Detection of heavy metals and pesticides in the raw materials of *Araxacum Officinale* Wigg and *Taraxacum Kok-saghyz* Rodin plants

Sokhiba Yuldasheva[1,*], *Sanjar* Sherimbetov[2], *Abdukodir* Tulaganov[3], and *Khalima* Khaydarova[1]

[1]Tashkent State Agrarian University, University str., 2, Tashkent province, Uzbekistan, 100140
[2]Institute of Bioorganic Chemistry, Academy of Sciences Uzbekistan, M. Ulugbek str., 83, Tashkent, Uzbekistan, 100125
[3]Uzbek Scientific Research Institute of Chemistry and Pharmaceuticals, Tashkent, Uzbekistan

Abstract. *Taraxacum officinale* Wigg and the results of scientific research on the development of modern methods of physicochemical analysis of heavy metals that can be found in raw materials of *Taraxacum kok-saghyz* Rodin, and the presence of pesticides in plants using the GOST (governmental standard) European Pharmacopoeia standard. Methods for the quantitative determination of inductively coupled plasma mass spectrometry (ICP-MS) of heavy metals; macro and microelements in plant raw materials have been developed. The test for the presence of pesticides and heavy metals in plants according to the GOST standard of the European Pharmacopoeia was carried out in accordance with the Sanitary Rules and Standards of the Republic of Uzbekistan.

1 Introduction

Worldwide, health organizations pay great attention to the prevention of various levels of poisoning in humans as a result of the use of bioactive substances and drugs made from raw materials [1]. One of the factors that cause poisoning from biologically active substances and medicines made from plant raw materials are toxic chemicals such as heavy metals and pesticides that can be found in plants. In the normative and technical documents of the World Health Organization, these are the items [2].

Today, with the growing population, the need for industry and transport is growing day by day. Due to anthropogenic factors, millions of tons of toxic gases (aerosols, dust, smoke, microbes, and plant pollination) are released into the atmosphere each year, gaseous substances, industrial gas and water vapor, hydrogen, sulfates, sulfur dioxide, hydrogen sulfide, nitrogen oxides, nitrates, iron, fluorine, manganese, radioactive substances, pesticides. Due to humanity, about 20 billion tons of carbon dioxide (SO_2) is released into the atmosphere every year [2, 3].

In recent decades, the city's atmospheric air has been polluted by vehicle exhaust gases and dust, as well as industrial waste. This leads to local and global climate change,

* Corresponding author: sokhiba.yuldasheva@yandex.com

deterioration of human life, the life of other organisms, as well as the deterioration of public health [4].

As a result of environmental pollution, trophic processes within ecosystems disrupt the formation of substances, their circulation, and the functions of energy flow. In the atmosphere, photochemical water, and in soil biotopes, the interaction of chemical biological processes and the development of living organisms from the disruption of natural harmony, the amount of substances they process and regenerate, the environment in the ecosystem of the elements in the environment becomes useless, dead space [5]. Among the pollutants in the environment, the most dangerous are heavy metals, many of which are necessary for living organisms, but excessive accumulation in the atmosphere, soil and water remains harmful to the biotope. Heavy metals play a major role in the metabolism of substances in nature, but their excess contaminates the soil, raw materials used in agriculture and pharmaceuticals [6]. As a result, it directly poisons all living organisms, disrupting the stability of ecosystems. In addition, heavy metals are absorbed very slowly and in small amounts in the soil, they are stored in the soil for a long time. For example, zinc is stored in the soil for 70 to 510 years, cadmium for 13 to 1100 years and copper for 310-1500 years, and lead for 740 to 5900 years [6, 7].

Toxic gases and heavy metals released into the atmosphere accumulate in the environment and plants. The formation and accumulation of biologically active substances in medicinal plants is a dynamic process that changes in the ontogenesis of these plants and depends on many environmental factors, including anthropogenic factors. The existence of a correlation between the environment and the composition of heavy metals in plants determines the use of plants as an indicator of natural and anthropogenic landscapes in them [7, 8].

