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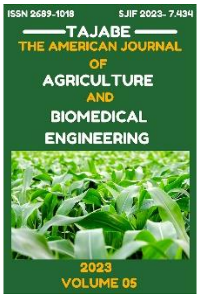

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Research Article

ACCUMULATION OF HEAVY METALS IN THE LEAVES OF ORNAMENTAL TREES TASHKENT CITY

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ABSTRACT

This article presents the results of a study of the accumulation of heavy metals (Cu, Zn, Pb, Cd) in the leaves of ornamental trees in two families Magnoliaceae (2 species) and Pinaceae (2 species) in the urban environment of the city of Tashkent. Growing in the Botanical Garden of the Academy of Sciences of Uzbekistan, and on the central streets of Amir Temur in Tashkent. In the leaves of trees in the urban environment, there is an excess of background concentrations of lead, copper and zinc. The maximum content of heavy metals in trees noted in the areas of industrial enterprises and in areas with increased traffic load. Species features of metal accumulation revealed. Ornamental trees with a high metal storage capacity can be useful for phytoremediation of polluted urban areas.

KEYWORDS

Environmental pollution, heavy metals, accumulation, bio indicator phytoindication, phytourbocenoses, phytoremediation, atomic absorption spectrometry.

INTRODUCTION

In the world, much attention paid to solving the problems of protecting the environment from pollution by anthropogenic and natural aerosols. The main reason for the deterioration of the ecological situation in urbanized areas is the ever-increasing manufactured pollution of the environment. In this regard, the study of the possibility of using ornamental trees to reduce techno genic stress on the ecosystem, where their leaf surface can be used as a unique bio indicator.

Purpose of work: assessment of biochemical parameters of leaves of species Magnolia grandiflora L., Liriodendron tulipifera L. Pinus Pallasiana Lamb. Picea pungens Engelm and their degree of accumulation by heavy metals.

Urbanization has the greatest influence on the composition of urban air. Automobile gases, industrial emissions and dust pollute the air of the city. In this case, greening the city with phytourbocenoses considered the most effective measure, one ha of greenery provides 200 people with pure oxygen because of photosynthesis, while 8 kg of SO2 carbonate swallowed. One of the main reasons for the deterioration of the ecological situation in cities is technogenic pollution of the environment [5; 7].

Among the gases, substances and aerosols polluting the urban environment, one of the dangerous effects are heavy metals. Heavy metals - metals having a density of at least 5 g/cm3. These include mercury, copper, nickel, cobalt, lead, zinc, tin, cadmium, chromium. Copper (Cu) pollution sources are enterprises in the chemical industry, non-ferrous metallurgy, electrical engineering, paper industry and machine building; zinc (Zn) - in non-ferrous metallurgy, chlorine, paint and varnish, automotive, chemical-pharmaceutical and mining industries; cadmium (Cd) - from smoke emissions from industrial enterprises; The main indicator of the amount of lead - (Pb) is formed from the composition of vehicle exhaust gases [1;2].

Metals relatively easily accumulate in soils, but how difficult and slow they removed from it. According to different authors, the half-removal periods are different, but on average the half-removal period from the soil for cadmium Cd is up to 155 years, zinc Zn - up to 500 years, lead Pb - up to several thousand years [4].

According to F.A. Titov [10] found that the effect of heavy metals on plants mainly depends on their concentration in soil, air, precipitation and anatomical and morphological features of the species.

In urban environments, pollutants have a dangerous effect on human health. Lead (Pb) and zinc (Zn) considered toxic metals and are more toxic when absorbed through the air than when ingested through food and water. An increase in the amount of zinc (Zn) in the human body has a negative effect on the blood and nervous system, while an increase in the amount of copper (Cu) in the human body slows down the natural growth process, changes in the blood, anemia (decrease in the amount of blood) and changes in the system other organs. An increase in lead (Pb) is absorbed into the lungs through the respiratory tract (lung disease) and into the blood through the alveoli (thin-walled) of the lungs, causing dangerous consequences. Accumulation of a large amount of cadmium (Cd) in the human body leads to deformation of the skeleton [8; 9].

