

Paper packaging materials and food safety

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Packaging should be adjusted to the features of a specific product. Choosing relevant packaging materials is a complex issue due to a huge variety of products, packaging materials and systems. Natural materials used for packaging production, such as paper and board, pose little risk to the environment or human health. However, operations requiring converting and functional properties, for example printing, may lead to contamination of packed products. The easiest and the only effective method to protect products against negative impacts resulting from the migration of substances from packaging is the use of properly selected materials.

Today packaging has become an integral part of the product, on many occasions even more important than the content. According to the definition for the purpose of Directive 94/62/EC packaging means all products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, and from the producer to the user or the consumer [1]. Paper and board have been used as the most important packaging materials for years. The production of packaging paper and board grades in the European Union is around 30 million tons per year. It is estimated that half of that volume comes into contact with food. Awareness of possible risks as well as technological progress contributed to the fact that quality requirements for food packaging have become stricter. Consumer expectations for packaged food include aspects such as health, safety, reasonable price, convenience, extended shelf life and environmental friendliness. It is possible to meet those requirements only through the right packaging, that – apart from protection during transport and storage – has to protect the product against spoiling, transmit information to consumers, and be easy to use as well as play an advertising role.

Packaging has become a necessary element of the food production process. At different stages of converting, preparing and storing, chemical substances may migrate to the food (Fig. 1). If packaging is made from wrong materials it may pose a risk to the packed product, thus to human health [2,3]. When the materials are discussed, printing substrates, inks, varnishes and all the auxiliaries used in the printing process have to be taken into account. The easiest and only ef-

fective method to protect the product against negative impacts resulting from migration of substances from packaging is to use appropriate materials that are sensory neutral for printing. The use of just one element which does not meet neutrality requirements may endanger the packaging protection function. Printing substrates have to be sensory neutral both before and after being printed. This is why it is extremely important to test substances released from packaging prior to its usage. Since obligations for packaging compliance with legal requirements lie with packaging manufacturers and operators introducing the product to the market, expected quality and compliance can be guaranteed only by strict supervision of the entire manufacturing process and its components. Interactions between packaging material and food do not involve only a group of chemical and/or physical reactions. An extremely important aspect is the effect of packaging surroundings, which in unfavourable conditions may change its composition, quality or physical properties of the packed product or packaging itself.

The results of safety tests carried out on paper products used as food packaging indicate that papers made from virgin fibres are characterized by low penetration of chemical substances to the packed product, whereas in the case of recycled paper grades the contamination risk is very high. To obtain required converting properties, packaging made from virgin fibres is usually refined using various sizing, dyeing agents and varnishes. Those substances have less effect on the packed product than the packaging made from recovered fibres. The main contaminants from recovered fibres are aldehydes, alkanes, ketones, phthalates, hydrocarbons, trace

