GENERAL ISSUES CONCERNING THE WAYS OF CONTAMINATION HORTICULTURAL PRODUCTS RAW MATERIALS FOR INDUSTRIALIZATION

ASPECTE GENERALE PRIVIND CĂILE DE CONTAMINARE A PRODUSELOR HORTICOLE MATERIE PRIMĂ PENTRU INDUSTRIALIZARE

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Abstract. *Hygienic quality (innocuity) to food is influenced by microbiological contamination orwith other organisms, by chemical pollution and natural toxicity of food. To maintain population's health, vegetables and fruits for industrial must meet primarily in terms of innocuity, because the failure of the condition can lead to disease more or less serious. The environment the fruits and vegetables are produced in which are obtained, can be a source of contamination of horticultural products with different chemical pollutans or biological contaminants. Normally existing in nature or taken from human activity, nitrites, heavy metals, pesticide residues, bacteria and dangerous molds, can accumulate in horticultural products, sometimes up to dangerous concentrations for the human body. Also, must be considered the contamination with various human pathogens (viruses, parasites) and presence of toxic compounds in the product that forms naturally.*

Key words: innocuity, contamination, toxic compounds

Rezumat. *Calitatea igienică (inocuitatea) a alimentelor este influenţată de contaminarea microbiologică sau cu alte organisme, de poluarea chimică şi de toxicitatea naturală a produselor alimentare. Pentru a menţine starea de sănătate a populaţiei, legumle şi fructele pentru industrializare trebuie să corespundă în primul rând sub aspectul inocuităţii, deoarece neîndeplinirea acestei condiţii poate conduce la îmbolnăviri mai mult sau mai puţin grave. Mediul înconjurător în care se obţin fructele şi legumele poate reprezenta o sursă de contaminare a produselor horticole cu diverşi poluanţi chimici sau biologici. Existenţi în mod normal în natură sau preluaţi din activitatea umană, nitriţii, metalele grele, reziduurile de pesticide, bacteriile şi mucegaiurile periculoase, se pot acumula în produse horticole, uneori la concentraţii periculoase pentru sănătatea omului. De asemenea, trebuie avută în vedere şi contaminarea cu diverşi agenţi patogeni pentru om (viruşi, paraziţi) cât şi prezenţa în produs a unor compuşi toxici care se formează în mod natural.*

Cuvinte cheie: inocuitate, contaminare, compuşi toxici

INTRODUCTION

The products consumed must provide us with the optimal quantities of all substances our body needs. A correct nutrition also means the fulfillment of

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another essential condition: the canned fruits and vegetables should lack toxic agents or these should be below the dangerous limits (Banu C. et al., 1982).

Fruits and vegetables in fresh state or in a processed form may represent a valuable source of nutritive principles contributing to a healthy nutrition and fortifying the human body at the most different ages. But in certain situations, we lose the initial and favorable benefit by resorting to unprofitable technologies in terms of food safety and seeking first the quantity and the volume of merchandise for trading (Beceanu D., 2009).

MATERIAL AND METHOD

Bibliographic material was used both from national and international specialized literature, as well as electronic databases from the internet network, with scientific papers in the field, which allowed studying and evaluating ways of contamination of horticultural products, raw material for industrialization.

RESULTS AND DISCUSSIONS

Sometimes irreproachable in terms of appearance and with a good storage period, fruits and vegetables are relatively frequently contaminated with diverse substances that might jeopardize the health of certain categories of consumers on a medium or long term. We may say that the effect is not obvious in case of a small dose or quantity since the body reacts differently depending on numerous factors (Beceanu D., 2009).

The migration of different chemical and biological compounds and the presence in the food of some toxic products appeared naturally may have two side effects: they may give the food an unpleasant flavor and/or smell and they may be toxic for the consumer. The first situation is generally encountered by the manufacturer; consequently they will take remedial measures. The efforts and national and international regulations focus on the toxic potential of these compounds (Deshpande S.S., 2002).

The toxic action of nitrites and nitrates has been known for a long time. The toxicological implications of these chemical substances have become even more complex in order to highlight the cumulative effect of nitrates. High concentrations of nitrites in plants (especially vegetables) are dangerous for the human body for two reasons: the possibility of appearance of methemoglobinemia in children and the conversion of nitrates into nitrites in saliva and the formation of carcinogenic nitrosamines in the intestinal tract.

Based on some studies made on animals and the clinical experience in human beings, the admissible daily intake mentioned by FAO/OMS Expert Committee on Food Additives for 0-5mg/kg body weight (expressed as sodium nitrate) had to be increased to 0-25 mg/kg. On the basis of the same criteria, the admissible daily intake for nitrite is 0-0.1 mg/kg, expressed as sodium nitrite.

