

FOOD SUPPLEMENTS QUALITY AND SAFETY REQUIREMENTS

- 10.1 Introduction in Food safety. Legislation in force
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 - 10. 2.1.1 Hazards coming from raw materials and ingredients
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 - 10. 2. 2. Hazards coming from environment and processing
- 10.3 How to keep food/food supplements safety?



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Legislation to protect the consumer

Safety Aspects

- Protect the health of the Consumer
- Ensure the implementation of maximum limits

Quality Aspects

- Ensure correct labelling
- Detection and prevention of frauds



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10.1 Introduction in Food safety. Legislation in force



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10.2. The main hazards in food supplements

- capacity of plants/food to accumulate chemical substances from the environment and from agriculture and food industry technologies as a consequence of intensive production;
- influence of health by human exposure;
- the widening of the phenomenon and its continuous expanding.

The toxicity of chemicals in food/food supplements are depending on:

- Quantity and periodicity;
- Sinergies and antagonisms between chemical substances and plants/foods;
- Metabolic changes on the animal/vegetal tissues which will lead to decrease/increase of pollutant toxicity.



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Environmental potential polluted

Soil: rezidues, manure or garbage (organic, packaging materials) unproper stored.

- Pollutants from the environment , i.e. through industrial heating processes – furans, dioxines or PCBs;
- Agrochemicals;
- Microbs – fungi – micotoxins.

Air: sulphure oxides, nitrate oxides, heavy metals and other volatile organic compounds from heavy industry;

Water: substances used in agro-food technological processes – contamination of surface waters.

Technology Pollutants

- Synthetical additives: flavours, dyes, preservatives etc.;
- Acrylamid;
- Hydroximetilfurfural (HMF);
- Polycyclic aromatic hydrocarbons (PAH);
- Polychlorinated biphenyls or PCBs;
- Nitrozamines;
- Phatalates, bisfenol A (BPA) .

Agrochemicals

- Pesticides;
- Fungicides;
- Nitrates;
- Plant protection chemicals.

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Pollutants from the environment

- Dioxins;
- Heavy metals;
- Micotoxins;
- Polycyclic aromatic hydrocarbons (PAH);
- Substances from car traffics: benzene,
- Radioactive substances;
- So on.

Veterinary pharmaceuticals or drug-resistant pathogens

- Antibiotics;
- Hormons;
- Other drugs.



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Bioaccumulation and Biomagnification

Bioaccumulation refers to the accumulation of substances, such as pesticides, or other organic chemicals in an organism (vegetal or animal). Bioaccumulation occurs when an organism absorbs a toxic substances at a rate greater than at which the substance is lost.

„ Bioaccumulation is defined as the accumulation of chemicals in the tissue of organisms through any route, including respiration, ingestions, or direct contact with contaminated water, sediment, and pore water in the sediment”

„**Biomagnification** is a result of the process of bioaccumulation and biotransfer by which tissue concentrations of chemicals in organisms at one trophic level exceed tissue concentrations in organisms at the next trophic level in a food chain”

– US Environmental Protection Agency, 2000.

HEAVY METALS

- Heavy metals transferred via the food chain represent a relevant group of contaminants which may induce toxic effects in consumers;
- Heavy metals are sometimes polluting soil and air and human activities like waste disposal, mining, sludge applications, and from exhaust, fertilizers, fungicides and, are very much depending of the industrial level of the area;
- The main hazard from heavy metals are associated with lead, cadmium, mercury and arsenic contamination;
- People are primarily exposed to mercury via fish, especially shark, swordfish and tuna or pike, walleye and bass.

BENZENE

Benzene is ubiquitous in the atmosphere.

- It has been identified in air samples of both rural and urban environments and in indoor air.
- Although a large volume of benzene is released to the environment, environmental levels are low because of efficient removal and degradation processes.

The U.S. Food and Drug Administration funded for 5 years period a study to determine the amount of volatile organics in food from 1996 to 2000. Benzene was found in over 40 type of foods. Greenberg, A, Weisel, CP, Benzene, POTENTIAL FOR HUMAN EXPOSURE, 2006, USDA, U.S. Department of Agriculture.



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Polycyclic aromatic hydrocarbons - PAHs

benz[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene chrysene, indeno(1,2,3-cd)pyrene

- one of the most widespread organic pollutants;
- lipophilic substances.
- in soil, sediment, fossil fuels or various edible oils and oily substances; component of concern in particulate matter suspended in air;
- in addition to their presence in fossil fuels they are also formed by incomplete combustion of carbon containing fuels such as wood, coal, diesel, fat or tobacco.
- natural crude oil and coal deposits contain significant amounts of PAHs, arising from chemical conversion of natural product molecules, such as steroids, to aromatic hydrocarbons.
- these compounds can enter the food chain through organisms such as plankton or fish.

