GENERAL ISSUES CONCERNING THE WAYS OF CONTAMINATION ON TECHNOLOGICAL FLOW OF PROCESSED HORTICULTURAL PRODUCTS UNDER PROCESSING

ASPECTE GENERALE PRIVIND CĂILE ŞI MODUL DE CONTAMINARE PE FLUXUL TEHNOLOGIC A PRODUSELOR HORTICOLE ÎN CURS DE PRELUCRARE

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Abstract. *One of the main functions of the contaminated food is the innocuity. This implies that food is free of harmful microorganisms, heavymetals and other chemicals for the human consumption. For that, it takes into account both the degree of raw material hygiene and the proper way to process the aliments. In processed products made from horticultural raw materials, appear specific sources of pollution and contamination, which depend on the nature and type of equipment or process lines applied, food additives and packaging technologies or implemented framework. Food preservation prevents their degradation in time, stopping the loss of nutritional and organoleptic qualities. For total elimination of biodegradation germs, the industry appeals to: physical treatment (thermal, iradiations) or the use of chemicals which can have negative effects, their residues being present in finished food.*

Key words: horticultural products, contaminants, conservation.

Rezumat. *Una din funcţiile principale ale alimentelor contaminate este reprezentată de inocuitate. Aceasta presupune ca alimentul să fie lipsit de microorganisme dăunătoare, metale grele şi alţi compuşi chimici improprii consumului uman. Pentru aceasta se are în vedere atât gradul de igienă a materie prime cât şi modalitatea corectă de procesare a alimentelor. În produsele prelucrate, realizate din materii prime horticole apar surse specifice de poluare şi contaminare, care depind de natura şi tipul utilajelor sau liniilor tehnologice folosite, aditivii alimentari şi ambalajele utilizate. Conservarea alimentelor previne degradarea acestora în timp, împiedicând pierderea calităţilor nutritive şi organoleptice. Pentru eliminarea totală a germenilor biodegradării, se apelează la: tratamente fizice (termice, iradieri) sau la utilizarea unor produse chimice care însă au şi efecte negative prin prezenţa reziduurilor acestora în alimentele finite.*

Cuvinte cheie: produse horticole, contaminanţi, conservare

INTRODUCTION

In order to provide consumers with processed horticultural products having a high level of innocuity, it is necessary to find the most adequate technological methods for the inactivation or removal of the substances having an antinutritive

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character that may be frequently found in the horticultural raw materials or that may form during preservation or processing. A special attention must be paid to those processing methods that inhibit the development of alteration or pathogen microorganisms or those that ensure the destruction of these microorganisms.

The processing of the raw materials and the different processing methods of food products may lead to the penetration of certain toxic substances for the body (nitrosamines, polymers of thermal oxidization etc) besides the fact that they may lead to the reduction of quality of such products.

Since the processing of food raw materials into finite products triggers in certain cases a diminution of the nutritive value, it is necessary to take actions to improve these products through the addition of vitamins, mineral salts and proteins (Banu C. et al., 1982).

MATERIAL AND METHOD

In addition to studying specialized literature I have consulted various websites of non-governmental agencies in our country, which have as main activity the study of contaminants in the finished product.

RESULTS AND DISCUSSIONS

In the processed products obtained from horticultural raw materials there are specific sources of pollution and contamination.

Besides the possible impact, which may be avoided, of the contaminants from the fresh products, here appear specific sources of pollution and contamination depending on the nature and type of equipment or technological lines used, the food additives and packing used or the technologies applied (Beceanu D., 2009).

The manipulation and transport of horticultural products to the packing and processing location is often made in specific containers. These may be often sources of microorganisms that contaminate products. A good example is the fungus *Geothricum candidum* also known as tool mould that may be found on the harvest and processing equipment which was improperly cleaned.

The storage of vegetables and fruits after harvest in inadequate conditions favoring the development of degradation microorganisms may lead to the accumulation of large quantities of nitrites through the reduction of nitrates.

Down-times in the technological flow for the manufacture of processed products from fruits and vegetables are also cases for the conversion of nitrates into nitrites.

The vegetables characterized by strong reducing systems such as spinach, asparagus and lettuce, which quickly turn nitrates into nitrites, will be stored only for short time periods before processing.

In the processing method they must choose those procedures that ensure the decrease of nitrates. Thus, the washing of vegetables with large quantities of water and their boiling for a short period of time and the throwing away of water may reduce nitrates up to 30% from the initial quantity.

