Analysis of chlorophyll "a", "b", and carotenoids in leaves of oriental maple, biota, common oak, and chestnut trees resistant to harmful substances emitted by motor vehicles in Tashkent city

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Abstract. The work is devoted to the composition of the atmospheric air on the main streets, the level of traffic on these streets, the selection of resistant species of phenol trees for growing ornamental trees, and the laws of changing the number of pigments in these trees depending on the streets and season in the Republic of Uzbekistan. At the same time, the types of ornamental trees and their resistance to pollution from the pollution of carbon dioxide, nitrogen oxides, and sulfur dioxide are mainly represented by atmospheric air pollution.

1 Introduction

Nowadays, the growth rate of large cities depends on the growth of industrial enterprises and motor transport, which requires many environmental issues. Air pollution is mainly caused by large-scale enterprises and motor vehicle emissions, especially on roads along major highways, with motor vehicle emissions. In this case, pollutants are mainly exposed to tree leaves. This is because photosynthesis and many other processes that allow the growth of the leaves to take place in these leaves. Therefore, it is important to study the degree of contamination of tree leaves with various contaminants and to evaluate the resistance of these toxic compounds to the green and yellow pigments involved in the photosynthesis process in the leaves and their resistance to heavy metals. The volumes of carbon dioxide absorption and oxygen production in different species of trees and leaves vary. The air purification efficiency of ordinary juniper trees is 100%, pine – 164%, large deciduous – 254%, oak – 450%, and Berlin poplar – 691% [1]. Decorative trees play an aesthetic and social role in the environment and affect the quality of atmospheric air [2].

Trees in urban areas were planted to create favorable environmental conditions close to optimal parameters corresponding to the so-called comfort zone. When the wind speed in...
2 Methods
to 100% acetone solution. The homogenate was centrifuged at 10,000 rpm at a rate of 5,000 rpm. Chlorophyll “a”, chlorophyll “b” and carotenoid light absorption values were determined at 662, 645, and 470 nm (Agilent Cary 60 UV-Vis spectrophotometer). Based on this index, chlorophyll “a”, chlorophyll “b” and carotenoid content in leaves of ornamental trees were calculated using the equation Lichtenthaler and Wellburn (1985):

Statistical analysis of experimentally obtained plant chlorophyll a and chlorophyll b and carotenoid levels was performed in EXCEL 2016, Stat View 5.0 by anova.

One of the main environmental problems of Tashkent city is the negative impact on the environment of various harmful gases emitted by vehicles. More than 70 percent of air pollution in Tashkent is caused by various gases emitted by motor vehicles. As a result of the growth of the population in Tashkent and the expansion of the city territory, the number of motor vehicles in the city is also increasing. As of January 1, 2022, motor vehicles belonging to individuals in our Republic totaled 3.6 million units, which are 10.6% more than last year’s figures. Of these, the number of motor vehicles belonging to the residents of Tashkent city is more than 450 thousand, and on average, more than 23 thousand motor transport vehicles from the region enter the city and move on the city streets. 60% of motor vehicles in the capital run on gasoline and diesel, and 40% run on gas.

Table 1. Classification of motor vehicles moving in Tashkent by types of fuel (2022 year)

<table>
<thead>
<tr>
<th>Total number of vehicles</th>
<th>Gasoline</th>
<th>Diesel</th>
<th>Compressed gas</th>
<th>Liquefied gas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.6 mln.</td>
<td>911.0 thousand</td>
<td>135.3 thousand</td>
<td>2.3 mln.</td>
</tr>
</tbody>
</table>

Fig. 1. Process of nitrogen dioxide production during high-temperature combustion of various fuels (natural gas, gasoline) in car engines. Effect on a person - reduces the normal function of the lungs and has an adverse effect on the respiratory system. As a solution to this problem, it is necessary to increase the number of green spaces in the city; that is, as a result of scientific principles, it is necessary to study the city’s climatic and soil conditions.

It is desirable to selectively plant and maintain tree species that are resistant to various gases emitted by motor vehicles in urban areas [13-18]. Planting and cultivating landscape trees can achieve enormous economic and social benefits. Because plants are designed to meet the natural and vital needs of the population, which plays an important role in human health, trees prevent various infectious diseases. Ionization of the air under the influence of needles and broad-leaved trees and shrubs from E3S Web of Conferences 401, 02032 (2023) CONMECHYDRO - 2023 https://doi.org/10.1051/e3sconf/202340102032
The types of decorative trees recommended based on scientific principles is of great importance for the health of the natural environment in cities. The level of air pollution is determined due to the effect of atmospheric air quality on the positive charge of light and heavy ions. For example, the number of light ions present in 1 cm³ of atmospheric air:

- up to 2000-3000 in forests
- up to 800 in urban parks
- up to 200-400 in industrial zones
- up to 25-100 in densely populated buildings by influencing, it ensures the harmony of cardiovascular, respiratory and circulatory systems, strengthens brain activity, lowers the amount of sugar and phosphorus in the blood, improves mood, reduces headaches and fatigue, and ensures people live longer.

This, in turn, increases the economic efficiency of citizens living and working in the area. The better a person's physiological and psychological condition is, the more effective he will be in his work [15-18].

Currently, satellite imagery monitoring of tree stands is also being conducted to study emissions and reduce damage.

3 streets and 1 park with ornamental trees were selected as the research object of Tashkent city. These objects are Sergeli district along Nyi Sergeli Street, Ukhtapa district along Farkhod Street, Sheikhontohur district along Abdulla Qadiri (Ganga) Street, and Yunusabad district along the botanical garden.

Experiments were conducted to determine the amount of pigment in the leaves of eastern sycamore, eastern biota, common oak, and chestnut trees planted on these objects.

Fig. 2. Process of conducting experiments on samples taken from landscape tree leaves in laboratory conditions

3 Results and Discussion

![Graphs showing results of analysis of leaf pigments of oriental sycamore tree](image-url)
Results of pigment analysis of leaves of oriental biota (Table 3).

Results of pigment analysis of common oak leaves (Table 4).
Results of pigment analysis of chestnut tree leaves (Table 5).

Compared to the general results, it was found that the amount of pigments of all trees are different, and the varieties of ornamental trees depend on the environment of the growing regions. Tree leaves in areas with less vehicular traffic also have higher amounts of pigments. For example, the number of pigments in the leaves of ornamental trees growing along Nyi Sergeli Street in the Sergeli district is lower because the level of traffic in this area is high. These indicators indicate that harmful substances emitted by motor vehicles hurt the leaves of ornamental trees. On the contrary, the number of pigments in the leaves of ornamental trees growing in the Botanical Garden of Yunusabad district is slightly higher. This is because the trees grow in natural conditions, the impact of substances emitted by motor vehicles is almost absent, and the abundance of other types of ornamental trees shows its positive effect.
4 Conclusions

It was found that the number of pigments in the leaves of ornamental tree species growing on city streets and then planted differed, and their amount changed depending on the season. The results of the phenological observation of ornamental trees growing on the streets selected for the study showed that various spots appeared on the leaves of the trees on the streets of Nyi Sergeli, Farkhod, and they began to dry up. From the end of the summer months, it was found that the leaves fell early. The reverse was observed in the leaves of trees growing in Ganga Street and Botanic Garden, and these changes were explained as directly proportional to the number of harmful substances in the streets.

References

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