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LOW MIGRATION AND UV INKS - THE FUTURE OF PRINTING ON FOOD PACKAGING

Food safety regulations set high standards for packaging materials. Consequently this also applies to inks used for printing on food packaging. Any foodstuff which may possibly be harmful is deemed to be unsafe. Generally UV curing inks contain potentially harmful substances. This mainly applies to the uncured printing ink. However the cured ink film still presents a potential risk. Therefore according to the EuPIA Guideline cured UV-inks are not suitable for direct food contact.

According to Regulation (EC) No. 1935/2004 materials and articles in contact with food must not transfer their constituents to food in quantities which could:

- endanger human health,
- bring about an unacceptable change in the composition of the food, or
- bring about a deterioration in the organoleptic characteristics of the food (scent, taste).

In accordance with "Good Manufacturing Practice" UV-curing inks may be used for printing onto the non-food contact surface of food packaging. Thus printing inks must be formulated and processed in a way that substances from the printed outer side of the packaging do not transfer to the food-contact side, neither by set-off (roll printing) or by migration through the packaging material.

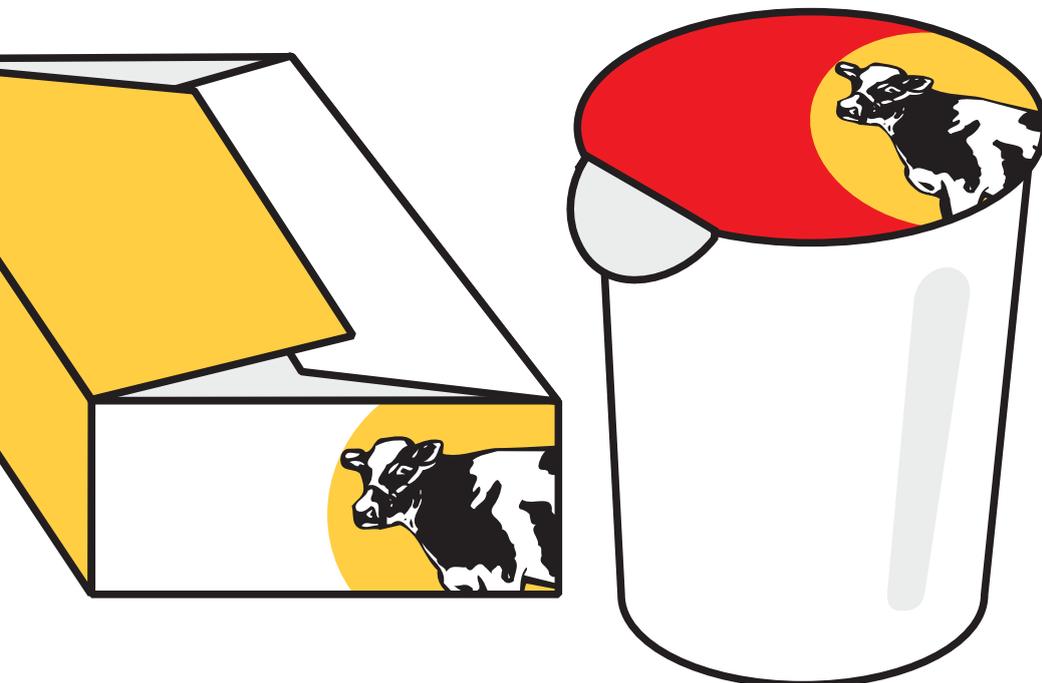
UV-Inks - Problematic Substances: Photoinitiators and Monomers

Usually polymeric and oligomeric substances of UV inks are no problem. Monomers and photoinitiators have a much higher migration potential. However these substances are essential ingredients of UV-inks. It is not possible to formulate UV-inks without photoinitiators.

Small molecules diffuse through materials much easier than big ones. Many of the traditional photoinitiators and their by-products have quite a low molecular weight thus presenting a high migration potential. Especially since the so-called "ITX-scandal" of 2005/2006 photoinitiators contained in UV printing inks have become a real issue of food packaging manufacturers.

In that case however, contamination of foodstuff was not caused by migration through the packaging material but by set-off of chemicals from the printed side to the inside of the packaging material. This started a process still not completely finished today. Three years after ITX photoinitiators have been detected the photoinitiator substances benzophenone and 4-methylbenzophenone were detected in foodstuff also.

This was a good reason for the European Printing Ink Association EuPIA to define guidelines for Good Manufacturing Practices in respect to the use of photoinitiators in low-migration printing inks.



Commercial photoinitiators have been split up into two main groups. First group contains photoinitiators which do not tend to migrate due to their high molecular weight so that values below 10 ppb in food material can be expected. This group also comprises substances which may migrate, but have been evaluated in respect to migration potential. Those substances have a specific migration limit.

The second group lists photoinitiators with a migration potential which has not been sufficiently evaluated. These photoinitiators may only be used with additional use of a barrier inside the packaging (such as aluminum foil) to exclude any potential migration.