From the nutritional viewpoint, the metals found in food products are metals having a well determined physiological role, thus they are called essential or biometals and nonessential metals, respectively.

Sodium, potassium, calcium, magnesium, iron, copper, zinc, manganese, cobalt, and selenium belong to the first category. Their lack or insufficiency from human nutrition triggers after a certain time period disorders of metabolic processes and the appearance of deficiency diseases.

Nonessential metals are lead, mercury, aluminum, tin, nickel, cadmium, chromium, silver etc. their presence into foods appears as a contamination. Introduced in the body, metals behave like chemical impurifiers traversing the body and getting eliminated.

The severity of the toxic effect is dependent on the nature, quantity and chemical form under which the metal exists in fruits and vegetables, the share of the contaminated food in the menu structure, the body's resistance, the synergic or antagonic effect of other chemical compounds, and other factors. Some metals start producing their toxic effect only after they already accumulated in the body in a critical quantity. This cumulative effect is encountered for lead, cadmium and mercury.

The toxic metals that appear most frequently in food poisonings are: lead, cadmium, chromium, copper, mercury (Dumitru V., 2008).

Lead poisonings appear after the lead has entered the body and accumulated in it. This acts on the peripheral nervous system causing disorders in intellectual development, disorders of the function of the peripheral nerves manifested in most serious cases by motor paralyses. It is estimated that if the lead absorption does not exceed 1 mg/day, the body manages to eliminate it through the renal tract (Watson D.H., 2002).

Cadmium causes numerous and profound modifications of metabolic functions within the body manifested by the increase of blood pressure. The water for nutrition must contain less than 5 μg of cadmium per liter (Dumitru V., 2008; Banu C., 2007).

The main way of exposure to cadmium for nonsmokers is the nutritional one, since smoking triggers an important quantity of cadmium. There is no evidence that any of the inhabitants of villages have suffered from side effects (Watson D.H., 2002).

Chromium is present in a concentration close to 0.1 mg/kg of dry substance in the vegetal and animal tissues. The hexavalent chromium derivatives (chromic acid, chromates and bio-chromates) are very dangerous because they are allergic and carcinogenic (Dumitru V., 2008; Savu C., Georgescu N., 2004).

Copper manifests its toxicity directly on tissues by accumulating into the liver, kidneys and suprarenal glands. It mainly appears in root crops, nuts, and alcoholic drinks.

Like lead and cadmium, **mercury** has a cumulative effect. Its toxicity it is for a long term and manifests at the level of kidneys and the nervous system. 5 to 15% from the swallowed quantity of ionized mercury is absorbed by the body (Clemensa T., 2001).

Human being's main source of pollution with methyl mercury is represented by foods, especially by fish and products resulted for them. According to the statistical data related to the fish consumption in the countries

having a fish tradition, for a consumption of 600 g fish/week (80 g/day) containing 0.5 mg Hg/kg, a significant quantity of mercury accumulated in the body that may cause problems to the consumer. The provisional tolerable weekly intake (PTWI) for mercury and methyl mercury, approved by EFSA (European Food Safety Authority) in 2004 is 1.6 μg/body weight (Savu C., Georgescu N., 2004; Banu C., 2007).

The heavy metals existing in the soil in large quantities may penetrate fruits without being metabolized in synthesis processes and through these into the human body. Though the cases where fresh fruit contain large quantities of such elements are rare, this issue is regulated by the national legislation, thus according to order no. 975/1998 of the Romanian Ministry of Public Health and JECFA 2005, they establish maximum limits accepted for heavy metals (table 1).

Table 1

Maximum limits of heavy metals in vegetables and fruits expressed in mg / kg of fresh product according to Order no. 975/1998 of the Romanian Ministry of Public Health and JECFA 2005

Vegetables and fruit	As	Cd	Pb	Zn	Cu	Sn	Hg
Fresh vegetables except leafy vegetables	0,5	0,1	0,5	15	5	-	0,05
Leaf Vegetables	-	0,2	0,5	-	-	-	0,03
Fresh Fruit	0,5	0,05	0,5	0,5	5	-	0,05

The pollution of foods with pesticides represents a considerably hazardous potential for consumer's health. The toxicity of pesticides manifests by acute and chronic intoxications, the influence on the nervous system, histological modifications of lever, disturbance of immunologic responsiveness and interferences within the vitamin metabolism (Diaconescu I., 2007).

The contamination of vegetables and fruits in fresh state may occur easily during their growing, maturation, harvest and delivery.

The environment in which fruit and vegetable raw materials are obtained may represent a source of contamination of horticultural products with diverse chemical or biological polluters. Normally existing in nature or taken over by the human activity, nitrites, the heavy metals, the pesticide residues, hazardous bacteria and molds may accumulate in horticultural products sometimes in dangerous concentrations for the human health (Dumitru V., 2008; Banu C., 2007).

