Packaging Materials & Food Safety

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Introduction

Packaging materials play an important role in preserving food materials and consumer acceptance. To achieve better and longer preservation and to get consumer appeal many natural and synthetic packing materials are widely used. Often these materials are used individually and in combination to give desired properties like moisture resistance and barrier properties against permeation of gases, oil, microbes, light etc. To achieve these properties many a product like synthetic polymers, natural films and boards, metal foils/sheets are used individually as well as multilayer laminations using a variety of adhesives.

Most of these packagings are tested for a variety of quality parameters to decide on their suitability as food packaging. The major criteria in this respect are certain physical properties and the retention of these properties when they are used as packages for the specific food products. Often many food manufacturers and enforcement authorities are not concerned about health hazards that can arise from packagings. Depending on the nature of the packaging material and the storage condition several health hazards can arise from packagings.

Microorganisms

Boards and films prepared from plant products like cellulose are widely used as packagings. Storage of such packagings in humid atmosphere without proper ventilation and lighting can result in a variety of microbial loads including pathogens and toxigenic fungi. Initially in the packagings the microbial load may be insignificant. But on use of these packagings for packing food the food get inoculated with these hazardous microbes and if suitable storage temperature and adequate storage time are available these microbial hazards multiply to form either infective doze or to a level sufficient to produce adequate toxin to create health problems. To prevent such microbial hazards all water absorbing type of packagings shall be stored in dry well ventilated rooms on racks without touching floor, walls and roof. Such storage rooms shall also be fly proof and dust proof.

Heavy metals, their salts and certain toxic chemicals

For commercial production of paper and paper products a variety of plants from different agro climatic regions are used. Under such varied conditions the raw materials carrying contaminants like heavy metals and poly phenols can not be ruled out. To take care of such avoidable contaminants screening of raw materials before production of food grade packaging as well as testing of the products before release for use are very important to avoid public health problems. Any way salts of heavy metals like lead, cadmium and mercury and chemicals like polyphenols, lignin etc. are also encountered in cellulose based packaging materials. The chances of these hazardous residues are more in case of recycled cellulose based products.

Toxic monomers in synthetic packaging

Most of the modern packaging widely uses synthetic polymers like polythene, nylon, polystyrene etc. for specific properties like water resistance, flexibility,

elasticity and barrier properties against moisture, gas, oil etc. As long as the polymers are properly formed there is no problem. But in real situations of manufacture of synthetic polymers the polymerization reactions will not be complete and there will be occluded left over monomers and dimers. In case monomers like Vinyl chloride, acrylonitrile etc. are the left over molecules they are toxic and form health hazards as they will permeate into the food packed in these packagings. To take care of such leaching from packaging materials often an estimation of solubles in select solvents are performed. However, this quantitative test is not designed to take care of the concentration of toxigenic monomers like Vinyl chloride and acrylonitrile. Recently Codex (1991) has come out with a guideline level for both these synthetic chemical monomers. Their levels have to be monitored for each batch of synthetic/semi synthetic/mixed packaging for conformity to specification to exclude the chance of introduction of food safety hazards through packaging.

Need for certain hazard control criteria for packaging

In the light of the above revelations it is evident that there is need for checking the safety of various packaging materials in terms of significant health hazards like pathogens, toxigenic fungi, toxic heavy metals like lead, cadmium, mercury, polyphenols / lignins in natural packing materials like duplex carton, corrugated cellulose boards etc especially when they come into contact with food materials. In case of synthetic packaging materials like polyethene, polyamides, polystyrenes etc the possibility of monoamines like Vinyl chloride, acrylonitrile have been identified as significant hazards. Whenever, cellulose based packaging materials are used for high moisture foods it is usual that the packaging materials are given a coating with wax, which is of petroleum origin. There is a significant possibility of occurrence of polynuclear aromatic hydrocarbons (PAH) which are carcinogens in wax coated cellulose boards. To avoid contamination and resulting health hazards to the consumers it is advisable to monitor the PAH content of wax coated packaging materials before they are advised for packing of food materials. In this way, there is need for monitoring at least the items shown in Table I to ensue that the packaging materials are not introducing any health hazards into the food packed in them.

Table I: ***Pathogens***

Sl.No.	Significant hazard	Guideline level
1.	Fungus (Aflatoxin producing species)	Absent in 25g
2.	Lead	<0.5ppm
3.	Cadmium	<0.5ppm
4.	Mercury	<0.5ppm
5.	Polyphenols	<50ppm
6.	Vinyl chloride	<0.01ppm
7.	*Acrylonitrile	<1ppm
8.	**Polynuclear Aromatic Hydrocarbons	<20ppm

* Relevant only for synthetic packagings
** Relevant only for wax coated packaging materials.

Methods to achieve hazard control Criteria for packaging materials

Having established food safety criteria for packaging materials there is need for establishing appropriate methods to achieve the hazard control criteria. The methods available for hazard control in packaging materials are 1. Good Manufacturing Practices; 2. Food Grade Certification 3. Appropriate storage condition 4. Specific cleaning procedure for packing materials store

1. Good Manufacturing Practice

In case of production of packaging

materials apart from following the normal good manufacturing practice, there is need for special practice to ensure that the entire raw materials used in the production are certified free from, heavy metals, synthetic monomers and poly nuclear aromatic hydrocarbons.

2. Food Grade Certificate:

Packagings manufactured shall be stored in dry storage areas which are well ventilated and are free from any type of contamination, so that during storage and till consumption, there is no scope for physical, chemical or biological contamination.

3. Storage conditions

All packaging materials shall be stored in a dry store where there is no scope for introducing any wet items so that the humidity of the store is maintained between 50% to 60%. Further the packing material store shall be well ventilated. The doors, ventilators and chute doors if any shall be provided with suitable fly proof arrangements like fixing of fly proof nettings, self closing chute doors and doors with strip curtains and automatic air curtains. The walls, floor and roof of the packing material store shall be made of smooth and water resistant construction material which can be easily cleaned. For stacking the packing materials elevated pallets or racks shall be used and the stacked packing materials shall be provided with flexible covers to prevent deposition of dust on the packing materials.

4. Specific cleaning procedure for packing materials store

The normal procedures of cleaning food contact surfaces like washing with detergent and sanitizing with chlorine water etc. are not advisable for packaging material store. The recommended procedure for cleaning packing material store is dry cleaning procedures like brushing followed by vacuum cleaning. In case of infestation by pests, fumigation can be resorted to after emptying the store. The recommended fumigation is fumigation with formaldehyde followed by defumigation with ammonia whenever there is visible fly/pest population. However, there is no recommended time schedule for fumigation. Thus its GMP, Food Grade Certification, appropriate storage condition and specific cleaning procedures are adopted, the packaging materials used for packing food materials will remain hazard free. Use of such packaging materials will ensure food safety and public health in the entire food production, storage & distribution chain.