



Shriram Institute for Industrial Research

Delhi Campus: 19, University Road, Delhi -110007; Email: customercare@shriraminstitute.org
Bengaluru Campus: 14-15, Sadarmangla Indl. Area, Whitefield Road, Bengaluru - 560048

Addressing Ethylene Oxide (EtO) Residues Concern in Spices, Nuts & Other Foods

Introduction

According to Rapid Alert System for Food and Feed (RASFF) Annual Report 2020 by European Food Safety Authority (EFSA), 279 Indian consignments got rejected with the incidents concerning ethylene oxide contamination of sesame seeds; 296 notifications regarding the Ethylene oxide contamination in nuts, nut products and seeds.

Further, India received RASFF alerts from the European Union (EU) in September 2021 for the presence of Ethylene Oxide in spices exported from India to the EU.

Given the strong antibacterial properties of Ethylene

What is Ethylene Oxide and why is it used?

Ethylene oxide is a colorless, flammable, highly reactive, toxic gaseous organic compound with a characteristic faintly sweet odor. Ethylene oxide is commonly used to prevent microbial contaminants such as Salmonella and E. coli, it also reduces bacterial loads, yeast and mold, coliforms and other pathogens. Ethylene oxide is also used as a pesticide to control pests. Instead of high temperature processes that may damage certain products such as herbs, spices and seeds, this chemical is employed.

Owing to this property, it is used to sterilize food items, spices, medical and pharmaceutical products.

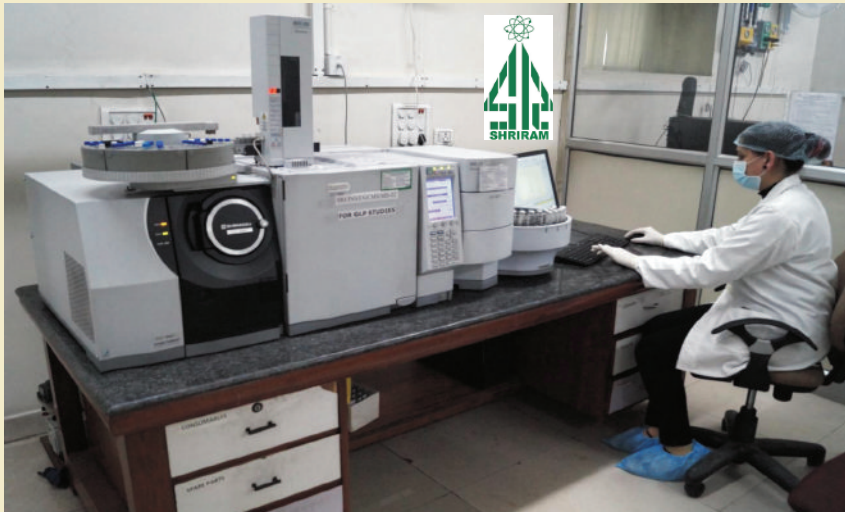
Why is Ethylene Oxide a concern?

Whenever Ethylene oxide is used for sterilizing food products and food contact surfaces or pharmaceuticals or medical purposes or fumigants, it leaves its residues.

Though these residues can be removed to some extent by adopting few simple techniques like nitrogen washes, extended aeration and heat treatment, the residue contamination might be present due to nature of the material; type of material and packaging used and load configuration w.r.t. the volume, density and overall configuration of the load.

Why is there a problem of residual Ethylene oxide in spices?

Spices and herbs are ubiquitous in food systems. In developing countries like India, contamination of herbs and spices with pathogenic bacteria is very well recognized attributed to growing conditions and environment, hygiene practices and sanitation among harvest workers and lack of good agricultural and



oxide, it is conceivable that Ethylene Oxide fumigation has been initiated in India as a countermeasure for reducing the incidences of pathogenic contamination with salmonella and other fecal bacteria.

Ethylene oxide is not approved by the European Union as an active substance in plant protection products and is classified in category 1B as carcinogen and mutagen contamination. Ethylene Oxide has led to numerous border rejections of consignments from India by EU Member States.

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manufacturing practices. Hence, Spices must be processed for the control of microbes for safe consumption.

Processing of herbs and spices includes fumigation with ethylene oxide prior to use in food systems for protecting food quality and safety.

However, when the aeration step foreseen for spices after fumigation with ethylene oxide is not properly carried out, residues of Ethylene Oxide and its derivative ethylene chlorohydrin (ECH) is produced by reaction with chloride ions always present in the matrix.

How to address this concern in Spices?

Ethylene oxide when not aerated properly, can remain as residue. This can lead to the formation of 2-Chloroethanol, another toxic compound capable of causing damage to the heart, liver and kidneys as well as respiratory failure.

