

Chapter 2

Ecological Chemistry Aspects of Food Safety

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ABSTRACT

The presented results reflect the researches carried out over the last decade, having as their object the soil, water, vegetal raw materials, and wines from the Republic of Moldova. The analysis of the possible anthropogenic contamination (NAA method) demonstrated the absence of systematic soil pollution. A total of 30 elements were determined in soil samples and the soil-leaves-fruit transfer factors were calculated. Approximately 3000 samples of local wines have been analysed to determine the residual quantities of pesticides. POPs were not found in any of the wine samples. In most of the examined cases (> 60% of samples), the lack of organic pesticide residues was observed. The migration of phthalates into different solutions from polymeric materials (PVC, rubber) and the influence of the temperature on the extraction rate were investigated. It has been shown that the contamination with phthalate residues occurs predominantly at the stage of grape processing, technological treatment, and storage.

INTRODUCTION

Food is a system that is closely related to the individual and it is the fundamental biological link of man to the environment (Weiss, 2016). Thus, any environmental disturbance finds the ideal way to reach man via food. A characteristic of food products is the wide variety of factors that can influence safety and hygienic quality (Mylona, 2016). In a brief classification, they can be distributed as follows: biological pollution agents, pollution and chemical contamination agents, natural toxic substances and toxic compounds formed by food processing.

The main agents that can reduce or even annihilate food safety, with varying degrees of harmfulness and extremely random penetration, can be synthesized in the following groups (Sturza, 2017):

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– Toxic compounds can be found naturally in foods, including toxic aminoacids in seeds, unripe fruits and vegetables. Biogenic amines, alkaloids, glycosides releasing hydrogen cyanide, toxins from fungi fall also into this category. Their effects on the body are manifested by growth retardation and renal tissue damage (produced by amino acids), cardiac lesions, effects on the adrenal gland, increased blood pressure (caused by amines), gastrointestinal disorders, vomiting, diarrhea, haemolytic lesions by alkaloids), nerve disorders and even death caused by toxins from poisonous fungi.

– Toxic compounds that are formed in foodstuffs within technological and preservation processes: nitrosamines from plants grown on nitrogen-treated lands, condensed polycyclic hydrocarbons (3 – 4 benzo[a]pyrene), azotates and nitrites from plants, meat, milk. These chemicals have irritating action on the digestive tract, causing congestion and haemorrhage, increased blood pressure, severe hepatotoxic effects, liver damage.

– Pesticides and fertilizers representing the chemicals used in agriculture and veterinary medicine to combat various pest categories: fungicides, insecticides, rodenticides; act primarily on the liver which increases its volume and intensifies enzymatic action, causing disturbances in human metabolism and leading to tumor formation.

– Industrial chemicals: organics, packaging materials, plastics, synthetic rubber, lacquers, industrial solvents, aerosols, nitrates and nitrites, polycyclic aromatic hydrocarbons, metals with toxic potential, antibiotics, hormones, detergents, radionuclides, etc.

The large number of exogenous aggression factors on food requires food control throughout the food chain. As the chemicals diffuse into the food chain, the chemicals and their metabolites accumulate at all levels of the food chain. Effects on living organisms can range from mild discomfort to serious illness, such as cancer or physical deformities. Experts recognize that the effects of pollution are quite often underestimated and that more research is needed to understand the connections between pollution and its effects on all forms of life. Conditions related to water polluted by chemicals (such as pesticides, hydrocarbons, persistent organic pollutants, phthalates, heavy metals, nitrates) can induce cancer, hormonal problems that can disrupt reproduction and development processes, damage to the nervous system, liver and kidneys, DNA damage. Soil pollution also has many effects, including cancer and leukemia. Lead from the soil can be transfer in food via fruits and vegetables; it is particularly dangerous for children, causing damage to brain development. Mercury increases the risk of kidney damage; pesticide residues can cause liver toxicity. Other effects may include neuromuscular blockage, central nervous system depression, headaches, nausea, fatigue, eye irritation and rash. The random nature and impact of different types of toxins implies the knowledge of the sources of pollution.

The purpose of this study was to elucidate the impact of same exogenous factors (environmental contamination) on food harmlessness. These aspects will be examined, such as the heavy metal accumulation in plant foods depending on the soil composition, the mineral transfer factor in the soil-leaf-fruit systems; accumulation of pesticide residues in horticultural products; the causes of contamination of the food chain with phthalate residues.

CIRCUIT OF MINERAL ELEMENTS IN THE SOIL-PLANT-FRUIT-PRODUCTS SYSTEM BACKGROUND

Analysis of published data indicates that heavy metals, such as cadmium, arsenic, chromium, lead and mercury, naturally occur. However, anthropogenic activities contribute significantly to environmental

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