The Definition of "Nothing"

Substances used for packaging materials without sufficient evaluation data must not be found in foodstuffs at all. As "nothing" a limit value of 10 ppb (parts per billion) has been determined. Compared to the number of inhabitants of Germany this would be less than one person.

The EuPIA Guideline on Printing Inks specifies that toxic or so-called CMR substances of categories 1A and 1B (carcinogenic, mutagenic or toxic for reproduction) must not be used in printing inks. Use of these substances is forbidden for packaging printing inks, regardless of their migration potential. As a member of EuPIA we do not use such raw materials at all. The limit value of 10 ppb for non-evaluated substances is so low, that according to current knowledge any harm to humans can be excluded.



Guidelines and Legislation

Following the above mentioned "ITX-crisis" Nestlé has issued their own "Guidance Note for Packaging Inks" as at that time there were no legal requirements. In 2010 the Swiss Ordinance on Materials and Articles in Contact with Food became effective. This was the first binding legislation for package printing inks in Europe. However the "Swiss Ordinance" is legally binding in Switzerland only. In Germany the 5th draft issued by the Federal Ministry for Food and Agriculture (BMEL) currently exists. This draft contains regulations similar to the "Swiss Ordinance" like a positive list of substances for manufacturing food packaging inks.

However to date that draft has not been ratified. As soon as this regulation becomes effective there will be a two-year transition period before full implementation becomes a legal requirement.

In addition EuPIA has set guidelines for all members to implement.

The potential problem is that different guidelines and regulations are quite similar but not absolutely congruent.

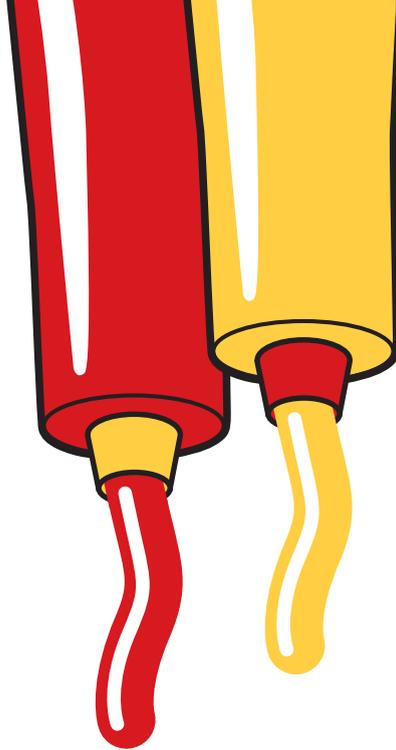


Are UV-Low Migration Inks suitable for printing on food packaging without restriction?

The term "Low Migration" only refers to the fact that the manufacturer avoided or reduced the use of substances with a high migration potential in the ink formulation. As a first step many ink manufacturers started to follow the corresponding EuPIA guidelines when choosing photoinitiators. Thus there should have been a significant reduction of exceeding of limit values due to migrating photoinitiators. In addition to photoinitiators with a low molecular weight, however commercial acrylic monomers also show a significant migration potential. The barrier function of polyethylene or polypropylene packaging materials is quite low; therefore most of the common UV-curing inks used so far can no longer be applied. PET or compound materials may be better in that respect. In addition to ink formulation and packaging material there are many more factors influencing conformity to food regulations. Migration tests are essential. Theoretical calculations (modelling) may be helpful, however in that case you have to know all conditions. Experimental migration tests are much more reliable as they also detect substances one did not expect based on the formulation. These are the so-called NIAS components (Not

Intentionally Added Substances), which could have been introduced with raw materials used or during the manufacturing process. They could also be decomposition products of the substances contained in the formulation.

Finally the content of the packaging is another factor influencing the migration potential of substances into food. Presently there is no general answer to the question whether a certain UV ink is suitable for printing on food packaging. In our industry currently some ask the slightly provocative, however not very serious question, if UV-curing and food packaging are not a contradiction in themselves.



Future Perspectives

At present UV ink manufacturers are facing many and quite demanding challenges. There is only a small choice of accredited monomers, which drastically reduces formulation possibilities.

We quote the summary of the dossier "Will food packaging run out of printing inks"* of one of the leading experts for printing inks for food packaging in Germany, Dr. Jürgen Baro of BASF:

"Raw material manufacturers will put a lot of efforts in supplying the necessary documents for admission of their raw materials to the positive list before the regulation becomes effective".

Surely first the focus will be on raw materials preferred for flexographic, gravure or offset printing. We will see if the results will present anything suitable for screen ink formulations.

In theory low migration UV screen inks for package printing are possible. However in our experience they do not show the excellent properties and performance printers are used to.

There are possible reductions in adhesion and/or resistance properties. We, Coates Screen Inks GmbH, are confident that we will meet this demanding challenge in close co-operation with our customers. We are on the right course...

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