Safety first
Ink Series for Food Packaging

Migration and Influencing Factors
Legal Requirements for Inks
The Gecko Safety Concept

More than just ink ...
The Functions of Packaging

The packaging is the calling card of a product. It's the first visual and tactile impression the prospective purchaser gains in the shop.

In addition to the information describing the package contents, the packaging provides lots of other helpful references and tips about the goods inside. It tells the purchaser the price, size, condition and texture of the product, where and when it was made and when it should be used by. Food packaging is an immensely important segment in the packaging sector because it addresses both people's basic needs and quality-of-life issues. It provides the consumer with a range of information that can be of crucial importance to their health: the degree of freshness and ripeness, colour, shelf life, ingredients and nutritional values (such as the number of calories and fat content). But details such as the country of origin, the weight and production methods can also be important factors in consumers' purchasing decisions. Depending on the design, the customer is given sug-
gestions on how to prepare and serve the food, and in what quantities. The packaging also takes on practical functions, such as protecting its contents against damage and preventing them from going bad; it can also play an active role in ripening processes or extend a product’s shelf life, to mention just a few examples.

Many of the functions above can only be fulfilled by packaging if the packaging has printing ink applied to it. Ink is the often unnoticed information medium that both simplifies and makes our lives safer in many respects.

More than 95% of all foodstuffs sold for instance on the Western European market are packaged. Rising urban population levels and retail infrastructure development is similarly driving the Asia-Pacific food packaging market. Over the past years, the share of direct packaging (with no inner bag) has increased. In this type of packaging, the food comes into direct contact with the unprinted inner side of the packaging material. The situation is different when the contents are packaged in an extra inner bag. Unfortunately, it is frequently and incorrectly assumed that this additional packaging provides the contents inside with an adequate level of protection against substance transfers, but not every inner bag offers such protection.

Many of the products packaged by the food industry are organoleptically* sensitive. Many of the products packaged by the food industry are organoleptically* sensitive. Changes in smell or taste spoil people’s enjoyment of the products and must therefore be prevented at all costs. One of the main functions of the packaging is to protect the food and prevent substances from transferring to the food or from the food. It is obvious that the packaging itself must under no circumstances have a negative influence on the quality of what goes inside it.

Migration of Substances from Food Packaging Materials

First we need to clarify what kind of substances might be transferred onto the food, and how this transfer of unwanted substances works.

Transfer and migration can follow different mechanisms. Substances may originate from different components of the packaging, including the print. These components might be specific components of the ink formulation. They might even be chemical trace impurities or by-products coming from raw materials of the inks or substrates, or potentially also come from auxiliaries used during ink manufacture or the printing process.

Any transfer or migration of substances into food is important because it can have two impacts on the food which are both unwanted:

* Food safety – specific substances could be harmful to health if small amounts are ingested with the food on a regular basis
* Food quality – migrants might deteriorate the organoleptic properties or change the composition of the food

Food packaging materials like plastics, rubber, paper and adhesives can release minute amounts of their chemical constituents when they are in contact with certain types of foods. This transfer of chemicals into the packed food is technically known as migration. Migration can proceed by different mechanisms:

*organoleptic*: being perceived by human senses. Organoleptics is the testing of foodstuffs in accordance with a specific rating system in relation to the quality-influencing properties, taste, odour, colour, appearance, shape retention and consistency, without the use of aids but purely by means of the human senses.
• Penetration (or "through-migration")
• Invisible set-off
• Substance transfer via the gas phase

Substances of low molecular weight, coming from the substrate or from the print or coating on the outer surface of the packaging, can pass through the substrate and to the food inside. This mechanism is known as "penetration" or "through-migration".

Due to the nature of the production process, the side of the packaging that will face the contents of the package in the finished article comes into contact with the printed side while on the press (on the reel or in the stack). This means there is a possibility of colourless and therefore invisible ink constituents being transferred to the food contact side. This transfer is called "invisible set-off". In the finished packaging, these substances will come into contact with the package contents, e.g., with food, and can be transferred to it. As is obvious from its name, invisible set-off is not visible. By the very nature of things, prints suffering from visible set-off are waste.

Moreover, volatile substances in the enclosed air space inside the packaging can transfer to the food via the gas phase and may have a negative effect on its smell or taste.

