Sheetfed Offset Inks for Food Packaging

Packaging can be found in every household. Packaging plays an important role in selling the product; it promotes and protects the product contained inside. Food packaging takes many appearances, plastics (essentially in the form of foils), and also paper and board. In this review, we will concentrate on packaging produced from paper and board.

Legal situation

When talking of packaging, food packaging has taken a very special and regulated position. At first glance, the amount of rules and regulations involved regarding food packaging, seem almost impossible to oversee. If however we restrict ourselves to packaging made of paper and board, only two essential and important regulations have to be considered:

Firstly the regulation EG No. 1935 of 2004[1] and especially article 3, which states: Materials and articles, including active and intelligent materials and articles, shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could: (a) endanger human health; or (b) bring about an unacceptable change in the composition of the food; or (c) bring about a deterioration in the organoleptic characteristics thereof.

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Secondly, the EG-guideline No. 2023 of 2006[2], which has had to be complied with from August 1st 2008, is of great importance. This legislation essentially states that producers of materials and objects, which are destined to come into contact with food, are obliged to use a GMP-system. This means, that producers of packaging which is intended to come into contact with foodstuff, have to introduce a documented quality assurance system with corresponding controls. Also important is an annex, in which detailed information is given on inks, coatings and process conditions at the packaging production site.

It is stated: Printing inks applied to the non food-contact side of materials and articles shall be formulated and/or applied in such a manner that substances from the printed surface are not transferred to the food-contact side: (a) through the substrate or; (b) by set-off in the stack or the reel, in concentrations that lead to levels of the substance in the food which are not in line with the requirements of Article 3 of Regulation (EC) No 1935/2004.

Further on it is stated that: Printed materials and articles shall be handled and stored in their finished and semi-finished states in such a manner that substances from the printed surface are not transferred to the food-contact side: (a) through the substrate or; (b) by set-off in the stack or reel, in concentrations that lead to levels of the substance in the food which are not in line with the requirements of Article 3 of Regulation (EC) No 1935/2004. Lastly it is also stated in the annex, that: The printed surfaces shall not come into direct contact with food.

However, no limit values are given for permissible migration. In the plastics directive[3] (individual measure of Regulation No 1935), general migration limit values for packaging are given. These are 10 mg/dm², 60 mg/kg for the general migration and 10µg/kg for not assessed substances.

It seems convenient when in doubt, to also accept these limit values when evaluating packaging made of paper and carton board.

Since April 1st 2010 the Swiss ordinance 817.023.21 has been in force. In this ordinance, requirements for inks used for food packaging are also defined. Beneath other not so important requirements, all inks used on food packaging must be composed of raw materials which are listed in the Ordinance, or, at least the raw materials from which the ink raw materials are produced must be listed.

Additionally all printing inks have to meet requirements concerning migration, which match with the requirements from the plastics directive[3]. Because of this we will not make assumptions from the Swiss ordinance in the following text.

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Actual situation printing inks

The individual requirements of regulation 1935 (2004) should firstly be considered. The demand, that no endangering of health can occur from the packaging, can be regarded as the central stipulation of this regulation.
With respect to ink, there is a voluntary restriction on the printing ink industry[4], not to use raw materials which are classified as follows:

a. Carcinogenic, mutagenic and toxic for reproduction substances and preparations classified and labelled as toxic (T) according to the Dangerous Substances Directive 67/548/EEC and the Dangerous Preparations Directive 1999/45/EC with risk phrases R 45, R 46, R 49, R 60 and R 61,

b. Substances and preparations classified and labelled as very toxic (T+) or toxic (T) according to the Dangerous Substances Directive 67/548/EEC and the Dangerous Preparations Directive 1999/45/EC with risk phrases R 23, R 24, R 25, R 26, R 27, R 28, R 39 and R 48 combined with any of the R 23, R 24, R 25, R 26, R 27 or R 28,

c. Pigment colorants based on and compounds of antimony, arsenic, cadmium, chromium (VI), lead, mercury and selenium.

Basically these restrictions which have been implemented by the ink and coating industry would be completely sufficient. Some of the raw materials used in inks however, have not been tested and evaluated thoroughly regarding their mutagenic or repro toxicity. Especially the raw materials used in sheetfed offset which have been used for many years and are generally accepted as being completely harmless. As part of the ongoing REACH process, more information will be gained on the so far untested raw materials.