Packaging material chemical hazard

Packaging materials can come with several chemical hazards as the following substances: antimony, tin, lead, perfluorooctanic acid (PFOA), semicarbazida, benzophenone, isopropyl thioxanthone (ITX), bisphenol A.

Bisphenol A (BPA) is an industrial chemical widely used in the production of polycarbonate plastics;

- Used in food contact materials – baby bottle and food containers;
- Consumer exposure to BPA via the diet
- Exposure of adults to BPA was $<0.01-0.04\mu\text{g}/\text{kg}$ body weight per day and for children and teenagers $0.1-0.5\mu\text{g}/\text{kg}$ body weight per day.



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Agrochemicals

- as insecticides, herbicides, fungicides, fertilizers, rodenticides and plant growth regulators, nitrates can also be chemical hazards and contaminate the raw materials which will be further used for producing food. If they are not used according with the best agricultural practices it is possible to be found residues of these chemicals in agro foodstuff.
- after decades of heavy industrial activities and intensive use of pesticide in agriculture, the environment in some areas in the world has become polluted with mixtures of chemical compounds, of which some have been restricted and banned since decades, such as DDTs, PCBs and dioxins.
- these and other persistent organic pollutants (POPs) have physical and chemical properties which result in long range atmospheric transport, bioaccumulation and biomagnification in living organisms.
- POPs are toxic substances which may cause potential adverse health effects.
- The Stockholm Convention is an international treaty for protecting human health and the environment from POPs (of which Romania's ratification entered into force at 26/01/2005).



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Nitrates, Nitrites, Nitroamines

- Nitrates are used as fertilizers in high quantity where intensive agriculture is done.
- Nitrates are easily transformed into nitrites;
- Nitrosamine is produced from nitrites and amines, which often occur in the form of proteins.
- Epidemiological studies have demonstrated association between increased risk of cancer, with consumption of foods with elevated levels of nitrosamines.



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DIOXINS

A group of chemically-related compounds that are persistent environmental pollutants (POPs): *2,3,7,8- tetrachlorodibenzo para dioxin (TCDD)*. The name "dioxins" is often used for the family of structurally and chemically related *polychlorinated dibenzo para dioxins (PCDDs)* and *polychlorinated dibenzofurans (PCDFs)*.

419 types of dioxin-related compounds have been identified but only about 30 of these are considered to have significant toxicity, with TCDD being the most toxic.

- are found throughout the world in the environment and they are accumulated in the food chain, mainly in the fatty tissue of animals.
- more than 90% of human exposure is through food, mainly meat and dairy products, fish and shellfish.
- dioxins are highly toxic and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer.
- due to the omnipresence of dioxins, all people have background exposure, which is not expected to affect human health. They last into the body a long time because of their chemical stability and their ability to be absorbed by fat tissue, where they are then stored in the body. Their half-life in the body is estimated to be 7 to 11 years.



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SOURCES OF DIOXINS

- are mainly by-products of industrial processes but can also result from natural processes, such as **volcanic eruptions and forest fires, leaves backyard burning**;
- manufacturing processes including smelting, chlorine bleaching of paper pulp and the manufacturing of some herbicides and pesticides;
- release into the environment - uncontrolled waste incinerators (solid waste and hospital waste) ;
- extensive stores of PCB-based waste industrial oils, many with high levels of PCDFs, exist throughout the world. Long-term storage and improper disposal of this material may result in dioxin release into the environment and the contamination of human and animal food supplies.
- **although formation of dioxins is local, environmental distribution is global.**



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10.2.1 Hazards coming from outside Food supplements processing area (raw materials, ingredients, others)

