

Market Based Processed Spices: Safe or Threat?

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Introduction

Spices are extra additional ingredients added in minute quantities to enhance the taste and flavor of the dishes. Most commonly used spices purchased from markets are turmeric powder, red chili powder, cumin powder, coriander powder as well as other curry specific spices in different names such as sambhar masala, curry masala, biriyani masala, chhole masala of various worldwide famous brands like MDH, Everest etc. India being the world's biggest producer, consumer and exporter of spices held a market value of 10.44 billion dollars in 2022. Additives are chemicals added up to a specific limit to enhance the shelf life, color, flavor and texture of food items. Any additive beyond its recommended highest limit is considered as adulteration. The most recently noticed issue in Indian spices market is adulterated spices having synthetic textile dyes and fumigants e.g. ethylene oxide and other chemical additives. Thus, in present scenario, it is really doubtful whether the market based processed spices are safe to consume or a medium of threat to consumer's health and well-being.

Mechanism of action

Ethylene oxide (C₂H₄O) is a cyclic ether and the simplest epoxide: a 3-membered ring consisting of 1 oxygen atom and 2 carbon atoms. Ethylene oxide is a colourless and flammable gas with a faintly sweet odour, industrially produced by oxidation of ethylene in the presence of a silver catalyst. Ethylene oxide is an alkylating agent; it has irritating, sensitizing and narcotic effects. Exposure to ethylene oxide causes alkylation to microorganisms at nuclear level and disinfects like heat sterilization. Hence ethylene oxide is used as a fumigant in spices to increase the shelf life by preventing microbial spoilage.

Risks on exposure

Chronic exposure to ethylene oxide has been proved to be carcinogenic and mutagenic. The International Agency for Research on Cancer classifies ethylene oxide into group 1, meaning it is a proven carcinogen. Ethylene oxide is classified as a class 2 carcinogen by the German MAK commission and as a class A2 carcinogen by the ACGIH. Ethylene

oxide is toxic by inhalation, with a US OSHA permissible exposure limit calculated as a TWA (time weighted average) over 8 hours of 1 ppm and a short-term exposure limit (excursion limit) calculated as a TWA over 15 minutes of 5 ppm. At concentrations in the air about 200 parts per million, ethylene oxide irritates mucous membranes of the nose and throat; higher contents cause damage to the trachea and bronchi, progressing into the partial collapse of the lungs. High concentrations can cause pulmonary oedema and damage the cardiovascular system; the damaging effect of ethylene oxide may occur only after 72 hours after exposure. The maximum content of ethylene oxide in the air according to the US standards (ACGIH) is 1.8 mg/m³ (0.00079 gr/cu ft). Ethylene oxide causes acute poisoning, accompanied by a variety of symptoms. Central nervous system effects are frequently associated with human exposure to ethylene oxide in occupational settings. Headache, nausea and vomiting have been reported.

Case studies

A 2003 study of 7576 women exposed to ethylene oxide at work during commercial sterilization facilities in US suggested increased incidence of breast cancer. A 2004 follow up study of 18, 235 men and women workers exposed to ethylene oxide reported to have bone cancer, breast cancer in a few women and lymphoid tumours in men. Peripheral neuropathy, impaired hand-eye coordination and memory loss have been reported in more recent case studies of chronically-exposed workers at estimated average exposure levels as low as 3 ppm (with possible short-term peaks as high as 700 ppm). Not only high level of ethylene oxide, also back in 2018, a few batches of MDH spices in US were feared to have *Salmonella* contamination. Most recently, in April 2024, Hong Kong and Singapore imposed a ban on the sale of four spices-mix products i.e. MDH curry powder, MDH Madras curry powder, MDH sambhar masala and Everest fish curry masala for containing ethylene oxide beyond permissible limits. After investigations, the US spice industry body in a letter to the Spices Board of India stressed that ethylene oxide is an approved antimicrobial fumigant in the US with

established tolerances for ethylene oxide and its byproduct ethylene chlorohydrin or 2 chloroethanol set at 7 ppm and 940 ppm, respectively, for herbs and spices. Both the US Food and Drug Administration (FDA), the US Environmental Protection Agency (EPA) and the

American Spice Trade Association (ASTA) has played a crucial role in ensuring compliance with food safety standards. Besides, inside India the raid conducted in Modi Nagar, Uttar Pradesh, seized more than 200 kg of turmeric powder and 150 kg of red chilli powder contaminated with synthetic textile colours from different spices mills, dhabas and hotels. The mill owners claimed the use of synthetic fabric dyeing chemicals to enhance the appearance and to make the spices more attractive. These synthetic fabric dyes being mutagenic and carcinogenic impose several health risks for consumers. Dyes such as Sudan III, IV, Sudan Red B, Sudan Red G, Sudan Red 7B, Garnet RBC, dimethyl yellow, sunset yellow FCF, Erythrosine, Para Red, Indigo Carmine, Tartrazine and Metanil yellow are highly poisonous and mutagenic found in turmeric and chilli powder.

Rhodamine B is a synthetic dye used to enhance the visual appearance of chilli powder. All these synthetic colours are toxic and carcinogenic. Sudan dyes, besides being category 3 carcinogens harm skin and mucous membranes as well as destroy the intestinal microbiota balance. Rhodamine B in food leads to liver dysfunction or cancer and poisoning on persistent consumption.

Conclusion

Despite imposing the strict laws, regulations and ban by FSSAI, the manufacturers and production companies are not taking the responsibility of consumers safety by using these poisonous chemical adulterants. Hence, we, the consumers have to be careful and responsible while purchasing any food items, processed products and spices from market. We should be aware of various food scams, misbranding and violation of food laws and be alert during checking the certifications, colour marks and labels on package. We have to be nutritionally educated to find out whether any toxic or carcinogenic chemicals are present and to ensure the quality and standard of the food items we consume and our safety as well.

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