



## Safe metal packaging for foodstuffs The swedish-polish Eureka Project E!2603 – CANBA

K. Salmén<sup>a</sup>, K-Y. Thim<sup>a</sup>, K. Rybak<sup>b</sup>

<sup>a</sup>STFI-Packforsk AB, Drottning Kristinas väg 61, Box 5604, 114 86, Stockholm, Sweden,  
kristina.salmen@stfi.se; kai-ye.thim@stfi.se

<sup>b</sup>The Polish Packaging R&D Centre, Konstancińska 11, 02-942 Warsaw, Poland, e-mail:  
rybak@cobro.org.pl

**Abstract:** Migration from epoxy based coatings to foodstuffs was paid marked attention within the EU in the period 1996 – 2001 [1]. As a result of the various activities within EU such as official control, research and various toxicological assessments the Commission issued Directive 2002/16/EEC [2]. This directive regulates the use of certain epoxy derivatives (i.e. BADGE, BFDGE and NOGE and some of their derivatives) in materials and articles intended to come into contact with foodstuffs.

Thus, the goal of the Eureka project untitled "Safe metal packaging for foodstuffs" (acronym CANBA) was to ensure compliance of BADGE migration with requirements of the EC-Directive by optimising the relation between coating chemistry and production parameters.

The high performance liquid chromatography (HPLC) method was used for the project [3]. The project has given increased knowledge and know-how about the demands that have to be put on different parts of the production chain to achieve optimal food safety. In the course of the project, the participating companies have had their products evaluated in accordance with the demands in the EU directive.

**Keywords:** Monomers, BADGE, Migration, HPLC

### 1. PROJECT CONSORTIUM AND GENERAL IDEA OF THE CANBA PROJECT

The following companies participated in the project:  
Packforsk (Stockholm, Sweden), COBRO (Warsaw, Poland), Flint Ink AB (Helsingborg, Sweden) Polifarb Cieszyn-Wrocław S.A.,(Cieszyn, Poland), G&M Lysekil AB (Lysekil, Sweden) and CAN PACK S.A FOM Pol-Am Pack (Brzesko, Poland).