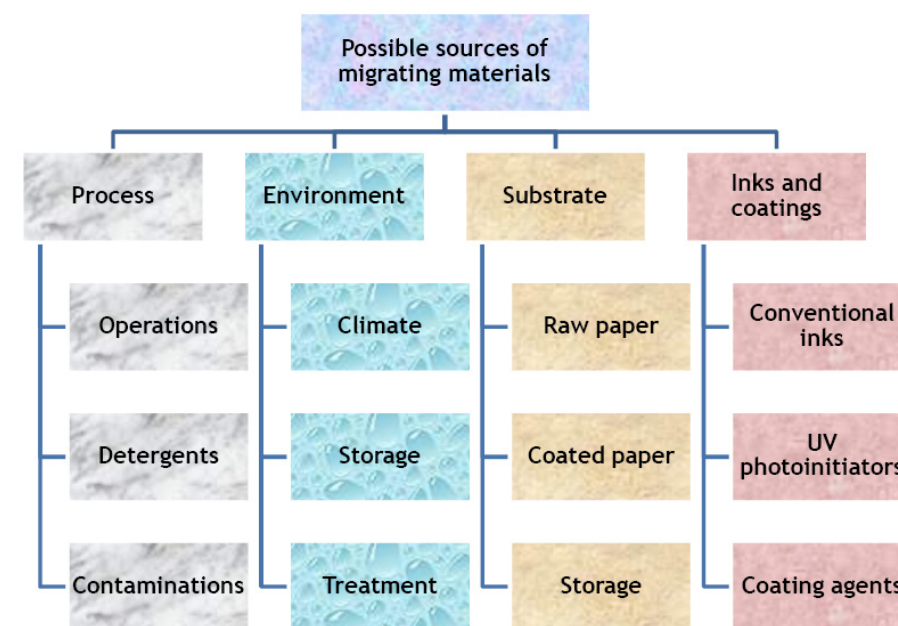


Figure 1: Potential sources of migrating substances

amounts of heavy metals, constituents of printing inks, sizing agents and coatings [2-19]. A migration ratio of the substances to the food depends significantly on paper grade, fat content in the food, chemical character and volatility of migrating substances. For example, a considerable migration level of organic contaminants is observed in case of foodstuffs with high fat content. Additionally, the migration of contaminants to food is tightly connected with testing conditions, i.e. temperature and time [12,13].

Over 90% of all manufactured foodstuffs and stimulants are sold in printed packaging that often is refined, varnished, embossed or laminated. With regards to assessment of packaging safety, the role of printing inks is difficult to define due to a small number of substances identified in the tests for specific migration. The risk of food contamination with constituents of printing inks from printed packaging can have two origins: transfer through packaging material or occurrence of invisible reflection. This means that components of printing inks migrate to the unprinted side of packaging that has contact with a

packed product. The test results on migration of printing ink constituents show that rejection of the printed packaging material as a result of migration does not have to be connected only with toxicity of migrating substances, it may result from changes in sensory properties of the product. In the case of some constituents of printing inks, particularly solvents such as alkylbenzene, mineral oils, or adipate, only a small amount of migrating substance may cause changes in the product, noticeable for sensitive senses of smell and taste.

In the case of UV inks for printing packaging intended to come into contact with food, particular attention should be paid to photoinitiators [20-22]. The most popular photoinitiator is benzophenone. Numerous tests show its presence in foodstuffs packed in printed packaging. It was found that if there is no direct contact between food and packaging when a packed product is stored at low temperatures, the migration rate of benzophenone to food is reduced six times. Meeting both conditions at the same time reduces the migration ratio forty times [5].

The group of potential contaminants from paper include 1,2-benzisothiazoline-3-one (BIT); 2-(thiocyanomethylthio) benzothiazole (TCMTBT); 2,4,5,6-tetrachloro-isophthalonitrile (TPN); 2,4,6-trichlorophenol (TCP); pentachlorophenol (PCP); 4,4'-bis (dimethylamino)-benzophenone; 4,4'-bis (diethylamino)benzophenone; 4-(dimethylamino) benzophenone (DMAB) and bisphenol A (BPA), which in chlorinated form (BPAs) may be found in effluent from wastepaper processing plants [15-17]. The slimicides may also be a source of contamination in recycled papers. A detection level of antimicrobial substances (BIT) – which are used not only as slimicides but also as fungicides in printing inks, coatings and adhesives – does not depend on how the paper is made. BIT is detected both in virgin fibre-based papers and recycled grades regardless of whether paper is printed or not. It means that BIT used as a slimicide remains in paper in trace amounts. Pentachlorophenol is used for wood conservation, therefore if the conserved wood or slimicides containing this substance are used in paper production there is a risk of contamination of packed food [23]. Despite the fact that specialist literature contains some information on toxic substances occurring in recycled papers, the majority of test results show that many potential contaminants are efficiently removed during processing.

Summary

Natural materials used for packaging production, such as paper and board, pose little risk to the environment or human health. However, operations requiring converting and functional properties may lead to contamination of packed products. The easiest and the only effective method to protect the product against negative impacts resulting from migration of substances from packaging is the use of properly selected materials. This is why it is extremely important to test substances released from packaging prior to its usage. Since obligation for packaging compliance with legal requirements lies with packaging manufacturers and operators introducing the product to the market, expected quality and compliance can be guaranteed only by strict supervision of the entire manufacturing process and its components.

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