Evaluation of heavy metal accumulation by landscape trees can serve as a unique filter for these tree species to reduce heavy metal pollution of the atmosphere, hydrosphere, and lithosphere. The correct selection of decorative tree species, their cultivation and proper placement in landscape works significantly affect the environment. This will improve the ecological situation in Tashkent, reduce the level of heavy metal pollution, that is, the release of toxic substances into the atmosphere by 60%, and protect people's health.

Phytoremediation: a modern method of cleaning the environment polluted with heavy metals. This biological method uses plants to detoxify the environment from heavy metals. In this method, hyper accumulators used to clean up technogenically-polluted territories. The study and assessment of

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heavy metal concentrations in plant systems is important for agriculture and ecology.

Research methodology: The accumulation of metals (Cu, Zn, Pb, Cd) in leaves of Magnolia grandiflora L., Liriodendron tulipifera L. Pinus Pallasiana Lamb. Picea pungens Engelm. Growing in the Botanical Garden of the Academy of Sciences of Uzbekistan, and on the central streets of Amir Temur in Tashkent. Brief instructions for the analysis: Weigh a sample of air-dry vegetation 2 g from a sample previously prepared for analysis (vegetation crushed). Place the sample in a 100 - 200 ml flask, pour in a vegetation sample - 50 ml M / l of nitric acid (TM / l = 62 ml of nitric acid, bring to 1 l of distilled water).

The flasks stoppered, mixed, placed on a shaker and shaken for 1 hour. Then the samples should stand for 1-2 hours until the solutions become clear over the precipitates, which decanted into graduated test tubes with ground stoppers. Samples filtered through a filter with blue tape into test tubes. Precipitates did not wash during filtration. Metal concentrations measured by atomic absorption spectrometry.

Calculation: The content of heavy metals calculated from the ratio:

C= (C-Co) *V/m µg/g where

C is the metal concentration in vegetation, µg/g;

C1 - metal concentration in the sample, µg/ml;

Co - metal concentration in a blank sample, µg/ml;

V is the volume of acid used to extract metals from vegetation, ml;

M is the mass of the sample taken for analysis, g.

Research results: The analysis of data on the content of heavy metals in the studied trees growing in the background and polluted areas made it possible to identify the types of ornamental trees that accumulate them in the largest quantities.

Tulip tree (Liriodendron tulipifera L.) According to the average sum of the results of studies conducted in 2019-2021, the average amount of lead (Pb) in the spring season in the leaves of a tulip tree (2 g of dry biomass) in the territory of the Tashkent Botanical Garden is 4.566 µg/ g, in autumn 9.088 mcg/g, on Amir Temur street in spring 5.207 mcg/g and in autumn 10.755 mcg/g, showing an accumulative character.

It established that the Tulip Tree accumulated from spring to autumn 4.522 µg/g of lead (Pb) in the Botanical Garden and 5.548 µg/g in Amir Temur Street from spring to autumn.