Railways, industrial plants and soil erosion also play an important role in ambient air pollution. The above sources are polluted by various dusts from the atmospheric air and this dust contains heavy metals Zn, Cu, Ni, Cd, Cr, Fe, Mn, and others. Atmospheric air requires chemical, environmental, and biological control. Medicinal dandelion was obtained from indicator plants for biological control; the contaminants are absorbed and filtered in the leaf plates of this plant [3, 9]

In recent years, more than 1,000 chemical compounds have been developed around the world, each of which has produced 10,000 to 20,000 drugs. The development of agriculture and industry, as well as health tasks, necessitated the preparation and production of special means - pesticides - to protect plants, animals, people and industrial buildings from pests [2, 5]. The widespread use of pesticides in the national economy leads to their accumulation in the environment, food and others. The rules and measures developed for application in the national economy to reduce the likelihood of pesticides falling on the environment, food and medicinal plants, to prevent their accumulation, do not ensure the full implementation of this task. Medicines derived from medicinal plant raw materials are widely used in medical practice [6]. Therefore, there are a number of requirements for the quality of medicinal plant raw materials and medicines based on it. However, in the pharmacopoeial articles of plant raw materials prepared in our country, there are no sections that control the norms of residual amounts of pesticides, which are widely used in the country. They also do not describe methods for detecting pesticides [10]. The effect of pesticides on the accumulation of biologically active substances in medicinal plant raw materials has not been sufficiently studied. Violations of pesticide use and safety regulations, as well as an increase in the number of food and agricultural products contaminated with pesticides, are leading people to frequent cases of acute and chronic poisoning [4, 8].

The local effects of pesticides are very long-lasting, secondary effects, and a pesticide with such an effect is very stable and spreads all over the globe. They are highly stable pesticides that have the ability to spread in a variety of ways (using air currents, cyclones, human, animal, or vehicle traffic). Pesticides are released into the air as a result of cultivation of agricultural crops, water bodies, and forests. Many stable pesticides are spread over long distances by air movement [1, 5]. When pesticides are applied by the spray method, especially when used in aircraft, pesticide particles can spread over long distances by air flow. Pesticides move in the external environment with the help of water, when they are applied to open water basins, plant waste, agricultural crops with the help of aircraft or tractor sprayers, as well as rainwater or runoff, molluscs, algae, parasites that spread various infectious diseases spreads as a result [9].

Heavy metals accumulate in the soil and spread through the food chain, threatening the normal development of natural anthropogenic ecosystems [4]. The process of loss of heavy metals in the soil is very slow, resulting in increased soil alkalinity, erosion and also impedes plant growth, causing poisoning by entering the human body through biologically active additives and drugs derived from medicinal plant raw materials [4].

Vehicles emit 100,000 tons of pollutants a year. All 280 components are toxic and accumulate in medicinal plants growing on the roadsides, and the population uses them as medicine. To this end, the level of anthropogenic contamination of the common medicinal dandelion plant from medicinal plants was studied. If the medicinal cream plant contains cadmium, zinc and magnesium, it is a sign of contamination of the soils of the regions with the same substances [5].

Based on the above information, *Taraxacum officinale* Wigg and *Taraxacum kok-sahgyz* Rodin studies were conducted to identify heavy metals and pesticides in plant raw materials by sampling plants in different variants.

2 Materials and methods

In the detection of heavy metals and pesticides in the raw materials of plants *Taraxacum officinale* Wigg and *Taraxacum kok-saghyz* Rodin (Figure 1), high sensitivity of heavy metals was determined by modern physicochemical methods. We studied the *Taraxacum officinale* Wigg plant, which is widespread around Tashkent, Chirchik and Gazalkent in Uzbekistan, by taking samples from highways using the method of quantitative determination of macro- and micro-elements inductively coupled by plasma mass spectrometry of heavy metals accumulated in the surface parts of plants.

