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Shashi Sharma
Department of Home Science,
Government Arts Girls College,
Kota, Rajasthan, India

Vikram S Chauhan
Department of Botany,
Government Bangur College,
Pali, Rajasthan, India

Toxins in food packaging materials: A cause of great concern

Shashi Sharma and Vikram S Chauhan

Abstract

Packaging materials made of plastics are necessary for the food industry, and this poses a major problem if they were suddenly made out of use. Most of the plastics used are known to be almost chemically inert towards the packaged food constituents, however it is known that still sometimes a small amount of toxic additives or unbound monomers and oligomers may cause migration into food items. Migration may occur during storage of food in plastic packages, and may be particularly extensive when fatty food surfaces are in direct contact with plastic packaging. Heating food in plastic containers, e.g., in microwave ovens, increase the rate and extent of migration. Safety of food packaging materials is controlled around the world. Legislative agencies in many countries assess migration levels of plastic constituents. This review article presents major issues regarding toxicity of food packaging and related regulatory rules to avoid their toxic invasion, further it suggests some recommendations to lower the risk of such invasive toxicity.

Keywords: Migration, Bioaccumulation, melamine, PET, Bisphenol A

1. Introduction

In the last two decades, the design of the retail market has transmuted in nice extent. Each edible item which was earlier sold unwrapped, today each of them, like vegetable oil, spices, sweets, milk, and most of the other items of grocery, is available in captivating packages. Now everything is out there in convenient packages. Another aspect of such *mall culture* is that you can relish orderly and clean AC ambiance of malls while having *kiraana* shopping. Here, some items additionally got purchased by you, which were not present in your pristine shopping list. Packages, which contained un-adulterated and fixed weighted food, off course, are eye-catching to the end user, but one issue, that how such packaging materials are harmful to your health, remain un-mused by the government, consumer and producer companies. The recent ban imposed on Maggi noodles is, of course, welcome in the direction of food safety, but not enough. Our cognizance about how plastics and polymers which are acclimated to make these packages can be deleterious to us is proximately cipher. So sir, don't feel much exhilarated, while optically canvassing claims printed on the packages like "zero trans adipose" or "high fiber". Keep yourself withal vigilant about material used to make these packages.

2. Toxicity of Packaging Materials

Packaging plastics are inevitable requisite for food processing industry. The polymers used to make them, are mostly inert to the food and they protect food from detrimental effects of light, oxygen and germs, which may, otherwise, may depreciate food quality. Due to such polymers, food products can be stored for months. Our health's apprehensions arise when some more minuscule units (monomers and oligomers) found in the polymer matrix, are absorbed by the food. This process is called "*migration*". If you frequently consume same monomers for a long time, such units start to accumulate in the body (Castle, 1987) [2]. This is called *bioaccumulation*. Such perdurable storage may give you chronic ailments such as cancer, infertility and hormone imbalance.

Plastic polymers may contain many other types of toxic chemicals that are utilized as plasticizers, stabilizers, antioxidants, lubricants and so many types of catalysts. Such chemicals are used during synthetic process of polymers. Converse to polymers, they are of

Corresponding Author:
Vikram S Chauhan
Department of Botany,
Government Bangur College,
Pali, Rajasthan, India

movable nature. Their migration to aliment material depends upon their nature, storage duration, storage temperature, fat amount in aliment and contact area between victuals and packaging material. High temperature and substantial amount of lipids in victuals, make the situation more formidable.

3. Types of Material Which Have Toxicity

In the European Union and USA, their Overall migration limits (OML) and Specific migration limit (SML) are set. Such migration constraints are withal applied to packaging machines, containers and pipes. WHO and FAO have expressed solemn guidelines about them through "Codex

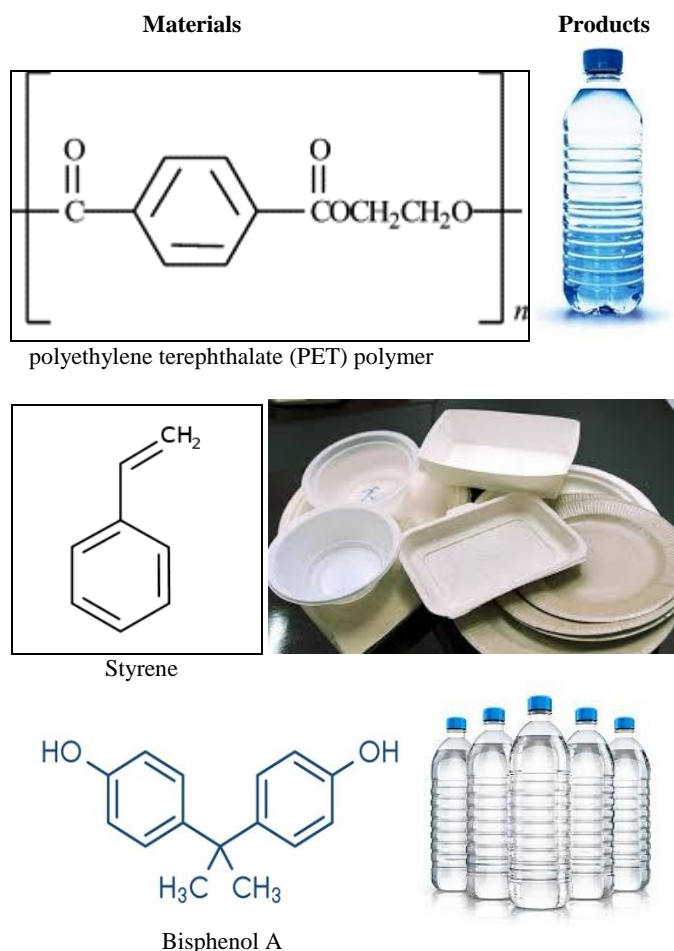
Alimentarius" (2003) [3] In India, the same is executed by the Food Safety and Standard Authority of India (FSSAI). The notification issued by FSSAI in 2011 enacted the specifications given by Indian standards (IS) for various polymers like polyethylene, styrene, PVC, polyethylene terephthalate (PET), ethylene acrylic acid and nylon. The concerns is that how such parameters will be monitored, is not ostensible anywhere. A Variety of polymers are used for making food packages like polyethylene, styrene, poly vinyl chloride (PVC), polyethylene terephthalates (PET), malamin, poly propylene, urea epoxide and phenols. Such a list of such materials are given in following table*.