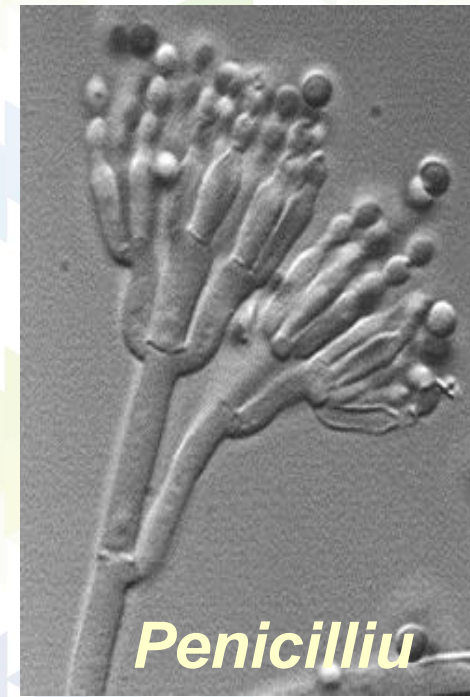
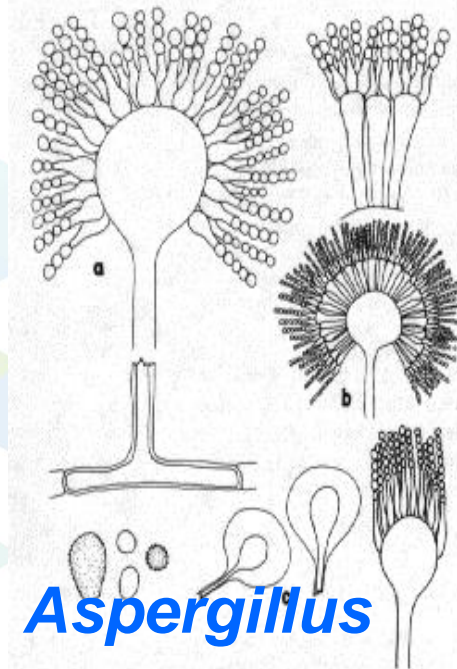
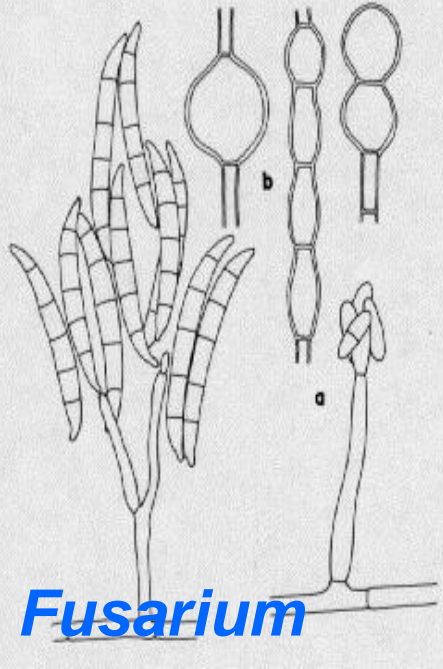


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Mycotoxins: Secondary metabolites, produced by fungi, mainly in field





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Mycotoxins: Secondary metabolites, produced by fungi, mainly in field

- Weak parasite
- Very susceptible to ecological conditions
- Opt conditions differ for growth & toxicity
- Mycotoxins production elicited by stress



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Rating health risks from food

Acute

Chronic

Microbiological

Phycotoxins

Some phytotoxins

Mycotoxins

Antropogenic contaminants

Pesticide residues

Food additives

High



Mycotoxins

Antropogenic contaminants

Some phytotoxins

Unbalanced diet

Phycotoxins

Food additives

Pesticide residues

Microbiological

Low

Kuiper-Goodman, 2006



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Molds and mycotoxins

- Fungi, algae and mosses are a highly diverse biological group
- They represent more than 85 % of the botanical diversity
- Moulds are a group of fungi
- Mycotoxins are secondary metabolites from fungi (mould)
- It is estimated that about 20% of crops are contaminated with mycotoxins worldwide
- Particular mycotoxins may be carcinogenic, neurotoxic, estrogenic, teratogenic, immunosuppressive
- Some mycotoxins have a world-wide importance having a significant impact on public health: Aflatoxins; Deoxynivalenol; Zearalenone; Fumonisin; Ochratoxin A; Sterigmatocystin; T-2 & HT-2 toxins



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Mycotoxins and climate conditions

- Climate conditions play an important role in fungal growth
- Moisture, temperature, oxygen and nutrients impact fungal growth
- Interactions of moulds with the hosts and the substrate are essential for their survival, reproduction, dispersal and geographic distribution
- Already today we need to adapt food safety measures to the fluctuation

CONCLUSIONS



There are many chemical hazards which can enter into the food chain.

Chemicals are easily accumulated in animal and vegetal tissues (bioaccumulation)

Many of them are spread by air and water and contaminate large areas.

Many are influenced by climate:

- high temperatures of air: forest fires;
- Changing in agricultural practices because of new plant/animal diseases: new agrochemicals, new drugs

New and improved food safety rules are needed

New analytical methods, less expensive and less time consuming are needed