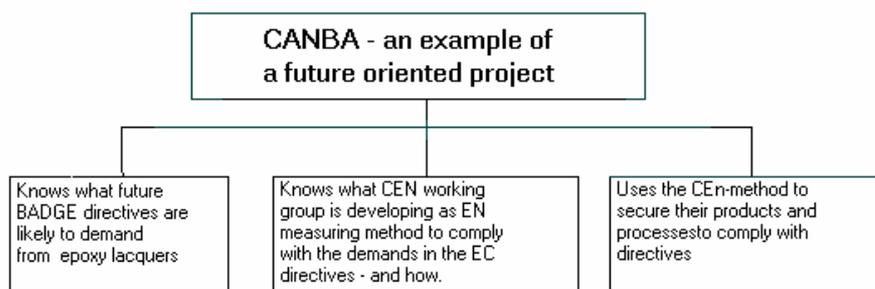


Figure 1. CANBA - A future oriented project

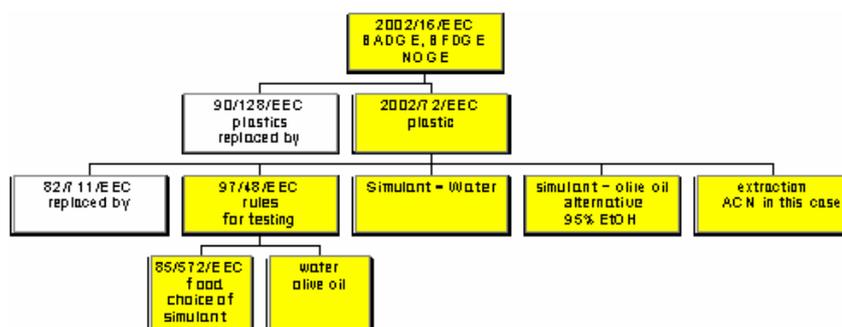


Figure 2. Directive system applicable for the CANBA project

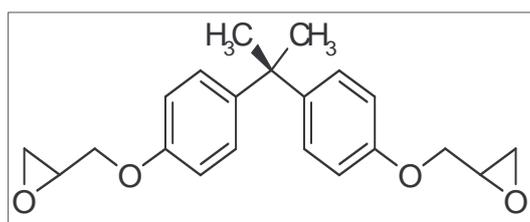


Figure 3. Chemical structure of BADGE

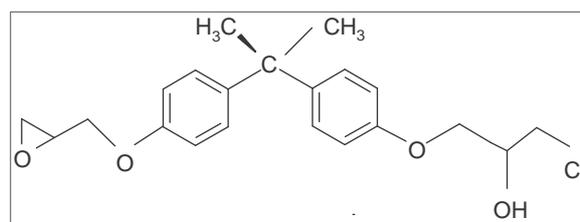


Figure 4. Chemical structure of BADGE.HCl

## 2. PARAMETERS, WHICH HAVE AN INFLUENCE ON THE DESIGN OF COATINGS AND MANUFACTURING PROCESS

The project has included the study and development of different production parameters such as chemical composition of the coating, temperature, time, and production speed in the coating and can industries, respectively. The project consortium has studied the production parameters 'in production windows' which can have a major influence on the migration of BADGE and hydrolysis-reaction products in the metal cans (Table 1). A multi-variable analysis of the main parameters in relation to the migration results and modification of the coatings developed by the coating producers participating in this project also has been done.

Combinations of these new coatings with other coatings used have been studied. The optimal production parameters for the reduction of migration of BADGE have been identified.

**Stages of choice of production parameters in the project**

- Definition of the "production window" for application of the coatings during the production process. Parameters of importance to the hardening degree of the coating and also for migration have been listed.
- Migration measurements have been made to verify whether the instructions given by the coating manufacturers to the packaging manufacturers are correct and sufficient.
- Checking whether the recommendations of lacquer producer have been implemented correctly.

The following important parameters have been studied

- *Quantity of dry coating* - DC - after hardening in the oven (g/m<sup>2</sup>).
- *Peak Time* - PT - time in the oven at the packaging manufacturer's. High PT = low manufacturing speed; low PT = high manufacturing speed. PT is the time when the substrate is exposed to the given temperature during hardening.
- *Permitted variation* of PT in the "30% production window".
- *Temperature in the oven* – T. The temperature profile of an oven might vary. Temperature variations were one of the parameters studied in connection with migration of BADGE.

Table 1.  
Project assignments

Production parameters	Test	Test	Test	Test	Test
ID- card referee	A	C	B	D	E
Hardening time [t] min.	Z-Y	Z	Z+Y	Z	Z
Temperature [T], °C	X	X	X	X-M	X+M
Coating "status"	Uh[T]	Rec. [T/t]	Oh[T]	Uh[t]	Oh[t]

**3. RESULTS AND BENEFITS OF THE PROJECT**

- All coatings studied in the CANBA project comply with the demands in 2002/16/EC. None of the studied coatings showed any migration of NOGE. As regards BFDGE the data are insufficient. Thus, they are safe to use on the markets where this directive applies.
- There was no migration to water as a simulant.
- The migration to olive oil as a simulant is lower than to 95% EtOH.
- Migration test to 95% EtOH as a simulant and extraction solvent can be used as an effective screening method of coatings, efficient and time saving.
- The amount of BADGE and derivatives migrating from cured coatings increased with decreasing curing temperatures and decreasing curing time. All migration figures, however, even at low curing conditions, were within the limits in the directive 2002/16/EC.
- The participants have got a clear grasp of how the composition of epoxy based coatings can be changed and still comply with the migration demands in 2002/16/EC.
- The participants have learnt how temperature and time in production ovens at the packaging manufacturers' could influence the migration of BADGE and related derivatives.

- High level of conformity was achieved between the results of two laboratories using an analytical method, which is expected to become the future EN standard method.
- The age of the cured coating on the metal can have a minimal effect on the migration of BADGE and the other studied compounds.
- Some results from measurements within the CANBA project were transferred to CEN, which means that CANBA resulted in the new European standard.
- The results of the kinetics study were of interest to WG8.
- As the analytical method used in this project will be the EN method in Europe in 2004, the reports produced in the project should be of value for the future as long as the composition of the coatings is not changed by the producers.

#### 4. RECOMMENDATIONS

- Use temperature and time at curing in production windows as close as possible to given recommendations for each coating to reduce migration of BADGE.2H<sub>2</sub>O and BFDGE.2H<sub>2</sub>O to a minimum.
- State one temperature and time, with reasonable tolerances, in the recommendations for a coating.
- Inform the user of the coatings that temperature variations in curing ovens have an effect on migration results. This is why the recommendations from coating producers should be followed as accurately as possible.
- Have a good quality control at the producer's.

#### REFERENCES

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3. European Prestandard, Determination of BADGE, BFDGE and their hydroxy and chlorinated derivatives in food simulants, Determination of NOGE and their hydroxy and chlorinated derivatives, CEN/TC194/SC1/WG8.