The International agency for Research on Cancer (IARC) has also classified Ethylene Oxide as carcinogen. As a consequence of carcinogenic and mutagenic concerns, European Union (EU) has proposed separate maximum residual limits (MRLs) for ethylene oxide and its primary metabolite 2-chloroethanol in different food and agriculture commodities ranging from 0.02 to 0.1mg/kg (Commission Regulation (EU) 2015/868).

Concern of spice, nuts and herbs trade

As per our findings, India exported spices worth US\$ 3.62 billion in FY20. India being the biggest producer and exporter of spices in the world, contributing about 48 per cent of the world's requirement of spices, Indian spice traders and producers are facing challenges like food safety, sustainability and traceability.

The recent issue of Ethylene Oxide residues in spices has cropped up consignments from India. Hence, it is better to take a preventive approach by investigating the

root cause analysis for every rejection of consignments leading to loss of potential revenue.

Where things can go wrong?

Exporters are facing rejections of spice consignments on instances of Ethylene oxide detection. Sources of Ethylene Oxide residue vary as it is considered that low



levels can be naturally generated within the growing environment from water logged soil and manure; frequent use of Ethylene Oxide treatment can lead to a risk of cross-contamination during processing, storage and shipment.

Root cause analysis for its occurrence and managing the risk of cross contamination should be in the hazard analysis critical control points (HACCP) of Spice Manufacturing Units. At the same time strict vigilance in accordance with risk assessment and system audit should be maintained for integrity of data; fraud prevention and detection through the creation of an auditable trail of evidence for resolution of fake quality/ audit reports.

How can SIIR help in addressing this problem and help Indian exporters?

SIIR holds the capability to assess various samples with fast turn-around time. Shriram Institute for Industrial Research, Delhi, is involved in the determination of ethylene oxide residue in food materials, including herbs, spices and gums. With centralized instrumentation

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facilities and based upon modern techniques including the meticulous sample preparation techniques, SIIR has the capability of analyzing Ethylene Oxide at parts per billion level, to meet the requirements of EU and simultaneously improving the lifestyle of a common man by preventing the use of such food products and directly increasing the longevity and also increasing the trade at an international level.

What is the SIIR proposal?

As SIIR pursues its mission to protect human health and the environment, addressing the issue of Ethylene oxide contamination and its adverse impact, it is a priority for the Institute to reduce this chemical impact for rejection of consignments. SIIR pursues this agenda by conducting and supporting research to improve and provide real time testing capability to measure Ethylene oxide on a continuous or near continuous basis.

A. Preventive Approach:

As the quality of product depends on the quality of raw materials and the practices adopted in its processing, packaging, storing and transportation, SIIR can perform sampling and quality check of:

- Pre-harvesting (seeds, soil and groundwater);
- Agriculture products at the time of harvest and post harvesting
- Samples after processing and packaging;
- Samples during storage period

B. Post-production Approach

On account of catering the needs of Food industries, SIIR propose:

- The surveillance by collection of different samples of spices & herbs
- Imparting training to Industry personnel's and Small Scale Entrepreneurs for residual analysis
- Performing export inspection
- Performing rejection analysis and fault findings

C. Alternate technologies to address the problem

Further, SIIR has high power Gamma Irradiation with Co 60 as radiation source and fully automatic computerized

plant setup as per the design and norms of BRIT/AERB which can be used to sterilize the products as an alternative to fumigation by Ethylene oxide.

Infrastructure facilities at SIIR to address Ethylene oxide residue problem?

As per address to the concern of spice industry to minimize export rejections, at SIIR we have the facilities and method for residual determination of Ethylene oxide and 2-chloro ethanol as a marker of ethylene oxide by using Gas Chromatograph Mass Spectrometer (GC-MS/MS).

Why is SIIR the right agency to work with to protect and promote Indian export and "Atma Nirbhar Bharat"?

Shriram Institute for Industrial Research is an independent, self-sustaining, non-profit multidisciplinary Indian institute established in 1947. SIIR is the only Institute in the country which has In-house world class infrastructure for various sectors which can offer inter-departmental and cross-functional capabilities and is a part of the journey of "Atma Nirbhar Bharat".

Shriram Institute for Industrial Research is a single point solution provider for all technical requirements in the following areas:

- a. Industrial Training
- b. Skill development to meet buyers demand
- c. Research and Development
- d. Analysis Support Services
- e. Technical Seminars and Workshops

The way forward

- Please visit our facilities and witness the infrastructure developed at SIIR to solve this problem.
- SIIR will be happy to have a partnership with national bodies, state agencies and trade bodies to address these concerns to solve this problem.
- Feel free to contact us.

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