In Europe, flexible packaging is frequently printed in the flexo or gravure printing process using printing inks based on volatile solvents. Traces of residual solvents may remain in the dried ink film and migrate into the packed foodstuff. Migration of residual solvents as well as of migratable plasticisers and other additives used in the ink formulation can be prevented only by the use of barrier layers. There are two types of barrier that can be used for this purpose:

• Absolute (permanent) barriers: glass and metals act as a reliable barrier to ink constituents. In the case of aluminium foil, it has to be thicker than 7 µm. Migration through permanent barriers is inherently impossible. Nevertheless, an eye has to be kept on the possibility of invisible set-off occurring in the finished packaging material.

**barrier** here is a layer within food contact materials or articles, preventing the migration of substances from behind that barrier into the food and vice versa.
Plastics films and layers are functionally specific barriers – i.e. plastics possess very different barrier properties in relation to different substances. For instance, while OPP films are a good barrier against water, they provide only poor barrier properties to certain constituent components of printing inks, such as residual solvents or plasticisers. In the case of plastics, the degree of migration that takes place is dependent on the migratable substances, the structure of the plastic layer and the temperature.

Paper and board pose no form of barrier at all to the low-molecular components of printing inks. This means that all ink components described above are able to migrate through the substrate.

Potentially detrimental or harmful substances can not only be originated by the packaging material or the printing ink. They can also be incorporated into the packaging during the printing or packaging process as well as the manufacturing processes of all components of the packaging. Therefore it is essential that the entire supply chain is strictly working according to certain guidelines to avoid and moreover to expel these substances from food packaging.
Responsibilities in the Food Packaging Production Process

Clear specifications of the packaging and proper communication during all phases of production is mandatory and helps avoid complaints. The majority of past complaints have been due to the use of materials which were not specified according to their intended purpose.

The diagram shows the pieces of information that need to be available by exchange between the parties involved. To produce a safe packaging, it is essential to know the type of product packaged, what production processes are to be used and how the end product will be handled throughout its life cycle.

Potential sources of contamination must also be avoided in all other printing processes. Equally, this applies to post-print finishing processes, such as laminating, gluing and packing.

Fig. 6: Information to be communicated in the packaging chain
Factors that Influence Migration

The **substrate** must satisfy the requirements of food packaging and be suitable for the respective printing process. Its own organoleptic properties must also not be ignored.

**Design** includes many factors: Selection of the right printing process for the job and the potential for migration must be taken into account. The amount of ink applied to the packaging plays an important role. The proportion of applied ink to the content's weight and surface must be considered for migration risk assessment.

Transportation and storage, i.e. conditions related to **logistics**, can influence the occurrence and extent of migration. The prevailing conditions, such as temperature, moisture and ventilation, as well as any strong-smelling constituents that may be present, can also have negative effects on organoleptics and migration.

All parties involved in the production **process** must exchange adequate information – which is quite a lot - between one other in order to assess potential migration risks. The communication chain must be maintained and is one of the biggest challenges in the entire value chain to be tackled. When it comes to materials, the name of the game is traceability: the origins and supply routes of all raw materials used to manufacture a type of packaging must be fully documented.

Only specific food packaging **inks and coatings** shall be used when manufacturing food packaging without a functional barrier. Such inks and coatings are formulated "low migration" and any contamination is minimised. Admixing of additives that are not explicitly intended for food packaging is not allowed.

Especially when using UV-curing inks, the **press speed** will influence curing of the ink and may result in undesirable migration if curing is incomplete. Check at regular intervals whether the UV lamps emit enough energy at the given press speed to trigger and complete the crosslinking reaction.

**Adhesives** play a decisive role with respect to composite (sandwich) materials, and, like other materials, must also be suitable for the application in question. It is also possible for substances from adhesives to migrate to the food packaged, and this is why it is just as essential to select the right adhesive products as it is when selecting inks and coatings.

**Cleanliness** of the press also plays a crucial role. Make sure that there are no residues of standard (non food-packaging) inks from the preceding production run or washup solution in the roller materials or somewhere else in the press.

Many parameters and **conditions** within the press can alter the results obtained when printing. In case of UV printed materials, the condition of UV lamps and curing units must be controlled, and proper maintenance is essential. Always follow the recommendations of the press manufacturer. Suitable construction and press conditions can also contribute quite decisively towards guaranteeing reliable production. As a general rule, the risks are higher when production on

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Fig. 7: Overview of the influencing factors of various situations and materials on migration.
a press switches between print runs using standard inks and inks suitable for printing food packaging, compared to when a press is used solely with food packaging inks.