A B

Fig. 1. *Taraxacum officinale* Wigg (A) and *Taraxacum kok-saghyz* Rodin (B)

Test for the presence of pesticides and heavy metals in plants using the European standard “European Pharmacopoeia” According to the Sanitary Rules and Standards of the Republic of Uzbekistan No. 0366-19, GOST (governmental standard) 26927-86, GOST 26930-86, GOST 26932-86, GOST 26933-86, MU 2142- made on the basis of 80 international standards. The tests performed (measurement test report of October 86, 2020) showed that it meets the requirements of the Sanitary Rules and Standards of the Republic of Uzbekistan.

Nowadays, when heavy metals are found in the body in excess, they become carcinogenic. Therefore, we set ourselves the goal of identifying heavy metals and pesticides that are toxic to the body in the composition of the medicinal plant dandelion. To do this, he collected the surface of the cream plant from different regions of the country and determined it by modern physicochemical methods with high sensitivity to heavy metals. We studied the *Taraxacum officinale* Wigg plant, which is widespread around Tashkent, Chirchik and Gazalkent, by taking samples from highways and using plasma mass spectrometry quantitative determination of macro- and micro-elements inductively coupled to heavy metals accumulated in the surface parts of plants.

Introduced in the Botanical Garden in Uzbekistan, *Taraxacum kok-sahgyz* Rodin and *Taraxacum officinale* Wigg were introduced from different regions, including Tashkent ring road, gas station, Chirchik Chemical Plant, and Chirchik River. Samples were collected to identify heavy metals and pesticides that could be encountered.

Heavy metals in the collected plant samples were determined using inductively coupled plasma mass spectrometry to determine the amount of macro and micro elements. To do this, a clear sample of 0.0500-0.5000 g of test substance is weighed on an analytical balance and transferred to a telephone autoclave, and then an appropriate amount of purified concentrated mineral acid is exposed to the nitric acid and hydrogen peroxide sample and poured into the autoclave.

The autoclaves are closed and placed in the microwave disintegrator BERGHOFF (Germany) equipped with the MWS-3 program, which shows the degree of decomposition and the number of autoclave indicators. After disintegration, the contents of the autoclaves are quantitatively transferred to vials of 50 or 100 ml and brought to the specified volume with 2% nitric acid. When viewing the sequence of analyzes, the specified amount in mg is given and the dilution rate in ml is indicated. Upon receipt of the data, the actual quantitative content of the substance in the test sample is automatically calculated and converted to mg/kg or mg/g with an RMS error limit in %.

3 Results and discussion

Reagents used in the determination of heavy metals in plant samples: standard sample nitric acid (chemically pure), hydrogen peroxide (chemically pure), bidistilled water, argon (gas purity 99.995) %) is obtained.

Taraxacum officinalis Wigg and Taraxacum kok-sahgyz Rodin collected from different regions provided indicators of heavy metal content (mg/kg or μg/g) as a result of analysis of plant samples (Table 1).

Table 1. Heavy metal content of Taraxacum officinalis Wigg and Taraxacum kok-saghyz Rodin

#	Chemical substance	Sample #1 Around the chemical factory, Chirchik, Tashkent province (June 14, 2020)	Sample #2 Grown Taraxacum kok-saghyz Rodin in conditions of botanical park, Tashkent (june 17, 2020)	Sample #3 Near Ring Road of Tashkent (May 15, 2020)	Sample #4 Around the natural gas distribution company, Tashkent (April 15, 2020)	Sample #5 Near Chirchik River, Chirchik, Tashkent province (June 21, 2020)
1	**Pb**	6.778	6.124	7.986	5.534	5.084
2	**Cd**	0.223	0.257	0.175	0.312	0.618
3	**Hg**	0.282	0	0.026	0.212	0
4	**As**	0.747	0.522	0.424	0.538	1.808
5	**Zn**	83.873	35.586	30.256	45.426	38.732
6	**Cu**	11.839	12.695	14.530	17.247	31.732
7	**Fe**	1486.09	1398.66	1080.37	1073.37	1518.98
8	**Mg**	5812.31	4226.62	2887.83	2265.43	4091.55