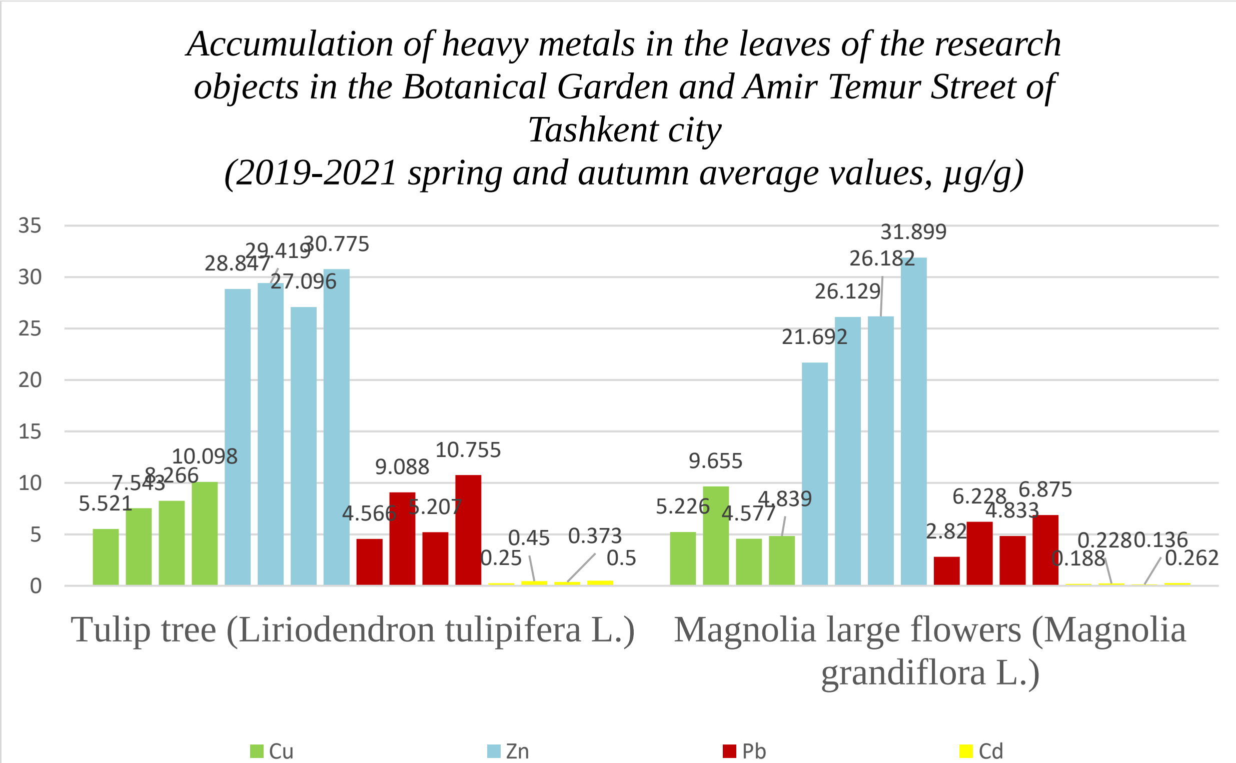

Figure 1. Concentration of analyzed heavy metals

The accumulation of heavy metal zinc (Zn) in the leaves of the tulip tree in the territory of the Tashkent Botanical Garden in spring amounted to 28.847 mcg/g, in autumn 29.419 mcg/g, in the streets of Amir Temur in spring 27.096 mcg/g, in autumn 30.775 mcg/g, i.e. 3679 mcg/g. accumulation. Absorption of copper (Cu) by leaves of the tulip tree increased to 5.521 µg/g in spring, 7543 µg/g in autumn; accumulation increased to 1.832 µg/g.

In spring, the amount of cadmium (Cd) in the leaves increased from 0.250 µg/g to 0.450 µg/g in the Botany area, and in the central streets of Amir Temur from 0.373 µg/g to 0.500 µg/g, and this figure was higher among the analyzed deciduous trees (see Fig. 1).

Magnolia (Magnolia grandiflora L.) The amount of lead (Pb) in the leaves of magnolias growing in the Tashkent Botanical Garden was 2.820 µg/g (mg/kg) in spring, 6.228 µg/g in autumn, and accumulation during the study period was 3.408 µg/g. lead (Pb). On the streets of Amir Temur, in an area with high traffic intensity, the amount of lead (Pb) in the leaves in the spring period was 4.833 µg/g, in the autumn period by 6.875 µg/g and increased by 2.042 µg/g. The accumulation of zinc (Zn) in magnolia leaves was 31,899 µg/g.