**Legal Requirements**

Our commitment is that the entire Gecko ink portfolio is fully compliant to the applicable European Regulatory requirements for food packaging.

The primary objective of all national and European legislation with regard to food packaging is to protect the health of consumers. Legal requirements for food packaging materials are becoming ever more complex, because EU as well as national legislation have to be complied with.

Unlike EU Regulations, which immediately come into force in every single EU country after being published in the Official Journal of the European Union, EU Directives first have to be implemented in national law by the respective member states. The EU has passed various Regulations and Directives pertaining to food packaging. According to both national and EU law, it is the manufacturer of the food packaging and the marketer of the food who are responsible that it is compliant with the law.


Regulation (EC) No. 1935/2004 sets the framework of European rules and regulations on materials and articles that, as finished products and under normal or foreseeable conditions of use, are intended to come into contact with foodstuffs.

Under these conditions of use, such materials and articles (and we are talking here primarily of packaging) must be manufactured so they do not transfer substances to the packed food that:

- do endanger human health,
- bring about an unacceptable change in the composition of the packaged food, or
- bring about a deterioration in the organoleptic properties of the packaged food.

In the case of packaging made of plastic or regenerated cellulose, Article 16 obliges the printer or packaging manufacturer to give a written declaration of conformity. To this end, the packaging manufacturer must obtain essential information concerning the design, materials of the packaging and the type of food to be packed, summarise and evaluate the supplier's statements, and demonstrate the packaging's conformity with the valid rules and regulations.
Under current law, it is sufficient that the manufacturer of the packaging issues an appropriate declaration which is supported by relevant internal documentation. Such certification can be issued voluntarily also for packaging made of other materials than plastics or regenerated cellulose.

Article 17 specifies that the traceability of materials and articles shall be ensured at all stages of production. This also includes documenting the substances and products used in the manufacture of the packaging.


This Regulation lays down good manufacturing practices for materials covered by Regulation (EC) No. 1935/2004. It covers the same field of application as the Framework Regulation and is therefore applicable to all materials and not just plastics.

The Regulation demands a quality assurance system and a quality control system to ensure ongoing monitoring of the implementation of good manufacturing practices. The raw materials chosen must be specified according to the requirements of the brand owner.

In the Annex of this Regulation detailed rules stipulate that substances from the printed surface are not allowed to transfer to the food-contact side of materials and articles "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". The handling and storage of printed materials and articles in their finished and semi-finished states must also ensure that these requirements are met, and as a general rule, the printed surface of a package must not come into direct contact with food.


This is a specific measure regulating the use of plastic materials and articles intended to come into contact with foodstuffs. This Regulation took effect on 1 May 2011 and has replaced the previous Directive 2002/72/EC and its amendments. With respect to multilayer materials (such as plastic-laminated board), the Regulation applies only to the plastic layer.

There are no specific measures applicable to printing inks and coatings/varnishes at EU level, neither to printing on the outside nor to printing on the inside of packaging, i.e. on the side that comes into direct contact with the food packaged.

**Resolutions of the Council of Europe**

In the absence of specific legislation, one can refer to Resolutions of the Council of Europe (CoE), a body that also includes non-EU countries, such as Switzerland. Those countries and states that work together to promote matters related to health protection, have joined forces under the "Partial Agreement in the Social and Public Health Field". CoE Resolutions are drawn up in expert committees and adopted by the Committee of Ministers, but they are merely recommendations with no legally binding character.
National statutory regulations

**Germany** - The German Foods, Consumer Goods and Feedstuffs Code (LFGB)* and the German Consumer Goods Ordinance (BGVO)* regulate the area of food packaging. Furthermore, a series of recommendations drawn up by the Federal Institute for Risk Assessment (BfR)* regulate the use of substances in food contact materials. However, like the Resolutions of the Council of Europe, these recommendations have no legally binding status. Some important recommendations made by the BfR are as follows:

- 9th Recommendation on "Colorants for Plastics used in commodities"
- 14th Recommendation on "Plastic Dispersions"*
- 15th Recommendation on "Silicones"
- 36th Recommendation on "Paper and Board for food contact"

The latter is currently the only basis on which to select and evaluate paper and board intended to come into contact with food.

Germany is presently drawing up an ordinance that will specifically relate to printing inks, starting from the Swiss Ordinance.