A further demand of 1935 (2004) is that no sensory changes of the packed material may be caused by the packaging. Many years ago, food packaging was printed with normal inks. During the sixties, a detectable change in the taste of packaged chocolate was first noticed. The reason for the changes in taste are, as we now know, that during oxidative drying, strong smelling fatty soluble substances are generated, which can easily transfer into the chocolate.

The first offset inks which had really low odour and taste transfer properties were brought onto the market in the middle of the eighties. These inks were not produced using drying oils such as linseed or wood oil as was usual since the beginning of printing. Due to the removal of the drying oils there is no more oxidative drying, which has a large negative impact on the film forming of the ink. Printed matter produced with this generation of inks must therefore be coated with a water based varnish. The development and perfection of water based

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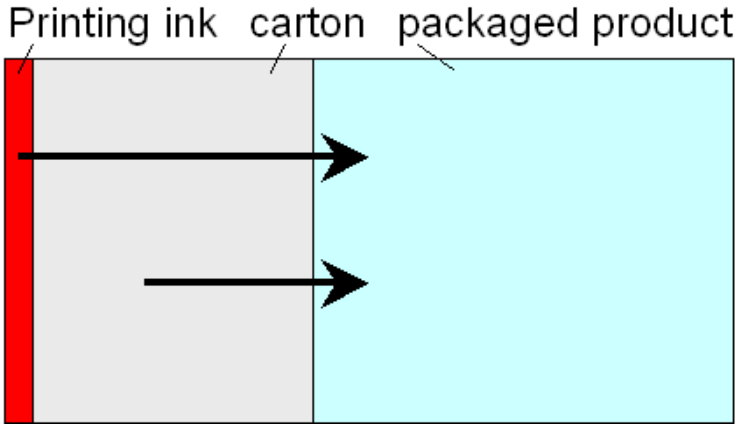
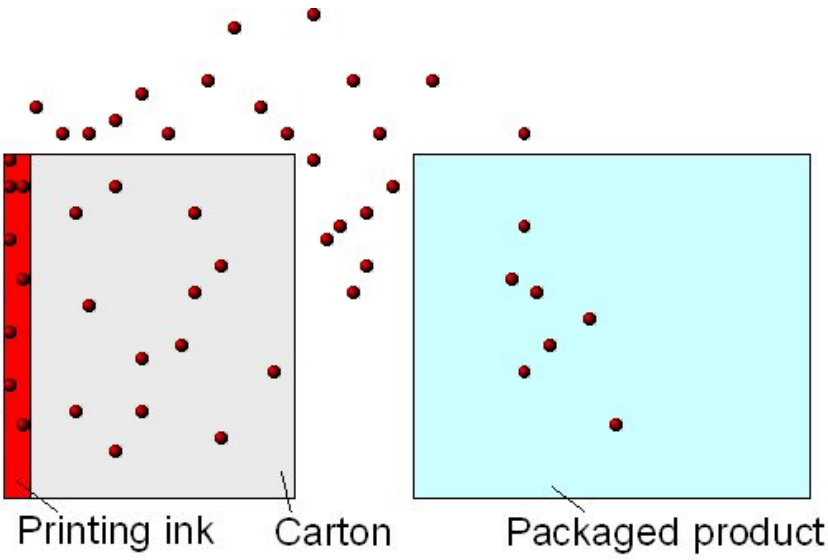
varnishes and consequent introduction as a standard application in print shops came just at the right time.
The last important demand of regulation 1935 (2004) concerns the change of the composition of food caused by components from the packaging (migration). Migration refers to the transport and consequent transfer of material from one body to another. Migration involves various mechanisms as follows:

Migration through penetration: The migrating substances are passing through another material, as shown in the following image.



Contact migration also exists and will be spoken about in more detail later on. Migration through vaporisation and the subsequent distribution of the vaporised substance afterwards (see image below).



