Food Packaging and health

Migration

Food packaging can be a source of chemical food contaminants. The transfer of chemical contaminants from food contact materials into food is called migration. According to some scientists, food contact materials are an underestimated source of chemical food contamination.

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Chemical partitioning from the packaging into the food is known as migration. Migration is of relevance for smaller size compounds (below 1000 Da). The extent to which migration occurs depends on various factors:

- the physico-chemical properties of the migrant, of the packaging material, and the food (e.g. fat content)
- temperature
- storage time
- size of the packaging in proportion to the foodstuff volume (smaller size packaging has a larger surface to volume ratio).

The types of chemicals that can migrate from packaging into food are highly diverse and depend on the type of packaging material. For inert materials (stainless steel, ceramic, glass), only chemicals from the inside surface, directly in contact with the foodstuff, can migrate. They transfer from the inner surface to the food by surface exchange. Chemical diffusion from within the packaging material or from the outside (printing inks, adhesives) is not possible. This inertness is due to the chemical structure, with pore sizes that are small and prevent molecules or single atoms from passing through. However, glass-packaged oily foods can be contaminated by migration of plasticizers (like epoxidase soy bean oil (ESBO) or phthalates) from the closure. Migration can be reduced by careful manufacturing or the use of specially developed low migration closures.

Non-inert materials, like paper and board or plastics, can be a direct source of migrants. Chemicals may also migrate from the outside through the packaging. An example are printing inks that have been shown to migrate through paper board into dry foods. The large pore size of paper-based materials permits smaller molecules to migrate from the outside to the food inside. The use of barrier materials can reduce food contamination significantly. For example, carton with an inner bag that contains the foodstuff and that is made of aluminum foil or plastics with barrier properties.

A special case of migration is “off-set migration”: the printed, outside layer of a food packaging can transfer chemicals to the inside, direct food contact layer when both layers are in direct contact with each other. Off-set migration occurs when beverage carton sheets are stored in rolls, or when paper cups are stacked into each other.

To determine the extent of chemical transfer from packaging into food migrants are measured in food simulants, not actual foodstuffs. Food simulants are used as substitutes for food due to the simplification of chemical analysis: Chemical detection and quantification requires specific analytical methods for each chemical of interest, specially developed for each food or food simulant type. Food simulants vary in terms of their chemical properties, thus representing several different food types: hydrophilic (water-based), lipophilic (fatty foods) or amphiphillic (foods with both watery and fatty properties). For example, migration into an oily food is measured with the food simulant vegetable oil. The food simulants 10% ethanol or 3% acetic acid are used for water-based foods and drinks. Dry foods are simulated by a synthetic polymer with defined pore size (trade name "Tenax"). Butter and other foods that are amphiphillic are simulated by 50% ethanol solution.

The use of food simulants is an approximation for actual migration into foods. Their use is generally assumed to overestimate actual migration but there are exceptions, for example for migration of perfluorinated compounds into butter. Perfluorinated substances are neither very fat nor water soluble, but they do partition into foods that have both properties, like butter. Migration into butter is now determined using 50% ethanol solution.

Not only single, known substances that migrate are of interest. Overall migration assessment serves to determine the whole chemical transfer from packaging into food without necessarily knowing their chemical identity. All food simulants can be used for this, but most commonly overall migration into distilled water is assessed.

You may please refer to below source:

https://www.foodpackagingforum.org/food-packaging-health/migration