Of a special importance is the contamination a chemical pollution (chemical innocuity) of horticultural raw materials as a result of the occasional or permanent use of some chemical substances in agriculture. In this respect, we mention the pollution with pesticides of horticultural products, the consequence of their use in phytosanitary treatments (fungicides, insecticides, acaricides, herbicides etc.). The ways of contamination of food products with pesticides are multiple and an important role is played by air, water and soil (Banu C. et al., 1982; Cuciureanu R., 2002).

The fixation by plants of the polluting chemical substances largely depends on the type of cultivated plants. For example, in case of pesticides the plants

concentrating the highest quantity of pollutant in the soil are carrots and potatoes. Fruits may contain variable quantities of pesticides due to the phytosanitary treatment of trees in their different vegetative periods (Cuciureanu R., 2002).

The chemical contamination of fresh fruits and vegetables may also occur naturally by means of some chemical compounds of natural origin or during harvest, transport and handling (natural toxins, mycotoxins etc.).

Another contamination source is the heavy metals (Cu, Fe, Sn, Zn, Pb, As and Cd) that may reach the vegetal products on several ways:

- air pollution;
- absorption into the soil, the use of waste waters in agriculture;
- following the treatments applied in agriculture (spraying of insecticides and fungicides containing heavy metals in their composition);
- use of fertilizers; cultures situated in areas near roads etc.

At the same time, nitrites and nitrates may penetrate vegetables and fruits through the use of natural organic fertilizers (manure) in agriculture, especially the synthetic nitrogenous ones. Their degradation products enrich the soil and may accumulate in the plants cultivated up to hazardous levels for consumers.

The temporary storage of vegetables and fruits after harvesting in inadequate conditions (in large piles, humid and warm areas etc.) may determine the accumulation of large quantities of nitrites through the reduction of nitrates (Dumitru V., 2008).

Natural pollution of waters with chemical substances resulted from different industries (derivatives of aluminum, antimony, arsenic, bromine, chlorine, chromium, iron, fluoride, cadmium, manganese, magnesium, mercury, lead, selenium, amines, cyanides, pesticides, detergents, tars, solvents etc.) may contribute to the contamination or pollution of products of vegetal origin.

Biological contamination (biological innocuity) of the horticultural raw materials with pathogen microorganisms occurs by several ways: soil, water, plants and products of plants, tools for working the soil, air and dust (Banu, C. şi colab., 1982).

The contamination of foods with microorganisms may also occur through the contact with contaminated individuals having precarious body hygiene during harvest, processing and delivery. Fruits and vegetables in fresh state may be contaminated with the following pathogen bacteria: *Campylobacter* sp, *Clostridium* sp., *Escherichia coli*, *Listeria monocytogenes*, *Shigella* sp., *Salmonella* sp., *Vibrio* sp., *Yersinia enterocolitica, Staphyloccocus aureus* (Banu C., 2007).

Viruses appear on the fresh fruits and vegetables by means of contaminated water and the employees that fail to comply with the rules f personal hygiene. The main viruses transmitted via foods are: hepatitis A virus, Norwalk virus, Rotavirus.

Mycotoxins and the compounds naturally released by molds into the environment contaminate the food products depending on the state of the product, temperature, air oxygen, the nature of sublayer and the water quantity. Thus, in carrots *Aspergilus parasilicus* synthesizes *A. flavus* and on the surface of citric fruit *A. parasilicus* develops.

The environment conditions may favor the pollution of food products with pathogen germs, viruses, the eggs of some parasitic worms, including heavy metals, pesticides, different chemical substances resulted from industry (Tofan C., 2001, Diaconescu I., 2007, Banu C., 1982).

Industrial pollution of air with different emissions, smoke, gases, aerosols, dust, vapors, mist represent at the same time a pollution factor of food products of vegetal origin.

Radioactive pollution of the environment and implicitly of the food products is the consequence if nuclear explosions, the wider and wider use of ionized radiations, radioactive elements and nuclear power. Radioactive contamination of vegetal products occurs directly through the radioactive deposits on such plants or indirectly via water and soil. The radionuclides that are mostly frequent in vegetables and fruits are: ^{137}Cs , ^{90}Sr , ^{131}I (Cuciureanu R., 2002).

CONCLUSIONS

1. Fruits and vegetables, raw material for industrialization can represent ways to convey different contaminants (nitrites, heavy metals, pesticide residues, bacteria and fungi) present in the environment;

2. Chemical and biological contaminants can accumulate in horticultural products, sometimes to dangerous concentrations for the human body;

3. Raw materials, the first elements in the food chain, make very difficult problems to industries in terms of determining the concentration of toxic compounds in food.

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