Shriram Institute for Industrial Research
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SIIR developed Technology to mitigate Aflatoxin Contamination in Groundnuts for Export Market

What is Aflatoxin?

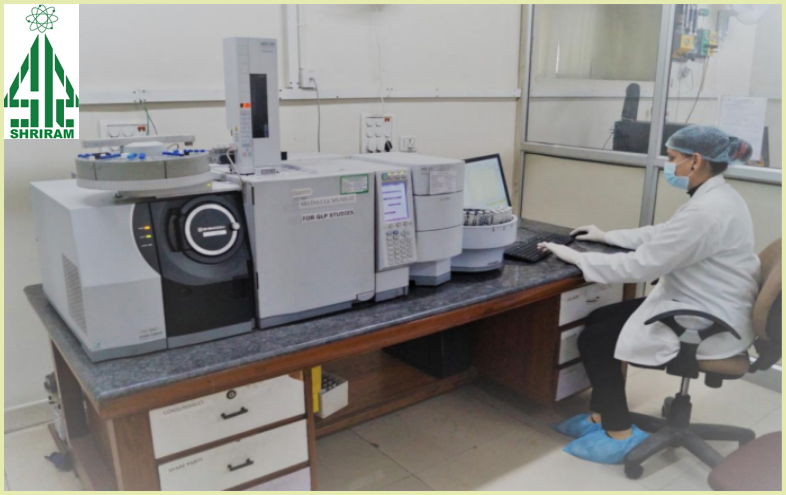
Aflatoxins are the secondary metabolites of fungus *Aspergillus flavus* and *Aspergillus parasiticus,* found to contaminate various agricultural commodities such as peanuts, cereals, pulses, millets, spices, etc..

How many toxic effects occur due to Aflatoxin Contamination?

They are known to suppress the immune system, causing carcinogenicity, hepatotoxicity, mutagenicity, teratogenicity and in severe acute exposure, death of the victim.

What are the factors responsible for Aflatoxin Production?

The production systems and situations are quite diverse, and the crop is grown almost round the year. The



crop-weather situations, therefore, varies from high temperature (40-45°C), scanty rainfall (450-500 mm) areas to low temperature (20-25°C), high rainfall (1500-2000 mm) areas that supports very high to negligible aflatoxin in produce.

Impact on Trade from India

India, is the second-largest producer of groundnut, next to China, with the total production of 10.1 million tons (2019-20) against 6.73 million tons estimated in 2018-19. Gujarat is the largest producer of groundnuts in the country, which is followed by Rajasthan, Tamil Nadu, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra. Indian Groundnuts enjoys a good premium in the world market but in the recent past, higher levels of Aflatoxin present in Indian Groundnuts have affected its export. India exported 6.38 lakh tonnes (worth of Rs. 5381 crores (727.40 million USD) of groundnuts during 2020-21. The groundnuts are exported to mostly countries like Indonesia, Vietnam, Philippines, Malaysia, Thailand, China, Russia, Ukraine, United Arab Emirates and Nepal.

Is there any effect on the Indian Market?

India faces difficulties in accessing the markets as the level of aflatoxin on Indian groundnut is high and is considered unfit for human consumption. According to Indian Council of Medical Research (ICMR)-Lucknow, 21 percent of groundnut in India is unfit for human consumption due to aflatoxin. Another study conducted by ICRISAT reveals that the level of aflatoxin in some samples of Indian groundnut is 40 times more than permissible limits.

What is the Regulatory limit of Aflatoxin Contamination in Groundnuts?

The permitted level of aflatoxin in groundnut for human consumption, according to international standards, is 4 parts per billion (ppb) in the European Union and 20 ppb in the US and 30 ppb in India. Owing to high food safety and animal and plant health concerns, many SPS (sanitary and phyto-sanitary) notifications have been issued against India by several countries over the last few years. This has resulted in shrinking of groundnut oil exports to many developed and developing countries.

Is there any Strategy for Aflatoxin Regulation?

Regulations directed at minimizing human exposure to aflatoxins in the food products require a lot of effort. This has two main consequences:

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a) adopt systems, practices & technologies to avoid contamination of food by aflatoxins,

b) adopt techniques and technologies to decontaminate foods that are already contaminated with aflatoxins.

In a warm and humid tropical country like India, it is not always possible to prevent aflatoxin contamination due to several reasons. In most of the cases, either due to the unawareness of producers about the aflatoxin contamination in food as well as about the consequences of contamination of foods by aflatoxin or due to the non-availability of infrastructure facilities in place, the foods get contaminated by aflatoxins. Therefore, in order to prevent the losses, it becomes important to adopt technologies which can result in decontamination & detoxification of the affected crops.

Technologies to address Aflatoxin contamination

Decontamination of aflatoxins in agricultural commodities can be attained by physical, chemical, or biological means. Since aflatoxin decomposes at 237–306°C, cooking, drying, pasteurization and sterilization cannot reduce aflatoxin levels in food. Although calcium chloride, alkaline cooking and steeping, hydroxides and bicarbonates can reduce 84%–95% aflatoxin content, these treatments also reduce the nutritional quality of the product. If pre-harvest infection in crops can be avoided through host resistance, then managing post-harvest contamination becomes possible using different technologies and practices.

Type of facilities available in SIIR to tackle Aflatoxin problem

SRI has all the facilities to analyze aflatoxin upto ppb level (ELISA and LC-MS/MS) and to evaluate the microbial load present in Groundnuts. SRI has a world class laboratory for microbiological studies, nutritional value studies and toxicological studies to evaluate the microbial load, nutritional value, oil quality parameters and sensory evaluation of groundnut and its oil and also to evaluate the effect of radiation on the toxicity caused in the groundnuts. Detailed study of nutritional value of groundnut and its oil can be done on latest chromatographic technologies at SIIR.

Technology Developed by SIIR to address this problem that can help Indian Exporters

SRI has developed the technology of aflatoxin decontamination in groundnuts using radiation processing where the level of aflatoxins in groundnuts were found to be out of the permissible limits as estimated by ELISA AND LC-MS/MS *without affecting the nutritional values (fat, protein, carbohydrates, total dietary fibers, amino acid profile and fatty acid profile) of groundnuts*.

In addition to this the oil quality of groundnuts (refractive index, iodine value, saponification value and free fatty acids) were also not affected at the optimized dose level. The fungal spores were also destroyed in the groundnuts after radiation processing.

SIIR Research focus on Aflatoxin in other products

Shriram Applied Radiation Center (SARC) has one of the most advanced and most reliable gamma radiation facilities in India and South Asia to irradiate any kind of food products. In order to address the problem of Aflatoxin in the food commodities, SIIR researchers are working on various product applications. If any department and exporters are keen to work with us on these advanced technologies, you are free to contact us..

The way forward : For research issues, please feel free to contact SIIR for your needs.

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