Polystyrene & Health Homepage

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Public Contamination

Because polystyrene products are so common, many people assume they are safe, and that a government agency, such as the Food and Drug Administration (FDA), would not allow a health-threatening product to be marketed to the public. But the EPA National Human Adipose Tissue Survey for 1986 identified styrene residues in 100% of all samples of human fat tissue taken in 1982 in the US. Styrene is used to make polystyrene plastic and is a contaminant in all polystyrene foam packages. But the migration of styrene is nothing new. It was first documented in 1972, and then again in 1976.

A 1988 survey published by the Foundation for Advancements in Science and Education also found styrene in human fatty tissue with a frequency of 100% at levels from 8 to 350 nanograms/gram (ng/g). The 350 ng/g level is one third of levels known to cause neurotoxic symptoms. determined that Styrofoam drinking leach Styrofoam into the liquids they contain. The cups apparently lose weight during the time they are at use. The studies showed that tea with lemon produced the most marked change in the weight of the foam cup.

2. Brian Lipsett, "Areas of Expertise Pertaining to McDonald's Corp."

Health Effects

The fact that styrene can adversely affect humans in a number of ways raises serious public health and safety questions regarding its build-up in human tissue and the root cause of this build-up. According to a Foundation for Achievements in Science and Education fact sheet, long term exposure to small quantities of styrene can cause neurotoxic (fatigue, nervousness, difficulty sleeping), hematological (low platelet and hemoglobin values), cytogenetic (chromosomal and lymphatic abnormalities), and carcinogenic effects. In 1987, the International Agency for Research on Cancer, Lyon, France, reclassified styrene from a Groups 3 (not classifiable as to its carcinogenicity) to a Group 2B substance (possibly carcinogenic to humans).

Although there is evidence that styrene causes cancer in animals, it has not yet been proven to cause cancer in humans. Styrene primarily exhibits its toxicity to humans as a neurotoxin by attacking the central and peripheral nervous
systems. The accumulation of these highly lipid-soluble (fat-soluble) materials in the lipid-rich tissues of the brain, spinal cord, and peripheral nerves is correlated with acute or chronic functional impairment of the nervous system. [3]

For example, women exposed to low concentrations of styrene vapors in the workplace are known to have a variety of neurotoxic and menstrual problems. A Russian study of 110 women exposed to styrene vapors at levels about 5 mg/m3 demonstrated menstrual disorders, particularly perturbations of the menstrual cycle and a hypermenorrhea (unusually heavy flow of menses during the menstrual cycle) syndrome. Styrene- exposed women often suffered from metabolic disturbances occurring during pregnancy. [4]


**Styrene Where?**

There are several reasons why styrene-based cups could be a source of contamination. First, the styrene monomer (vinyl benzene), a colorless or yellowish oily liquid, is the feedstock in the manufacture of polystyrene. Since the manufacturing process is not 100% efficient, polystyrene contains some residual styrene. Second, styrene is soluble in oil and ethanol -- substances commonly found in foods and alcoholic beverages. For instance, red wine will instantly dissolve the monomer. A 1985 Cuban study noted migration of monomers from low and high density polyethylene into milk, yogurt, and alcohol solutions. This means that ingestion can take place by using polystyrene cups to drink beer, wine, mixed drinks or perhaps even coffee with cream.

Most interesting is the degradation of food that contains vitamin A (betacarotene). In packaged foods with the addition of heat (such as microwave temperatures), vitamin A will decompose and produce m-xylene, toluene, and 2,6-dimethylnaphthalene. Toluene will aggressively dissolve polystyrene. This renders polystyrene as an unsuitable package for containing or microwaving products that contain vitamin A. [6]


**Infants?**

Further, since alcohol crosses the placental barrier [1] this could be the vehicle of transmission of styrene monomer into the fetus, and could explain why small children have traces of styrene monomer in their tissues even though they have never been exposed to the monomer directly. In a study of 12 breast milk samples from New Jersey,
Pennsylvania, Louisiana, 75% were contaminated with styrene amongst other hazardous chemicals.


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**In My Cereal? Styrene as a Food Additive**

"If you do not want to sprinkle styrene monomer on your breakfast cereal each morning, it has no business being a food additive." [1]

Even if styrene were declared non-carcinogenic, is it "safe" as a food additive? Serious questions exist as to the carcinogenic and mutagenic impact of metabolites of styrene monomer (styrene-7,8-oxide, a known carcinogen, and mandelic acid, a known mutagen), while the neurotoxic impact of this monomer may outstrip the carcinogenic and mutagenic implications. Further, 100 percent of the public has levels of styrene monomer at concentrations between 8-350 ng/g.[2] An obvious source of the monomer is food and beverage containers. Finally, neurotoxic problems occur at levels within one order of magnitude of known exposure concentrations currently found in adipose tissue. [3]

**According to the Federal Food, Drug, and Cosmetic Act:**

Section 210 S. The term "food additive" means any substance the intended use of which results of may reasonably be expected to result, directly, or indirectly, in its becoming a component or otherwise affecting the characteristic of any food (including any substance intended for use in producing, manufacturing, packing, transporting, or holding foods; and including any sources of radiation intended for such use), if such substance is not generally recognized, among experts qualified by scientific training and experience to evaluate its safety, as having adequately shown through scientific procedures (or, in the case of a substance used in food prior to January 1, 1958, through either scientific procedures or experience based on common use in food) to be safe under the conditions of its intended use; except that such term does not include

1. a pesticide chemical in or on a raw agricultural commodity;
2. or a pesticide chemical to the extent that it is intended for use or is used in the production, storage or transportation of any raw agricultural commodity; or
3. a color additive;
4. any substance used in accordance with a sanction or approval granted prior to the enactment of this paragraph. Pursuant to this act, the Poultry Products Inspection Act (21USC451 and the following) or the Meat Inspection Act of Mar. 4, 1907 (34STAT.1260) as amended and extended (21USC71 and the following); or
5. a new animal drug. [4]

The term "food additive" plainly includes not only substances that are intentionally added to foods, such as direct food additives..., but also substances that are not intentionally added but nevertheless contact and are reasonably expected to migrate to food. [5] Therefore, styrene monomer that migrates into food from packaging is by definition a food additive. It has been shown that styrene monomer can affect the quality of food products at known migration levels, and over 50 percent of the migration of residual monomer occurs within twenty-four hours (within the normal shelf life of many food products).[6]

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Additional Information About Styrene Monomer

Other than its use in polystyrene production, styrene monomer is used to form ABS plastic, resins, polyesters, and insulators.

The metabolites of styrene are mandelic acid, a known mutagen, and styrene oxide, a known carcinogen.

See SIRC Review, Styrene Information and Research Center, Washington, DC, April 1990, for more information. (Be forewarned, this is an industry publication.)

http://www.ejnet.org/plastics/polystyrene/health.html