

Risk Management: Humidity and Temperature Control of Nutmeg Supply Chain. To Ensure Food Safety

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Abstract

Nutmeg is an herb product that produce in Indonesia, especially eastern Indonesia such as Banda Island (Maluku region), Fakfak West Papua and Siaw island North Celebes. Most of EU people like very much nutmeg from Indonesia. Till now, Indonesia meets about 80% of the needs of EU for nutmeg. Nutmeg produce by view country. Another country that produce nutmeg are India and Ceylon. But quality of nutmeg from India and Ceylon origin not as good as Indonesian Nutmeg. EU Community use nutmeg in almost all their food, such as sausage, tea and other kind of their food.

Keywords: Humidity; Temperature; Nutmeg; Food Safety

There are two requirements of Nutmeg export to EU Country: contain Aflatoxin B1 ≤ 5 ppb (EU regulation No.24/216 and Ochratoxin ≤ 15 ppb (EU regulation 1881/2006).

A long 2016, there are 25 notification of Indonesian Nutmeg. Notification caused are:

- Aflatoxin contamination (more than 5 ppb of Aflatoxin B1 or 10 ppb of total aflatoxin) it's about 10 shipment
- Ochratoxin contamination (more than 15 ppb Ochratoxin A) 2 shipment
- Live insect contamination (requirements is a no live insect)
- Without Health Certificate from Indonesia Competent Authority.

Notification In case of contamination of aflatoxin and ochratoxin, these products has been declared safe, with publication of Health Certificate from Indonesian Competent Authority. Based on this fact, aflatoxin and ochratoxin, may appear during shipment from Indonesia to EU Country.

Aflatoxin and ochratoxin

Aflatoxin is a toxin that produced by fungi, *Aspergillus flavus*. Ochratoxin is a toxin produced by *Aspergillus ochraceus*. In Human, consumption of food with aflatoxin contamination can be caused hepatocarcinogenic. In the other side, consumption of food with contamination of ochratoxin can be caused hepatotoxin. Not only hepatocarcinogen but also hepatotoxin, is a long term hazard.

To avoid aflatoxin and ochratoxin, we should be avoid mold growth, such as *Aspergillus flavus* and *Aspergillus ochraceus*. Humidity and temperature is the key to growth *Aspergillus flavus* and *Aspergillus ochraceus*. Humidity should be controlled not only raw material but also along the supply chain. In the other side, temperature should be control to ensure hygienic sanitation requirement in place, to avoid another contamination such as microbe contamination.

Supply chain of Nutmeg

There are many chain of Nutmeg Production. The chain of nutmeg production are:

- Cultivation process of Nutmeg Tree
- Harvest handling
- Postharvest handling
- Handling in the collector warehouse
- Handling in the exporter warehouse
- Transportation handling
- Handling at transportation from Indonesia to EU Country

Cultivation and harvest handling process

Nutmeg is a perennial crop. Most of nutmeg tree is a plant that are old. When the fruit fall, this is Signs of ripe fruit. Then the owners of Nutmeg Tree shake nutmeg tree, until all Nut Meg fall. Nutmeg consists of: rind, flesh of fruit, mace, nutmeg shell and Nutmeg. Even though there are many part of nutmeg, commonly, mace and Nutmeg will be export to EU Country.

There is process of Nutmeg to ensure safe from mold growth inner. The process is Nut Meg drying, until water contain less than 10% (Ideally 6%). Method to drying should be meet requirement of hygienic practices, such as not drying above ground without pedestal. Water activity, water contain, humidity and Drying method is a critical point. If the water content of Nut meg more than 10%, mold such *Aspergillus flavus* and *Aspergillus ochraceus* will be growth, at the end aflatoxin and ochratoxin will be appear as well as mold metabolism result. Other critical points are:

- Mixing good quality Nutmeg with ground fall Nutmeg. For our case, we already teach farmers about cultivation and harvest method to ensure nut Meg is safe from mold and toxin contamination.
- Nutmeg Drying imperfect, then water contain of Nutmeg more than 10%. This condition can cause the growth of mold, and in turn will be produce mycotoxins consist of: Aflatoxin and Ochratoxin.
- Mixing nutmeg ripe and young nutmeg.
- Nutmeg drying not use the pedestal, if farmers or farmers group do not use equipment aid, such as Drying oven.
- Delivering Nutmeg not use decent and clean container.

For these critical control points, Govt, of Indonesia already accompany farmers and farmers group through program of Directorate General of Plantation. Accompany of farmers and or farmers group program done to province that produce Nutmeg. We have 3 provinces that produce Nutmeg, include:

- North Celebes (Siaw Island, Manado and Bitung)
- Maluku and North Maluku (Banda Island and ternate)
- West Papua (Fakfak).

Post harvest Handling in collectors and exporter ware house

Post harvest handling in collectors warehouse is one of critical point of mycotoxin contamination. To avoid mycotoxin (aflatoxin and Ochratoxin) contamination of Nutmeg, collectors warehouse should be implemented Good Handling Practice. There are several stage to implemented Good Handling Practices to avoid mycotoxin contamination of Nutmeg, consist of:

- Raw material Sortation on the collecting House.
- To control of temperature and humidity of ware house for nutmeg storage.
- Raw material sortation on the exporter comply with requirement.
- Testing for incoming raw material.
- Control of humidity and temperature of warehouse not only for raw material but also for finished product comply with requirement.

In Nutmeg Supply Chain, we lost 1 chain data. This chain is Transportation Handling. Logically, within one month of Nut Meg travel from Indonesia to EU country, will potentially occurrence of contamination, especially Mycotoxin contamination. Mycotoxin will be coming if, exporter not control humidity and temperature of container that they used. As well as we know, Mycotoxin be produces of mold or fungi. Mold or Fungi will be grow if container have high humidity (more than 75%).

Till now, Govt. only control up in the exporter ware house. We do not know about shipping or transportation handling. Till now, we do not have the data of humidity and temperature records along the journey.

By considering Nutmeg Supply chain and data of Govt. Inspection, mentoring programs for nutmeg farmers and exporter, Contamination likely occur in Handling Transportation chain, along journey from Indonesia to EU Country [1-5].

Conclusion

To prevent Aflatoxin contamination of Nutmeg, we must give different treatment between Nutmeg which has been contaminated with *Aspergillus flavus* fungi with nutmeg which is not contaminated with *Aspergillus flavus* Fungi.

For Nutmeg, which is free of fungal contamination, it can be sent in refrigerated containers to regulate temperature and humidity below 75%, to prevent fungus growth.

For nutmegs that have been contaminated with *aspergillus flavus* mushrooms, nutmeg seeds must be shipped with containers that have been regulated by temperature and humidity that do not grip the life of the fungus but do not support fungi to produce toxins.

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