

RESIDUE AND CONTAMINANTS

- Foods naturally contain proteins, carbohydrates and other chemicals. From raw material to the end product, some changes in food compositions are observed during processing or storage. If these are in the legal limits, there would be no problem. However, if the contents of the changes exceed the limits, then the foods can not be consumed (E.g. PAH formation during grilling of meat, acrylamid etc.)
- Some compounds can externally contaminate to the foods. E.g. Heavy metals
- Some others can be found because of applied techniques during growing of plants or animals such as pesticides and hormones.
- These all are called as **«residue or contaminant»**.
- In general, **contaminant** is defined as the compounds that **externally contaminate to the food or form during processing**,
- however, **residue** is defined as the compounds **remaning in the foods** after the treatments during the growing of plants and animals.
- In Turkish Food Codex, Contaminant Regulation, there is no differenciation between residue and contaminant and all are called as «CONTAMINANTS».
- **Reference suggestion:**
 - (1) *Encyclopedia of Food Safety*, (Matarjemi, Y, Moy, GG. and Todd, E.C.D., Editörler). Vol: 1-4. 2356 pages. Elsevier. (2014).
 - (2) *Food and Nutritional Toxicity* (Omaye, S.T.), 308 pages, CRC Press. (2004)

- Ideally, foods never contain any hazardous substances (residue or contaminant) for health, however, that is almost impossible. Therefore, **the maximum limits** have been defined for the toxic materials that they are harmless under them. For residues, these limits are called as **Maksimum Residue Limit (MRL)**. For example, there is a **maximum limit** for *Aflatoksin B₁* (due to fungi growth) in red pepper is 5ppb, while a **Maximum Residue Limit (MRL)** for *Alachlor* (a pestisit) is 10ppb.
- Humans or many living organisms have their natural detoxification systems (enzymes) and so, they can reduce the concentration of toxic substances by converting them into the other substances or discarding them from the body by urinary system.
- The amount of a substance (dose) that a person is exposed to is as important as the nature of the substance. For example, small doses of aspirin can be beneficial to a person, but at very high doses, this common medicine can be deadly. **Paracelsus**, a Swiss Chemist, defined poison as:

«All things are poison and nothing (is) without poison; only the dose makes that a thing is no poison».

That is the basis of modern toxicology.

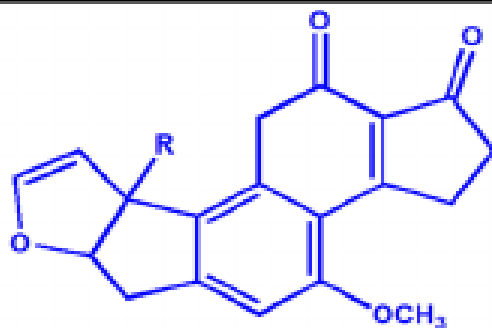


Paracelcus (1493-1541)

The Primary Contaminants in Foods

- There may be many type and number of contaminant and residue in foods. The major ones are:
- Pesticides
- Fungi toxins
- Heavy metals
- Process contaminants (PAHs, 3-MCPD, acrylamid, biogenic amines etc)
- Microorganisms
- Detergens-disinfectants
- Food residues
- Plastics and their wastes because of migration from packaging material
- Hormons
- Radioactive materials
- Allergenes
- Antibiotics
- Veterinery drug residues, hormones and plant growth regulators