The results of our study showed that Pb, Cd, Hg, As, Zn in plant samples were found to be contaminated with very dangerous heavy metals. As a result of the analysis of *Taraxacum officinalis* Wigg and *Taraxacum kok-sahgyz* Rodin plants collected from different regions, the indicators of the amount of very dangerous heavy metals in the plants were as follows.

The diagram in Figure 2 shows that 3 samples from the Tashkent ring road, a gas station, a chemical plant, and the Chirchik river area were found to contain 7.986 mg of Pb, which is higher than other plant samples.

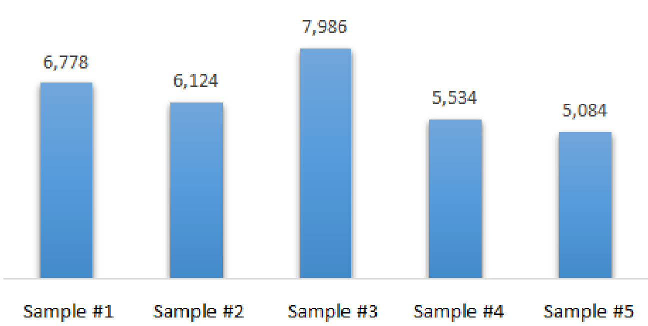

Fig. 2. Diagram of the quantitative indicator of the Pb element in plants

In the diagram in Figure 3, 5 samples from samples collected in different regions were found to contain 0.618 mg of Cd in the plant collected around the Chirchik River, which is higher than in other samples.

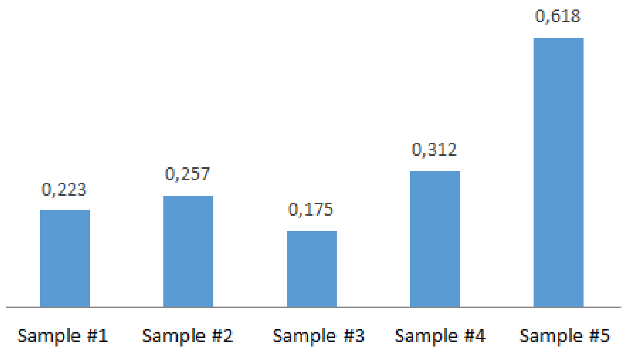

Fig. 3. Diagram of the quantitative indicator of the Cd element in plants

In the diagram shown in Figure 4, it was found that 1 sample of samples collected in different areas contained 0.282 mg of Hg in the plant collected around the canal of the chemical plant in large quantities from other samples.

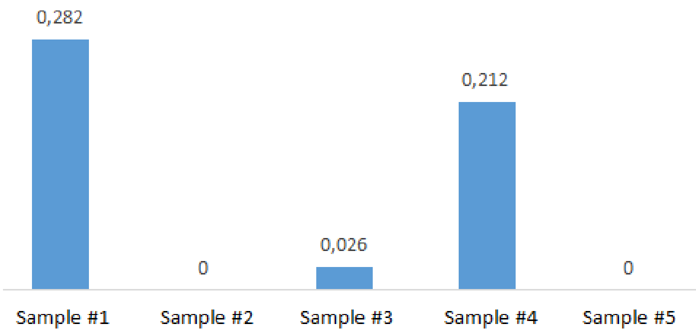

Fig. 4. Diagram of the quantitative indicator of the Hg element in plants

In the diagram in Figure 5, 5 samples from samples collected in different regions were found to contain 1,808 mg of As substance in the plant collected around the Chirchik River, which is higher than other plant samples.