As for the preparation of the raw material, they must ensure a maximum reduction of the content in microorganisms since the effect of sterilization process depends on the initial number of microorganisms. The effect of sterilization is much more certain if the number of microorganisms was reduced before sterilization.

To prevent contamination with pesticide residues, they will use certified raw materials in the manufacture process, materials that may comply with the sanitary regulations in force for such category of contaminants.

The processing of fruits and vegetables, the correct preparation of the raw material may lead to an important reduction of the pesticide content. Thus, during washing, between 10 and 50% of the insecticide residues are eliminated depending on the type of insecticide and the nature of the product.

Peeling fruits and vegetables reduces pesticide residues by 90-94%.

By pasteurization and sterilization of the products processed from vegetables and fruits, the pesticide content may be considerably reduced.

For the fruits and vegetables preserved by freezing and dehydration, the quantities of pesticides are high.

The contamination with patulin of processed products from vegetables and fruits occurs through the use of some raw materials inadequate from the qualitative viewpoint in the manufacture process, materials that are attacked by molds: *Penicillium patulum, Penicillium expansum, Penicillium urticae, Penicillium claviforme, Aspergillius clavatus.*

Due to the potential risks for health, the Food and Drug Administration limits patulin to 50 μg/l in fruit juices and in apple juices obtained from concentrated apple juice. This limitation only for the apple juices and concentrated apple juices relied on the fact that in time they could fin natural contamination only in the apple juice and cider and they are the major source of patulin for the human consumption. Wine and vinegar do not contain patulin because it cannot survive the alcoholic fermentation (Dumitru V., 2008; Tomás-Barberán F.A., Robins R.J., 1997).

Alcoholic fermentation of fruit juices destroys patulin and, consequently, the fermented products such as apple and pear cider do not contain patulin. Despite all these, patulin was found in fermented products to which they added apple juice for different corrections after fermentation. Patulin is relatively thermostable, especially to an acid pH. It has been proven that the short term treatment at high temperatures (150ºC) leads to a reduction by 20% of patulin concentration. Despite all these, only the thermal processing is not enough to obtain a patulin-free product. Sugar has a protective effect for mycotoxins, this is the reason why patulin may be found in sugar concentrated products.

When processing fruits and vegetables as canned food there may appear microorganisms causing their microbiologic alteration. The microbiological alteration of canned vegetable may appear under diverse forms depending on the product assortment and the characteristics of such microflora: “bulging” and “non-bulging”.

To totally eliminate the germs of biodegradation, they resort to the use of chemical products which also have negative effects through the presence of their residues in the finished foods (Derache R., 1986; Diaconescu I., 2007; Dumitru V., 2008).

Another source of contamination of industrialized products from vegetable and fruits is the addition of food additives to prevent the occurrence of some unwanted processes (antioxidants, antiseptic, acidulants, sequesters) and to give superior qualities to the finished product (sweeteners, flavor enhancers, colorants etc).

Some of the conditions that additives must met are: the lack of acute or chronic toxicity, lack of interaction with different compounds of the product, the lack of toxic compounds after administration, the reduced active intake etc. food colorants represent a category of additives highly criticized since their addition to foods is not always necessary. Monosodic glutamate (a flavor enhancer) is forbidden in children's food because it has been shown that it destroys the nervous cells in the developing animals.

At the same time, nitrites are used in foods to maintain colour or to prevent the growing of bacteria, but they are dangerous because they may form nitrosamines.

Sulphur dioxide very largely used in the wine industry has been recently limited due to the possibility of causing allergic reactions in certain individuals.

The contamination of foods with heavy metals and microorganisms or the formation of some toxic compounds may occur frequently during manufacture and subsequent storage of the finished product. The formation of nitrosamines in food products (exogenous origin) occurs depending on the processing temperature (frying, smoking) or their storage, the storage period, the pH of product or the presence of inhibiting compounds (ascorbic acid).

The high concentration of heavy metals existing in food produces organoleptic modifications (taste, smell), changes colour and diminishes the nutritive value through the degradation of proteins, vitamins or by reducing their absorption through the formation of non-absorbable compounds that accumulate in the body. By processing, preservation and packing, food may be contaminated by heavy metals.