According to the accumulation of zinc (Zn) in the leaves of the Crimean pine or Pallasiana pine (Pinus Pallasiana Lamb.) in the Botanical region, it was 21.619 µg/g in the spring season and 26.067 µg/g in the autumn season. The accumulation of leaves in the area of Amir Temur Street in spring amounted to 13.903 µg/g, in autumn 19.823 µg/g, that is, the amount of zinc (Zn) absorbed by tree leaves increased by 5920 µg/g from spring to autumn. The content of lead (Pb) increased from 1.735

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µg/g to 7.741 µg/g, i.e. the maximum accumulated amount was 6.006 µg/g (see Fig. 1).

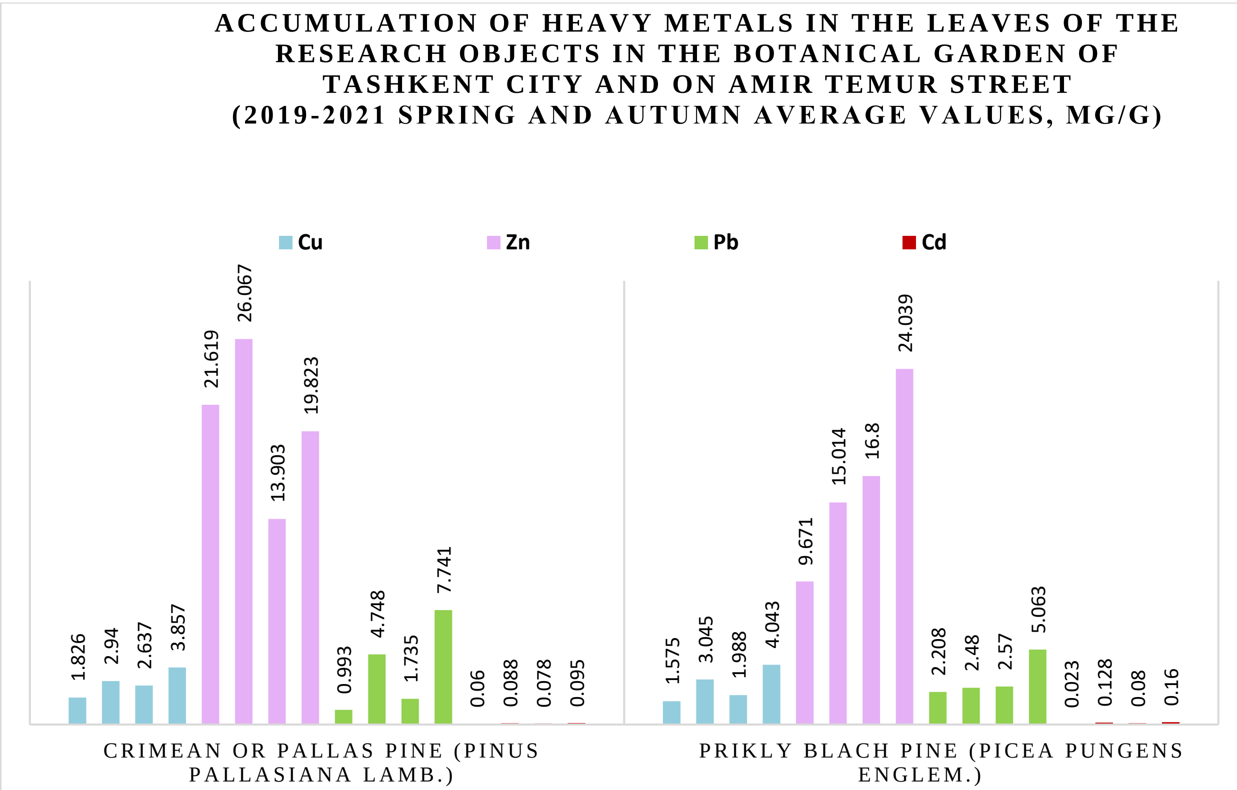

Figure 2. Concentration of analyzed heavy metals

Blue spruce or prickly spruce (Picea pungens Engelm.) showed a relatively lower accumulation of lead (Pb) for absorption of lead (Pb) compared to Crimean pine or Pallasiana pine and other conifers, but the absorption rate of zinc (Zn) was 24.039 µg/g, and absorption copper (Cu) increased from 1.988 µg/g. up to 4.043 mcg/g.