**Switzerland** - Switzerland’s Federal Department of Home Affairs (EDI)* has issued the Swiss Ordinance on Materials and Articles in Contact with Food (Bedarfsgegenständeverordnung, SR 817.023.21). An amendment adopted on 1 April 2008 introduced rules that apply specifically to packaging printing inks. Since 1 April 2010, only packaging that has been printed with inks that comply with this ordinance is allowed to be brought on the Swiss market.

The key paragraphs of this Ordinance are as follows:

- Printing inks may comprise only substances that are listed in Annexes 1 and 6.
  - Note: the lists in Annex 6 are based on a compilation by the European Printing Ink Association (EuPIA)* and were adapted by the Swiss Federal Office of Public Health.
- The lists in Annex 6 ("Printing Inks") are in two sections:
  - Section A: Substances that have undergone officially recognised scientific testing. Any migration limits (SML)* specified in this list must be complied with.
  - Section B: Substances that have not undergone officially recognised scientific testing. Migration of such substances must not be detectable; detection limit = 0.01 mg/kg foodstuff (10 ppb).
- Inks must be manufactured and applied in accordance with Good Manufacturing Practice.

**Summary of the legal requirements**

All regulations, both national and European, are founded on one basic principle: no transfer of substances from packaging to foodstuffs shall be permitted unless the substances are evaluated for food contact and the migration limits are met.

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* LFGB: Lebensmittel- und Futtermittelgesetzbuch (German Foods, Consumer Goods and Feedstuffs Code)  
* BGVO: Bedarfsgegenständeverordnung (German Consumer Goods Ordinance)  
* BfR: Bundesinstitut für Risikominimierung (German Federal Institute for Risk Assessment)  
* EDI: Eidgenössisches Departement des Innern (Switzerland’s Federal Department of Home Affairs)  
* EuPIA: European Printing Ink Association  
* SML: the "Specific Migration Limit" is the maximum quantity of a specific substance allowed to transfer from a material or article to 1 kg of a foodstuff or food simulant.
Even though there have not been any specific legal measures passed for many application areas, the following requirements are generally applied to all food contact materials:

- No CMR* substances belonging to Category 1, 2 or 3 are allowed to be used.
- The level of migration of any substance shall remain below defined concentration limits.
- SML or TDI* values for toxicologically evaluated substances are to be complied with.
- The overall migration limit of 60 mg/kg (sum of all migrants) must not be exceeded.
- Toxicologically non-evaluated substances are not allowed to migrate; detection limit = 0.01 mg/kg food.

European legislation reflects all of these requirements. Therefore Micro Inks has decided to formulate Gecko food packaging printing inks in accordance with the EuPIA Guideline and GMP, and in conformity with EU and Swiss legislation. In the absence of specific legislation, Micro Inks recommends the use of Gecko inks as the best available technology.

**GMP – Good Manufacturing Practices**

The legal framework for GMP is laid down in Regulation (EC) No. 2023/2006. With respect to the production of food packaging, the Regulation demands that migration, organoleptic changes and contamination shall be prevented and compliance with requirements laid down be ensured. This can only be achieved if all actors in the packaging chain work hand in hand and if the processes are optimised so as to prevent undesired interactions from taking place.

This must be guaranteed

- by an end-to-end exchange of information within the packaging chain
- by monitoring the individual production steps with the aid of a suitable quality assurance system that also takes into account contamination of the products.

This is covered in the relevant GMP recommendations for each individual process step. The process chain stretches from the customer (proprietary article manufacturer), possibly via a packer, to the packaging manufacturer/printer. For all steps and products involved, the respective associations have issued GMP Guidelines. At the front end of the chain are the suppliers of the substrates, adhesives, inks, coatings and fount concentrates, who also have to be considered. Another important step in the production process is, of course, the printing process itself.

*CMR* substances are substances known or presumed to be carcinogenic, mutagenic or reprotoxic for humans.

*TDI*: The *Tolerable Daily Intake* of a specific substance is defined as the exposure presumed not to be detrimental to the health of people. The method used to calculated this limit value is based on a common international procedure.
GMP for printers/packaging manufacturers

With printers and packaging manufacturers specifically in mind, CITPA* and FPE* have together drawn up a "Code for Good Manufacturing Practices for Flexible and Fibre-based Packaging for Food" (Version 5.0, June 2009). This GMP code covers the development/design of packaging, its production, but also the raw materials bought in. Hygiene requirements, such as those laid down in the BRC/IoP* Global Packaging Standard and HACCP, are also covered. That said, by taking account of migration and organoleptic changes, GMP goes far beyond previous HACCP* systems.