An important source of contamination of foods with heavy metals may be the contact with the processing machines, the storage in metal cans, the use of containers made from heavy metal alloys (lead, iron, chromium, aluminum, copper, zinc, tin, arsenic) inadequately insulated (Beceanu D., 2009).

The fruit juices, the tomato sauce, marmalades, jams, pickles, wine represent a major source of lead in nutrition because food acids may dissolve the soldering lead (the lead used to solder the metal parts) especially when high temperatures are also used in the process (Savu C., 2004).

The presence of tin in food products is the consequence of its retentivity in the raw materials following the use of fungicides in whose composition tin is present and due to the corrosion of containers in which products are packed. For the protection of the container against corrosion, they resort to lacquering that

preserves food from 12 to 36 months depending on the pH of product and the storage temperature.

The content in tin was found in cherry, plum and apricot compotes, in the tomato juice and the bean cans during their storage.

Different vegetables such as peas, spinach, and asparagus exhibit a particular effect of "de-tinning" of cans favoring the solubilization of tin formed in the product.

The content of elements is regulated by the national legislation and, thus, according to Order no. 975/1998 of the Romanian Ministry for Public Health, they have established maximum limits for the heavy metals accepted in the finished products (table 1).

Table 1

Maximum allowable limits of arsenic and heavy metals in vegetables and fruit processed according to the MHO no.975/1998 (expressed in mg / kg of product)

Produce	As	Cd	Pb	Zn	Cu	Sn	Hg
Canned vegetables in water	0,5	0,1	0,5	15	5,0	150	0,03
Canned vegetables invinegar, oil, broth	0,5	0,1	0,5	20	7,0	150	0,05
Tomato Juice	0,1	0,2	0,05	10	3,0	150	0,5
Tomato juice, spicy juices	0,15	0,3	1,0	20	10,0	150	0,05
Tomato paste (U.S. 28-30%)	0,2	0,3	1,5	30	15,0	150	0,05
Canned beans	0,15	0,3	1,0	40	10,0	100	
Stewed fruit, nectar, pasteurized fruit juice	0,5	0,05	0,5	-	5,0	150	0,05
Marmalade, jam, syrup	0,5	0,05	1,0	5	10,0	-	0,05
Concentrated fruit juice, fruit pulp and fruit concentrate	3,0	0,3	3,0	30	30,0	-	0,3
Grape juice	0,1	0,01	0,5	10	10	-	-
Concentrated grape juice	0,2	0,01	1,0	20	25	-	-

Though we may know the initial composition of any packing, the behavior of its constituents coming into contact with food may vary. The rate of migration of contaminants depends on several factors:

- concentration of the contaminant or its residues in the container;
- the degree in which it is bound or mobile within the material matrix;
- the thickness of the packing material;
- nature of food with which the material come into contact (dry, watery, acid, lipidic, alcoholic etc.);
- solubility of the contaminant in the food;
- contact period and temperature.

High quality glass releases lead into a concentration up to 30% lead oxide. The lead content of wines and alcoholic drinks kept in this type of containers increases in time up to 1-2 mg/L after 3-4 months or even up to 21 mg/l after several years of storage (Dumitru V., 2008; Deshpande S.S., 2002).

Ceramic coming into contact with acid drinks (fruit juices) causes the release of lead and cadmium from enamel.

Aluminum vessels used for the preparation of food (especially in case of acid foods) may bring the highest daily intake of aluminum, except the drinking water.

The plastic contaminants maybe polymerization residues, catalysts (metal salts, organic peroxides), solvents, emulsifiers, inhibitors, products from decomposition and secondary reactions, antioxidants, antistatic agents, heat and light stabilizers, lubricants, pigments and fungicides.

The use of cleaning materials for the equipment, production spaces, the packing from the industry for the processing of fruits and vegetables may have toxic or allergen effects on the consumer. These may penetrate the products following the incorrect handling, the insufficient washing after disinfecting the equipment and vessels (Dumitru V., 2008).

CONCLUSIONS

1. During the processes of food processing, must be taken into account the innocuity of raw material, auxiliary materials, water and food additives used and also the risks of microbiological contamination or any other type of contamination.

2. Horticultural products are relatively frequently contaminated with various agents that may endanger, the health of certain categories of consumers.

3. Different phases of the process flow for obtaining canned vegetables and fruits may influence not only for increasing but also for decreasing the content of contaminants in the finished product.

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