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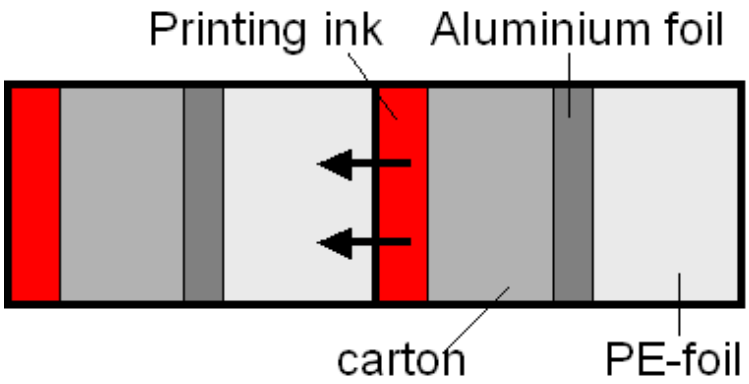
Public interest in relation to the migration from printing ink, board and paper components has increased very much since the ITX scandal in 2005. As a matter of general interest, the reason for this incident can be explained as follows:



At the end of 2005, ITX, a UV photo initiator was found in baby milk. The baby milk was contained in a package produced from carton board, aluminium and a polyethylene film compound. The aluminium foil is a functional barrier in this form of packaging. In spite of this, ITX was found in the baby milk. The milk bags involved are printed reel to reel in web offset and the printing ink is applied on the carton side. After printing however, the ink in the reel is lying in close contact to the print on the reverse side. As ITX is extremely soluble in polyethylene, it transfers, or migrates from the ink into the PE lamination during the time that the reel is stored. When the packaging was finally completed and filled with milk, the ITX from the PE surface in turn migrated into the fatty part of the milk thus the originally intended aluminium barrier was by-passed. In addition to the economic damage caused, this crisis seriously effected consumer confidence in packaging. Ironically, after the later extensive investigations of ITX, it became apparent that this compound is believed to be completely harmless. Unfortunately the damage to the industry was already done.

Evaluation of risk

If food packaging is to be produced in accordance with the relevant regulations, it is essential that the design of the proposed package be investigated in advance and the need for design alterations and/or extra expenditure be considered.

For example, labels which are to be glued onto glass bottles or tin cans are a part of food packaging, where neither a risk of odour and taste transfer, nor migration exists. In this case, normal printing inks may be used.

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In the case of chocolate packaging, there is a risk of odour and taste transfer. To avoid this risk, the functionality of the barrier needs to be evaluated in relation to the packaged product. From the Flint Group assortment of low odour, low migration inks, we would recommend the Novasens P 660 PREMIUM series for this application.

The two packages shown on the images below have a definite risk of odour transfer, migration and taste changes. Both the paper bag and the tea in the packaging are considered to be food.

Due to the fact that the filter bag paper is very absorbent, the components of the printing ink or of the board that are prone to migration could be found in the tea bag. The rough ground semolina in the other package has a high migration risk too, because of the big surface of the material migrating substances could be adsorbed.

Where such a high migration risk is involved, we would advise Novasens P 660 PREMIUM. The potentially migrateable component in this ink is very well investigated, found to be absolutely harmless, and is therefore listed in the positive list of the plastics directive[3] to be used without restrictions.

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Further measures

Substrate: The use of low migration inks is senseless without taking further precautionary measures. The most important measure after the ink is to choose a suitable stock. Pure cellulose boards (SBB) and fresh fibre boards (FBB) can be used.

Coatings and fount solution additive: Furthermore, a suitable water based coating and fountain solution should be used. For rollers and blankets, a washing solution has to be used which can be re-washed with water. The re-washing has to be done with utmost care. When cleaning has finished, the rollers and blankets should be rubbed dry.
One should also pay particular attention to the cleanliness in the press. This includes the inking system, complete damping roller circulation system and the rest of the machine that must be free from oils and greases, which could eventually contaminate the print. Ink and coating suppliers can give guidance and advice, and use should be made of their know-how. See also www.eupia.org.[4,5,6]

Finally a few fundamentally important remarks: The company introducing the final packaged product into the market is responsible for compliance with the legal regulations. Only this company is fully aware of the complete packaging together with the product, and only the completed package can be judged regarding odour, migration and tainting of the contents.

As was already mentioned earlier, as of August 1st 2008, a complete documentation of the production process will be required.

Conclusion

Production of food packaging requires special knowledge. The intense cooperation of all participants is absolutely necessary and must not be underestimated.

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Footnotes

[1] Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC

[2] Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food

[3] Commission Regulation (EC) no 10/2011 of 14 January 2011 relating to plastic materials and articles intended to come into contact with foodstuffs

[4] Exclusion list of EuPIA for printing Inks and related products

[5] EuPIA Guideline on Printing Inks applied to the non-food contact surface of food packaging materials and articles

[6] Good Manufacturing Practices for the Production of Packaging Inks formulated for use on the non food contact surfaces of food packaging and articles intended to come into contact with food

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