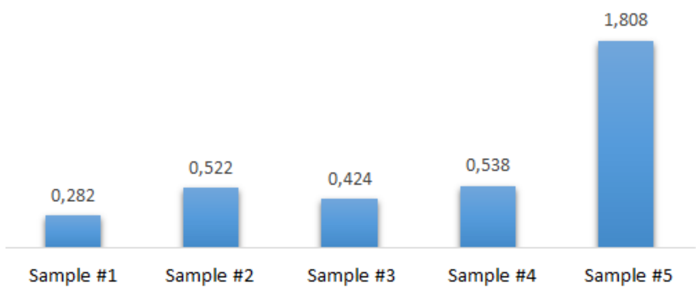

Fig. 5. Diagram of the quantitative indicator of the As element in plants

In the diagram shown in Figure 6, 4 samples from samples collected in different regions were found to contain 45,426 mg of Zn in the plant collected around the gas station, which is higher than in other plant samples.

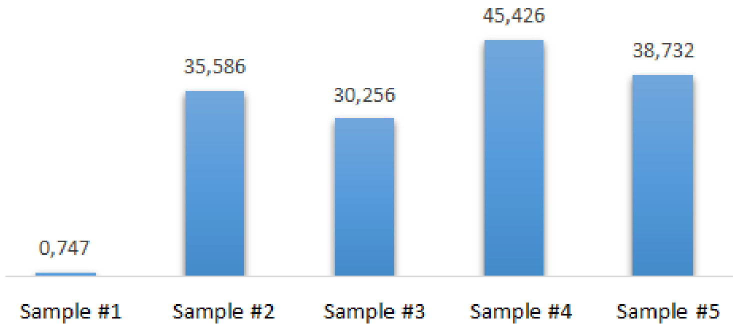

Fig. 6. Diagram of the quantitative indicator of the Zn element in plants

The diagram in Figure 7 shows that 1 sample of plant samples collected from the Tashkent ring road, gas station, chemical plant, Chirchik river area found more Mg in the plant collected around the Chirchik chemical plant than other plants. In the upper part of the plants collected in different regions, 5 samples were found to contain 7.986 mg of Fe in the plant composition than other plants, which was found in higher amounts than other plant sample.

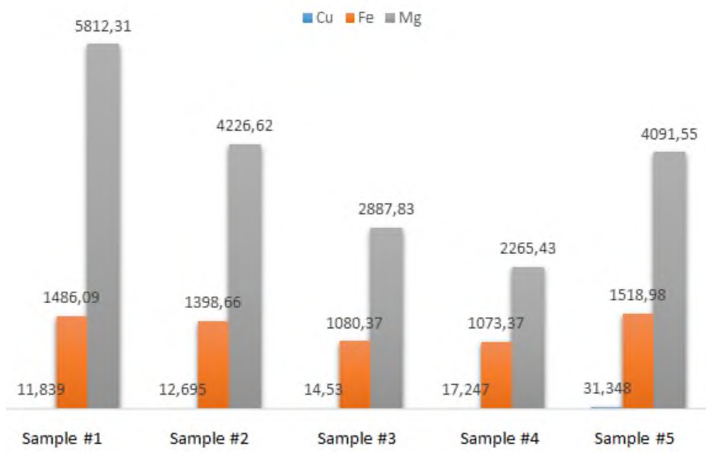

Fig. 7. Diagram of the quantitative indicator of the Zn element in plants

Samples of *Taraxacum officinale* were collected from different places and the presence of pesticides and heavy metals in the plants was determined using the European Pharmacopoeia GOST standard.