As is the case in the production of printing inks, contamination with undesirable substances must be ruled out during the printing and handling of prints, too. This means taking account of the migration issue in all process steps in the production of food packaging.

Gecko Printing Inks for Compliant Food Packaging

The characteristics and properties of printing inks are determined by a multitude of different factors and requirements. In addition to an ink's printability, its visual characteristics and the properties of the substrate to be used, the information provided in the overview opposite is of crucial importance. The variety of applications results in a large number of ink formulations that make use of a wide range of raw materials.

The legal requirements with regard to food packaging necessitate special formulation of the printing inks used. To help ink manufacturers comply with these requirements, the EuPIA has published a guideline that lays down rules to be followed when selecting raw materials and during the production of food packaging inks: "Guideline on Printing Inks applied to the Non-Food Contact Surface of Food Packaging Materials and Articles" (EuPIA Guideline).

Raw materials must be selected so that the limits set for evaluated substances are not exceeded in the finished product. Regarding substances that have not been evaluated with respect to food contact, the level of migration in the finished packaging is not permitted to exceed 0.01 mg/kg of food. Substances listed in the EuPIA Exclusion List are of course excluded from being used.

The composition of a printing ink is highly specific – dependent on the printing process and on the demands on the finished print product. But basically, all inks consist of a colorant, vehicle, solvent and additives.

CITPA: The "International Confederation of Paper and Board Converters" in Europe represents the interests of the national industry associations of paper and board-converting companies in Europe.

FPE: "Flexible Packaging Europe" is the European association that represents companies operating in the flexible-packaging industry.

BRC/IoP: The BRC Global Standard for packaging and packaging materials was developed by the British Retail Consortium (BRC) in cooperation with the Institute of Packaging (IoP). It meets the requirements with regard to food safety, in particular by integrating the HACCP (food hygiene) system and GMP.

HACCP stands for the "Hazard Analysis and Critical Control Points" concept and is a preventive system intended to ensure the safety of consumers in the context of food.

| Solvent-based printing inks, liquid: |
| Solvents: | mainly ethanol/ethyl acetate, ethoxypropanol |
| Vehicles: | synthetic resins, modified natural resins, nitrocellulose |
| Colorants: | pigments |
| Additives: | various, depending on ink type |

→ Many different formulae and constituent components as a result of manifold application profiles.

Fig. 9: Composition of Gecko solvent-based printing inks
Specifically with printing-ink manufacturers in mind, a GMP Guideline has been developed by the EuPIA that forms part of its overall EuPIA Guideline. This Guideline, called "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", comprises:

- **Requirements for the formulation of inks**
  - Raw materials must be selected in accordance with the EuPIA Guideline (suitable raw materials only).
  - Packaging design, the production processes and the type of food contents must be taken into account during ink formulation.
  - The ink films must adhere adequately to the substrate.
  - The inks must offer adequate resistance to physical and chemical stresses.
  - There must be no visible set-off.
  - There must be no deterioration in the organoleptic properties.
  - Potential migration, including invisible set-off, must be below applicable limits.
  - All legal requirements must be complied with.

- **Requirements for the production of inks**
  - Traceability of all raw materials used.
  - Production must be controlled, monitored and documented.
  - Conformity with the product specifications must be checked as part of quality assurance.
  - Test equipment must be monitored.

- **Requirements for production information (data sheets)**
- Correct packing into clean containers

### Gecko solvent-based inks for the gravure and flexo processes

A large proportion of food packaging is printed using solvent-based ink systems. Solvents used in solvent-based inks pose a minor problem with regard to migration. Thanks to the fact that they are highly volatile, they evaporate during the course of the drying process. Removing the solvents from the printed and dry ink film is the job of the printer.

Nevertheless, these inks also need looking at more closely:

Many liquid packaging ink formulations used outside of Europe are based on toluene. In the EU, toluene is not used in food packaging inks as its toxicological evaluation is not favourable. The tolerable daily intake (TDI) is quite low, as is the SML value set by the Swiss Ordinance, which can only be met if the residual solvent limits are strictly controlled and minimised. Also the workplace exposure limits are low and demand technical measures in the pressroom. It is therefore of great advantage to use instead solvents which more favourable toxicological profile, such as ethanol and ethyl acetate, which are used in Gecko inks.