Table 1: Such a list of such materials are given in following table

Material	Packaging Food item
Laminated polyethylenefibreboard-printed polyethylene	Milk carton
Laminated aluminum polyethylene	Chip bag, soup pack
Polystyrene	Yogurt tub, cheese tray, biscuit inner tray
Printed polyethylene	Biscuit, ice cream, bread and chocolate bar wrappers, chip bag, milk shake cup, milk thick shake straw, soy milk tetra pack, pasta, noodles, shredded cheese, outer cheese, carrot slice, coffee, lecithin, green beans, and brown rice packs
Printed fibreboard	Ice cream, biscuit outer, rolled oats, cereal outer, cocoa outer, tea, apricot pie, and jelly outer packs
Polyethylene	Cheese wrapper, cereal contents pack
Polyethylene terephthalate	Ice cream lid, juice container, soft drink bottle
High-density polyethylene	Ice cream tub, milk jug
Polyvinyl chloride	Lemon squeeze container
Polypropylene	Ketchup bottle

Source: data from Balafas *et al.* (1999) [1], Food Chem., 65, 279–287.

Let's take a look, how these substances are inimical. Mineral water and soft drink bottles are made from PET.



According to one research, water bottles placed in sunlight and high temperatures can increase chromosomal abnormalities by water itself. T. H. Begley, while working with Food and Drug Administration (FDA), showed the presence of PET in French fries, popcorn and pizza. Antimony trioxide, a catalyst widely used in PET production additionally found in foods.

Bisphenol-A

Similarly Bisphenol-A (BPA) is used in synthesis of many plastics. Water bottles, soft drink cans and computer CDs are made up with BPA. BPA mimics the action of steroid hormones inside the body. BPA mimics the action of steroid hormones inside the body (Hoyer, 2001) [4]. Bisphenol-S additionally deports as estrogen and is deleterious to uterus. In 2012, FDA imposed ban on BPA for its use in making baby bottles. Primary aromatic amines (PAA) such as diamino toluene and methyl diamine has been considered as carcinogenic and genotoxic by International Agency for Research on Cancer (IARC) and Environmental Protection agency (EPA). Polyurethane thermosetting plastics are synthesized from diamino toluene, which is considered as hepatotoxic substance.

Styrene

Styrene is used as copolymer with acrylonitrile and butadiene. According to IARC, styrene is also carcinogenic. In India, we have no restriction on its use. According to one report, styrene affects the level of dopamine, an important neurotransmitter in the brain. It is declared as agent for peripheral neuropathy and lung cancer, by EPA. Hot food served in styrene pot, may harm health.

PVC

The PVC monomer, vinyl chloride, is also carcinogenic, according to IARC. Its use is highly restricted in EU. According to the standards it should not be present in the food in any lower amount. In India, biscuits, jams and medicines are frequently packed within PVC wraps. Government entities have no plans for its vigilance and monitoring. Moreover, its packets are dumped in open after use. Such packages may give rise to sundry dioxins in the environment, which are potentially carcinogenic and teratogenic substances.

One report of National Institutes of Health (NIH) says that the plasticizer used in synthesis of PVC, diethyl hexyl phthalate (DEHP), is also carcinogenic. According to one study, PVC smoke contains as many as 108 types of toxic chemicals. Use of PVC utensils in microwave is also perilous to health. Nonylphenol is used as antioxidant during synthesis of PVC. Like styrene, it also acts as endocrine disruptor. It is known to migrate into food, while its film is used in microwave (Rozati, 2002) [5]

4. Conclusion

Despite all the damages caused by these chemicals, it's not possible to veto all of them immediately, as they are ineluctably foreordained requisite for food industry, so how to reduce their maleficent effects on health. First, regime should efficaciously implement and monitor their utilization under designated standards. Their manufacturing deserves customary periodic inspections. Secondly, government should make it compulsory for producers to have a declaration on the victuals' packages like the packaging material is thoroughly safe and in accordance with IS standards. The ideal storage conditions for each type of food should be pellucidly

designated on the packages, which should be rigorously followed by the retailers. Alternative substitutes should be found for BPA and PVC. Utilization of biodegradable plastic and recyclable polymers should be inspired (Soto, 1991) [6]. When the consumer buys a food pack, he not only pays for it, but conjointly expresses a sincere trust to the product. It is the accountability of producer, government and all of us to keep up this confidence among the consumers.

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