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Chemical-Analytical Control of Harmful Substances in the Quality Management System of Medicinal Plant Raw Materials

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Prevention and treatment of diseases with the use of drugs from medicinal herbal raw materials does not lose its relevance. This is due to the specificity of the complex effect of medicinal plants on the human body in the absence of significant side effects, which is of particular importance in the treatment of chronic diseases.

In general, the pharmaceutical market is characterized by a growing trend in the demand for herbal medicines and biologically active herbal supplements.

An important requirement for the control and standardization of herbal preparations, along with the identification and determination of the quality and quantity of active and auxiliary components, is the analysis of the content of harmful compounds, which is particularly important in view of the safety of herbal medicinal products. Compounds subject to mandatory control in Ukraine include pesticides, since up to 90% of the crops of medicinal plants are treated with pesticide preparations, heavy metals, as elements that can be accumulated by plants from the soil.

The analysis of medicinal plant raw materials is regulated in Ukraine by normative documents, in particular, the Law on Pesticides and Agrochemicals [1], the State Pharmacopoeia of Ukraine [1], and also the European Pharmacopoeia [3]. Chemical analysis techniques approved by the Ministry of Health and the Ministry of Ecology of Ukraine are also used for the quantitative analysis of pesticide content. First of all, chromatographic methods of analysis are used to analyze pesticides and other organic pollutants.

Given the ability of medicinal plants to accumulate harmful substances not only as a result of special treatment (pesticides disinfectants) but also other toxic substances of anthropogenic origin, which pollute the environment and enter the plants through air, water, soils, it is important to carry out their identification. [4].

Human production activities have led, in particular, to the pollution of the environment by polycyclic aromatic hydrocarbons (PAHs), which are known among the most hazardous substances. These common pollutants are mainly by-products of the fossil fuel combustion, chemical, metallurgical and pulp and paper industries [5-7].

In the environment, some PAHs can be stored depending on the geochemical resistance of tens to hundreds of years and have an affinity for volatile organic particles (soot, biogenic suspensions), which can travel long distances due to wind and other atmospheric phenomena, reach the upper layer of the water, to move in it with the currents, to accumulate in plants.

Soil studies, plantago major leaves and mixed grass species were collected near an oil refinery in Zelzat, Belgium, and analyzed for seven PAHs [8]. Samples from the site adjacent to the oil refinery contained very high total concentrations of PAHs, namely 300 μg / g for soil, 8 μg/g for Plantago major and 2 μg /g for mixed grass species.

Concentration in samples from more distant sites (up to 4 km from the factory) was 10-30 below. P. major / grass concentration ratios were not constant across sites and ranged from 1.2 to 8.8 μg/g. It is not possible to accurately predict the concentration of PAHs for one plant species from known concentrations of another species. According to the researchers, the strategy to study the accumulation of PAHs for the sampling of plants should focus on certain species.

The concentration of individual PAHs in soils is formed by natural processes (plant fires, volcanic emissions, etc.) and is approximately 1 to 10 μg /

kg, but in many cases the concentrations of PAHs in soils are ten times higher. Individual concentrations of PAHs in organic forest and urban soil horizons can range from 1 to 100 μg / kg. In soils temperate

latitudes, PAHs are dominated by benzofluoroenthene, chrysene and fluoranthene. Studies of tropical soils indicate that the concentration of PAHs is relatively lower than in moderate soils for most compounds, except naphthalene, phenanthrene and perylene, suggesting that unknown sources of origin for these PAHs are present. [9].

In studies conducted on models of artificial oil contamination containing PAHs, plant crops: Triticum aestivum L., Hordeum distichon L., Secale cerealeL., Fagopyrum esculentum L., Ocimum basilicum L. .. Tageteserecta L., Hypericum perforatum L. and Archangelica officinalis L., it was demonstrated that the concentration of benzopyrene in plants (50 ng/g) exceeded the level of soil contamination (20 ng/g), but different plants accumulated benzopyrene with different levels of intensity [10].

Studies on the accumulation of polyaromatic hydrocarbons in plants indicate that other organic pollutants also can accumulate in medicinal plants in quantities that are hazardous to human health. The spectrum of these substances is wide enough, which requires the development and use of methods of analysis of medicinal plant raw materials, which make it possible to identify a large number of organic compounds in a single sample. These methods include, first of all, chromatographic-mass- spectrometry [11], which simultaneously with the separation of substances conducts their identification. In order to ensure the effectiveness of the analyzes, it is necessary to improve and develop the methods of sample preparation, in particular solid-phase extraction methods.

These approaches and requirements should be reflected in the regulatory documentation for the analysis of medicinal herbs.

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