Furthermore, additives that were used in previously common formulations could possibly possess a certain potential to migrate. Not all of these have been evaluated toxicologically and low specific migration limits have been set for some. For this reason, the raw materials used to make inks for EuPIA GMP-compliant food packaging must be selected in line with strict rules: additives that are capable of migration may only be used if they have been evaluated for food contact and only then in concentrations below the specified limits. These inks must be formulated and produced in compliance with the EuPIA GMP Guideline. This also includes preventing known potential sources of contamination.

At the huber group, all solvent-based products for the gravure and flexo processes are formulated and manufactured in accordance with the GMP guidelines laid down by EuPIA.
How we Ensure the Safe Gecko Quality

Taking our part of the responsibility in the food packaging supply chain we are following a strict guideline to select raw materials according to all pertinent European regulations and to produce the Gecko inks according to GMP rules. This naturally includes the accurate raw material selection, ink manufacturing, packaging and ink handling.

The following workflow demonstrates the mandatory raw material selection process as well as additional quality control we have implemented uniquely for our Gecko ink series.

The raw material selection process includes proper selection of our suppliers, a control of the appropriate product documentation and certificates, an intense trace analysis on impurities or non-intentionally added substances and a migration testing on the final ink for every raw material like resins or additives for instance. All the profound analytical tests are performed in our experienced central analytical lab in Germany.

Before we approve the final quality of any Gecko ink produced GC-MS analysis is done. This clearly safeguards the regulatory food safety status at the end of our manufacturing process.
Methods of Testing Organoleptic Properties and Migration

To determine whether a particular food packaging conforms to the relevant regulations and guidelines, the following properties are tested:

- Organoleptic properties
- Migration

Verifying organoleptic properties by means of the Robinson test

The organoleptic properties are tested by means of the "Robinson test". The test conditions for paper and board packaging are defined in EN 1230-1 (odour test) and EN 1230-2 (taste test). In the case of the odour test, the print samples are stored in sealable 500-ml glass bottles for a period of 24 hours, for the taste test for 48 hours in a 1-litre preserving jar, together with finely grated whole milk chocolate. A separate sample is required for each test person. Afterwards, an odour and a taste test are conducted in line with a 5-step rating system:

**Transfer of odour/taste**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>undetectable</td>
</tr>
<tr>
<td>1</td>
<td>barely discernible</td>
</tr>
<tr>
<td>2</td>
<td>moderately discernible</td>
</tr>
<tr>
<td>3</td>
<td>clearly discernible</td>
</tr>
<tr>
<td>4</td>
<td>strongly discernible</td>
</tr>
</tbody>
</table>

A minimum of six testers is required to make up a test panel*. The median of the individual values is taken for the test result.

Determining organoleptically objectionable substances by means of gas chromatography (GC)

Owing to the fact that organoleptic tests are very complex to perform and heavily dependent on the respective test persons, organoleptically relevant substances are also measured using analytical methods. The vast number of chemical compounds in the world makes it impossible to analyse everything.

GC analyses are aimed at previously defined substances, such as solvent residues, or, as in this example, highly volatile and highly odorous aldehydes. Aldehydes arise during oxidative drying of unsaturated vegetable oils, hexanal is deemed to be a kind of "lead substance" (or marker) that is measured by means of what is known as "headspace analysis", in which the sample being tested is sealed in a sample bottle and subjected to increased temperature over a specified period of time. Volatile substances become enriched in the headspace of the bottle and are measured separately in the gas chromatograph by the detectors. Depending on the detection method used, the aldehydes are measured either according to their quality or quantity.

* A test panel refers to an entire test setup and group of people required to be able to carry out a standard Robinson test and produce a meaningful result.
Aldehydes are just one of many possible causes of poor organoleptic properties on the part of print products. Other strong-smelling substances, however, are not measured during an aldehyde test. Analytical testing with the aid of measuring instruments, such as a gas chromatograph, is therefore not in a position to replace the Robinson test.

**Measuring migration-capable substances**

This test method is used to measure the transfer of components capable of migration, with migration being evaluated in accordance with EU Regulation (EC) No. 10/2011 and the standards EN 1186 and EN 14338.

Migration is tested using food simulants, i.e. test media that simulate particular types of food. This allows to evaluate migration without any ambiguity compared to real foodstuffs, which are complex mixtures itself, may change during testing and complicate or even make impossible analytical determination. Food simulants, their categorisation into various food groups and the test conditions are defined in EU Regulation (EC) No. 10/2011.