The intensity of the technogenic impact on the leaves assessed using the biological absorption coefficient. According to the maximum value (2019-2021) of copper PBP in the leaves of Liriodendron tulipifera L. 10.098> Magnolia grandiflora L. 9.655> Pinus Pallasiana Lamb. 3.857 < Picea pungens Engelm 4.043 µg/g;

Zinc: Liriodendron tulipifera L. 30.775 < Magnolia grandiflora L. 31.899 > Pinus Pallasiana Lamb. 26.067> Picea pungens Engelm 24.039 µg/g;

Lead: Liriodendron tulipifera L. 10.755 > Magnolia grandiflora L. 6.875 < Pinus Pallasiana Lamb. 7.741> Picea pungens Engelm 5.063 µg/g;

Cadmium: Liriodendron tulipifera L. 0.500> Magnolia grandiflora L. 0.262> Pinus Pallasiana Lamb. 0.095< Picea pungens Engelm 0.160 µg/g;

Zinc: Liriodendron tulipifera L. 30.775 < Magnolia grandiflora L. 31.899 > Pinus Pallasiana Lamb. 26.067> Picea pungens Engelm 24.039 µg/g;

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Lead: Liriodendron tulipifera L. 10.755 > Magnolia grandiflora L. 6.875 < Pinus Pallasiana Lamb. 7.741> Picea pungens Engelm 5.063 μg/g;

Cadmium: Liriodendron tulipifera L. 0.500> Magnolia grandiflora L. 0.262> Pinus Pallasiana Lamb. 0.095< Picea pungens Engelm 0.160 μg/g;

According to A.I. Perelman [6], in the leaves of the studied trees, zinc characterized for Pinus Pallasiana Lamb., and Picea pungens Engelm as an element of vigorous accumulation, and for the rest, as an element of strong accumulation. In addition, a strong accumulation element is copper for Liriodendron tulipifera L. and Magnolia grandiflora L. from the entire studied tree leaves, lead - for Liriodendron tulipifera L. and Pinus Pallasiana Lamb., for all other leaves cadmium is an element of low accumulation and medium capture.

It found that the content of HMs in leaves selected in areas with different technogenic load differs significantly (Figs. 1 and 2). Therefore, the leaves collected in the urban industrial, transport zone accumulate more lead and zinc. Thus, trees growing in these zones accumulate more HM than in recreational zones.

CONCLUSION

Woody plants accumulate significant amounts of heavy metals and are capable of removing them from the cycle of substances; therefore, in order to maximize the purification of the atmosphere from heavy metals, it is necessary to create diverse plantations with high biological stability, which can effectively improve the quality of the urban environment. Significant accumulation of HMs by leaves of woody plants, as well as high values of CBP, allow us to conclude that the most informative species for indicating air pollution in Tashkent among deciduous trees of HMs are the leaves of Liriodendron tulipifera L., and among coniferous trees, Pinus Pallasiana Lamb.

Древесные растения аккумулируют значительные количества тяжелых металлов и способны к их выводу из круговорота веществ, поэтому для максимального очищения атмосферы от тяжелых металлов необходимо создавать разно видовые насаждения с высокой биологической устойчивостью, позволяющее эффективно улучшить качество окружающей городской среды. Значительная аккумуляция ТМ листьями древесных растений, а также высокие значения КБП позволяют сделать вывод, что наиболее информативными видами для индикации загрязнения атмосферы г. Ташкента среди лиственных деревьев ТМ являются листья Liriodendron tulipifera L., а среди хвойных деревьев Pinus Pallasiana Lamb.

Thus, these ornamental trees resistant to anthropogenic loads recommended for use in the landscaping of the city of Tashkent as atmospheric air filters.

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