Some Mycotoxins

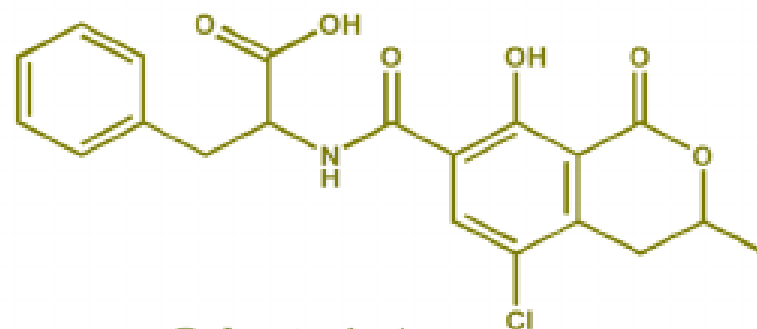


Aflatoxin B1

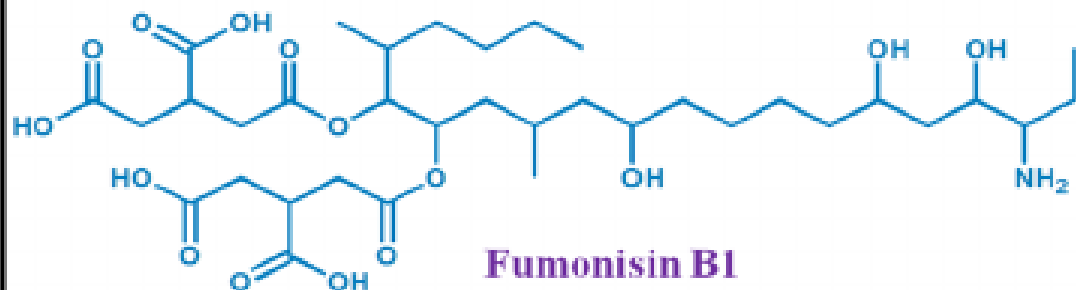
R = H

Aflatoxin M1

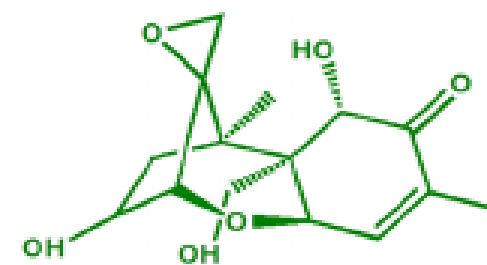
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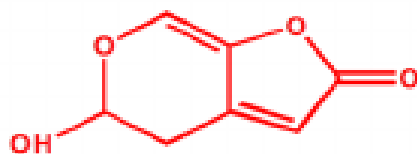
Ochratoxin A



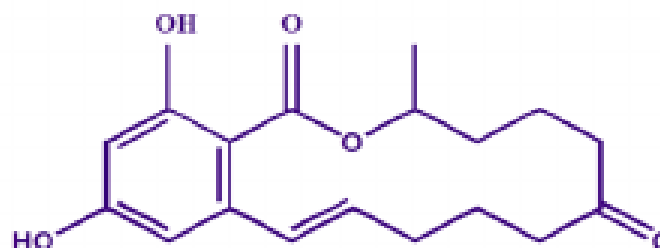
Fumonisin B1



Deoxynivalenol



Patulin



Zearalenone



Citrinin

AFLATOXINS

- Aflatoxins are amongst the most poisonous mycotoxins and produced by certain moulds (*Aspergillus flavus* and *Aspergillus parasiticus*) which grow in soil, decaying vegetation, hay, and grains.
- Crops that are frequently affected by *Aspergillus* spp. include cereals (corn, sorghum, wheat and rice), oilseeds (soybean, peanut, sunflower and cotton seeds), spices (chili peppers, black pepper, coriander, turmeric and ginger) and tree nuts (pistachio, almond, walnut, coconut and Brazil nut).
- The toxins can also be found in the milk of animals that are fed contaminated feed, in the form of aflatoxin M1.
- Large doses of aflatoxins can lead to acute poisoning (aflatoxicosis) and can be life threatening, usually through damage to the liver.
- Aflatoxins have also been shown to be genotoxic, meaning they can damage DNA and cause cancer in animal species. There is also evidence that they can cause liver cancer in humans.

OCHRATOXIN and PATULIN

Ochratoxin

- Ochratoxin A is produced by several species of *Aspergillus* and *Penicillium*.
- Contamination of food commodities, such as cereals and cereal products, coffee beans, dry vine fruits, wine and grape juice, spices and liquorice, occurs worldwide.
- most sensitive and notable effect is kidney damage, but the toxin may also have effects on fetal development and on the immune system.

Patulin

- Patulin is produced a variety of moulds such as *Aspergillus* and *Penicillium*
- Major human dietary sources of patulin are apples and apple juice made from affected fruit.
- For humans, effects on nausea, gastrointestinal disturbances and vomiting have been reported.
- Considered genotoxic but carcinogenic potential has not been demonstrated yet

Other Important Mycotoxins

- **Trichothecenes - *Fusarium spp***
 - Associated with a variety of cereals and wet harvest conditions
- **Zearalenone - *Fusarium spp***
 - Associated with maize grown in temperate climates
- **Fumonisin - *Fusarium spp***
 - Primarily associated with maize