**Migration test procedure**

![Fig. 12: Two typical chromatograms of an organoleptically neutral and an oxidative-drying offset ink show that the latter (black plot) contains various aldehydes, while the organoleptically neutral ink (red plot) is almost “aldehyde-free”.

Fig. 13: Sample preparation  
Fig. 14: Preparing the migration cell

Fig. 15: Fill in the food simulant (96% ethanol)  
Fig. 16: Storing during the migration process  
Fig. 17: Placing the samples in GC instrument
The important migration test is done to check the migration according to the defined regulatory migration limits per substance by using printed samples on typical print substrates. Standard migration test workflow with universal food simulant ethanol (96%):

As a final point a chromatogram is obtained where potentially migratable substances can be detected and quantified. The following illustrating example shows a direct comparison of three GC chromatograms between a blank substrate and two different printed samples:

- Overall migration: is a non-specific sum parameter that is measured by gravimetric* means, i.e. the non-specific recording of the sum of all migratable substances. The limit of quantification is ±2 mg/dm², and the *Plastics Regulation* stipulates an overall migration limit of 10 mg/dm² (for baby food 60 mg/kg). The level of overall migration describes the inertness* of a type of packaging.
- Specific migration: the migration of individual substances that is investigated by means of an appropriate analytical method (as a rule, gas chromatography). Specific migration limits have been defined for a range of substances on the basis of toxicity tests.

Gravimetric analysis is the measuring of quantities of a substance by weighing. Inertness: substances that behave stably and unreactive under given conditions are referred to as “inert”.

Fig. 18: Migration testing of print samples - GC chromatogram comparison (sample 2 exhibiting an undesired plasticizer, sample 1 is food safe)
“Worst-case” calculations are a common method employed for conducting risk assessment. They are conducted on the assumption that the entire content of a substance from the ink formula migrates from the ink layer to the packed food. If all potential migrants from a formula are known, this recognised method can be used instead of a practical migration test.

Summary

The demands being made on food packaging by consumers, legislators and food manufacturers are very high. The specialist products available in today's market enable compliant, i.e. food-friendly food packaging to be manufactured. It is absolutely essential, however, that the right products are selected and correctly and expertly processed at every stage of production. The rules of Good Manufacturing Practice must be applied at all stages of production.

This document can only provide a simple overview of the basic facts of this complex topic. It is intended to draw your attention to the fundamental requirements and highlight our desire to promote and enjoy a close working partnership with our customers, to assume responsibility and foster intensive communication between everyone involved in the packaging production process - this is the model of collaboration we follow in order to produce the best results and best serve and protect the consumer.

As consumers ourselves, each and every one of us relies on the industry to comply with the specifications and limits laid down. The motivating force behind all our efforts, however, must not be merely to remain below the given limits, but to find and implement every possibility for reducing the levels of undesirable contaminants ever further.

This is why our considerable team of specialists works day in day out to enhance existing and develop new products and processes. Whether it's to offer you advise, collaborate on joint projects or fulfil your wishes, we look forward to working closely with you.

Disclaimer

This document is a collection of items of information relating to the printing of compliant food packaging. Please check whether the information contained herein still reflects the current legislation. We assure you that the information contained in this document was, to the best of our knowledge, up to date at the time of compilation and that it was in accordance with the legislation valid at that time. However, in view of the fact that applicable legislation is continuously changing and the hubergroup has no influence over the age of individual documents and the correct application of the recommendations contained therein, the content of this document cannot be taken as the basis of any claims made under warranty.
The universal ink system for solvent-based packaging printing

Gecko is a unique modular ink system that covers a multitude of applications with minimum of products and components. It is specifically designed to comply with today’s high demands for food packaging safety.

The core of the Gecko product range is the easy-to-use modular mixing system that allows the formulation of the various inks series from the Gecko Base concentrate range.

A wide range of applications and fastness properties can be covered. The versatility of Gecko is underpinned by a broad catalogue of special products to meet the complex requirements of modern packaging.

... coming with added value and a list of complementing features

Gecko is proven to be one of the most reliable ink systems in terms of printing and final packaging performance. It has been designed to keep productivity in all production processes at a very high level. Gecko helps you to optimise your ink management, reduce press returns and leftover inks.

More products are available for a large number of additional applications.

Visit our website www.hubergroup.com or ask our representative for more information.