The root composition of the plant *Taraxacum officinale* contains taraxacin, taracacerin, bitter glycoside, R-cytoserin tarakserezol, sigmasterin, 24% inulin. In the fall, inulin was found as part of the root of the medicinal plant. Medicinal cream (*Taraxacum officinale*) is mainly distributed in the CIS countries. Milk juice, taraxin, taraxerin, taraxerol, tarakasterol, androsterol, sterol, choline, saponins, ascorbic acid, carotene, apigenin, lutein, nicotinic acid, nicotinamide, 2-3% rubber substance, resin, inulin, fatty acids, essential oils, Contains fats and proteins, flavonoids, vitamins C, B, RR provitamins A, asparagine, iron, potassium and phosphorus salts.

In the experimental part, samples of *Taraxacum officinale* plant were examined for the presence of lead, arsenic, cadmium, mercury, GCG and its isomers, DDT and its metabolites. The test was performed in accordance with the Sanitary Rules and Standards of the Republic of Uzbekistan № 0366-19, GOST 26927-86, GOST 26930-86, GOST 26932-86, GOST 26933-86, MU 2142-80. The test results are shown in the table (Table 2).

Table 2. Heavy metal content of *Taraxacum officinalis* Wigg and *Taraxacum kok-saghyz* Rodin

#	Substances	Values						Compatibility
		Norms	1	2	3	4	5	
1	Pb	5.0	0.02	0.03	0.01	0.05	0.012	Compatible
2	As	3.0	0.000	0.000	0.000	0.000	0.000	Compatible
3	Cd	1.0	0.000	0.000	0.000	0.000	0.000	Compatible
4	Hg	1.0	0.000	0.000	0.000	0.000	0.000	Compatible
5	GCG and its isomer	0.1	0.000	0.000	0.000	0.000	0.000	Compatible
6	DDT and its metabolites	0.1	0.000	0.000	0.000	0.000	0.000	Compatible

4 Conclusion

The results of our research showed that *Taraxacum officinale* Wigg and *Taraxacum kok-sahgyz* Rodin plants contain large amounts of lead, cadmium, mercury, zinc, which are dangerous to the human body when studying the composition of plant samples collected in different regions.

Thus, when the plant samples collected under different conditions are examined according to the European Pharmacopoeia GOST standards, the maximum level of samples of heavy metals and pesticides does not exceed. Only lead was found in the samples examined. Studies have shown that pesticides are not found in plants harvested around the city. This can be explained by the fact that the city does not grow agricultural products.

References

1. G. Khamidov, R. Makhsudova, M. Yuldasheva, Industrial botany, 24 (Chinor Press, Ferghana, 2011)
2. A. Ergashev, T. Ergashev, Agroecology, 408 (Ukituvchi Press, Tashkent, 2006)
3. YU. Mazhayskiy, S. Torbatov, N. Dubenok, YU. Pozhogin, Agroecology of technogenically polluted landscapes, 384 (Mazhenta Press, Smolensk, 2003)
4. A. Titov, F. Laydinen, N. Kaznina, Agrochemistry **9**, 61-65 (2012)
5. S. Huang, N. Meng, Z. Liu, L. Guo, L. Dong, B. Li, Q. Ye, Nutrients **10**(7), 926 (2018)
6. E. Eskov, M. Eskova, In: Problems of a botanist of South Siberia and Mongolia, 235-237 (2013)
7. T. V. Zhuikova, I. E. Bergman, E. V. Meling, A. V. Krivosheeva, Biology Bulletin **47**(10), 1351-1358 (2020)

8. K. Díaz, L. Espinoza, A. Madrid, L. Pizarro, R. Chamy, vidence-Based Complementary and Alternative Medicine, 2018 (2018)
9. O. M. Legoshchina, I. N. Egorova, O. A. Neverova, A. A. Bykov, E. M. Maltseva, V. V. Bolshakov, Ukrainian Journal of Ecology **9**(3), 11 (2019)
10. I. Ivanov, N. Petkova, J. Tumbarski, I. Dincheva, I. Badjakov, P. Denev, A. Pavlov, Zeitschrift für Naturforschung C **73**(1-2), 41-47 (2018)