethanol, *iso*-octane/*iso*-propanol (85:15 v/v) and a baby food (risotto with turkey and vegetables, 2.9% fat). Migration was kinetically measured over contact time at 40 °C up to 1 month and additionally 1 h at 100 °C into oil, baby food and extraction disks and 1 h at 60 °C into *iso*-octane to simulate pasteurization or hotfill conditions. For migration testing with the SPE discs different migration cells were used including a migration cell, which generates a defined compression by use of a spring. ESBO was determined in the simulants and the food sample according to the method described by Castle et al [3,4].

Results and Conclusion

The mixture of *iso*-octane and *iso*-propanol caused the highest migration values followed by 95% ethanol, *iso*-octane and olive oil (Figure 1). Into Tenax® and LDPE film only very low migration was found (Figure 2). Into extraction disks comparable migration values have been found in relation to the baby food (Figure 3). Pressure between test film and the oil & grease extraction disk had a high impact on the migration value (Figure 4). After solvent cleaning the extraction disks can be re-used. The use of extraction disks for simulating migration into partially fatty foods seem to be a promising alternative procedure for migration testing of sealing gaskets and sealing gasket material.

References

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[3] L. Castle, M. Sharman, J. Gilbert, *Journal of Chromatography*, **1988**, *437*, 274-280
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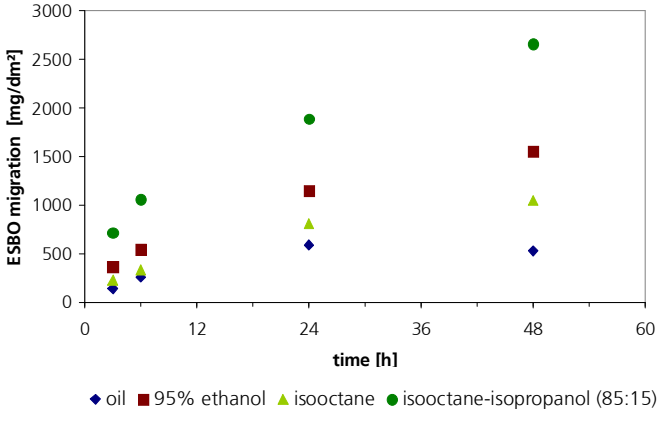

Figure 1: Kinetics of ESBO migration into oil, *iso*-octane, 95% ethanol and *iso*-octane/*iso*-propanol (85:15) at 40 °C up to 2 days contact.

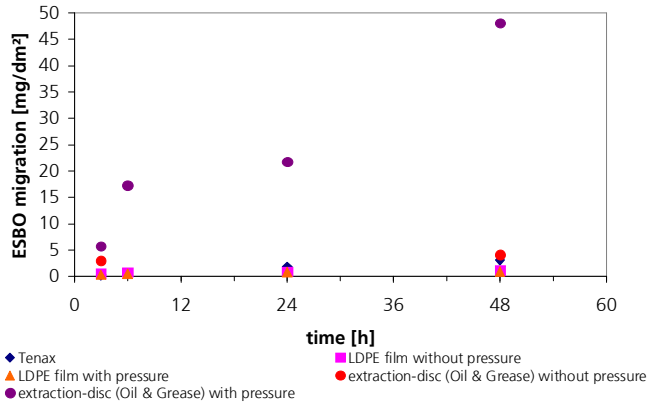

Figure 2: Kinetics of ESBO migration into solid simulants at 40 °C

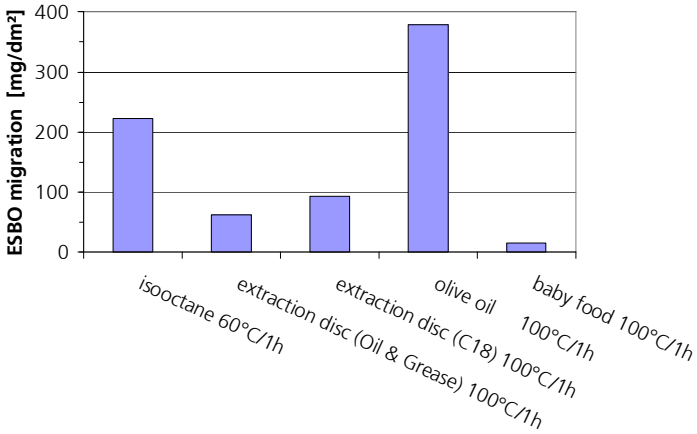

Figure 3: Comparison of ESBO migration into simulants and baby food after 1 h contact at 100 °C (*iso*-octane 60 °C)

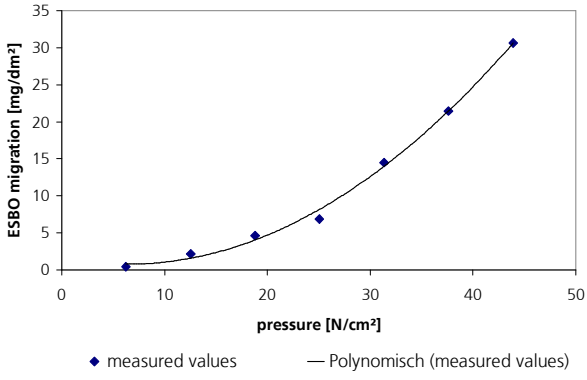

Figure 4: Pressure dependency of ESBO migration into oil&grease extraction disc at 40 °C (trendline quadratic fit)

Poster presentation at the 4th international Symposium on Food Packaging, 19-21 November 2008, Prague

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