FLUORESCENT INDUCES OF PLANT LEAVES TREATED WITH HEAVY METAL CHLORIDES

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Photosynthesis is one of the most important processes in the biosphere that ensures the ubiquity and diversity of life on our planet. Current photosynthesis research is largely inspired by the call for sustainable agriculture and the harmonization of food, feed and energy production with each other. Photosynthesis is important for living organisms because it is the number one source of oxygen in the atmosphere. Green plants, like other organisms capable of oxygenic photosynthesis, obtain organic compounds from sunlight, water and carbon dioxide in the atmosphere.

Keywords: fluorescence indices, photosynthesis, chlorophyll fluorescence methods.

Violation of photosynthetic processes can cause significant damage to the biodiversity of our planet and destroy existing food chains. There is pollution with heavy metals, which disrupts naturally formed phytocenoses, accumulating in the organs and tissues of plants, heavy metals have a negative impact on the physiological processes of plants. Rocks, Volcanoes, Cosmic dust, soil erosion, evaporation from the surface of the seas and oceans, their release by vegetation are natural sources of heavy metals.

Heavy metals such as Hg, Pb, Cd, Cu, As are common and highly toxic pollutants. They are widely used in various industrial productions, therefore, despite the treatment measures, the content of heavy metal compounds in industrial wastewater is quite high. Most of all, metals are of interest, which are most widely and in significant volumes used in production activities and, as a result of accumulation in the external environment, pose a serious danger in terms of their biological activity and toxic properties. These elements include Pb, Hg, Cd, Zn, Bi, Co, Ni, Cu, Sn, Sb, V, Mn, Cr, Mo and As.

Many heavy metals are trace elements. This means a chemical element present in organisms in low concentrations.

The state of plant communities is one of the main indicators of the ecological situation. The photosynthetic apparatus is primarily exposed to stress factors. Of particular interest in this situation is the role of photosynthetic pigments-components of photosynthetic structures (photosystems I and II and light-harvesting complexes) -chlorophyll a, chlorophyll b and carotenoids. Environmental pollution also negatively affects plant productivity. The main amount of pollutants accumulates in the vegetative organs, but the reproductive system is also exposed to a significant negative impact.

With an increase in the content of metals in the soil, the overall biological activity also decreases, and this sharply affects the growth and development of plants, and different plants react to an excess of metals in different ways.

The metal is distributed unevenly throughout the plant organs. To the greatest extent, metals accumulate in the leaves. This is due to many reasons, one of which is the local accumulation of metals as a result of their transition to a low-mobility form. For example, in the case of copper intoxication, the color of some leaves in plants changes to red and brown, which indicated the destruction of chlorophyll.

The toxicity of heavy metals is associated with their physicochemical properties with the ability to form strong compounds with a number of functional groups on the surface and inside cells. symptoms of heavy metal damage to plants are externally manifested in a slowdown in their growth and development, discoloration and wilting of leaves, ugliness and underdevelopment of the root system.

Heavy metals in most cases inhibit the absorption of both cations and anions by root cells. Inhibition of the absorption of macro- and microelements may be due to competition with heavy metals for carriers, which can lead to the development of a plant deficiency, for example, iron or copper. Another reason for the disturbance of ion homeostasis in cells is the outflow of ions (for example, potassium) from the roots due to changes in the activity of membrane enzymes under the action of heavy metals and membrane damage.

Growth is most sensitive to the action of heavy metals. Moreover, root growth is more sensitive than shoot growth. Cadmium and lead inhibit the growth of the main root of the seedling more strongly than the formation of lateral roots, as a result, the root system acquires a compact form. Seed germination is most resistant to heavy metals, which is due to the low permeability of the seed coat for them. Growth inhibition by heavy metals is a consequence of a decrease in the rate of both division and cell elongation. This phenomenon may be based on a decrease in tissue hydration, an elongation of the mitotic cycle, a violation of the elasticity of cell walls and the formation of microtubules.

Thus, almost all physiological processes in the plant are subject to the negative effect of heavy metals. Nevertheless, plants are able to grow in areas contaminated with heavy metals using special adaptive mechanisms.

Chlorophyll fluorescence analysis has become one of the most powerful and widely used methods available to biophysicists, plant physiologists and ecophysiologists. Chlorophyll *a* fluorescence kinetics can be an important source of information about the physiological state of a plant and the functional state of

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its photosynthetic apparatus. A set of fluorescence indices measured using a pulse amplitude modulation fluorometer (PAM-fluorometer) makes it possible to evaluate the contributions of photo- and non-photochemical fluorescence quenching to excitation energy utilization, as well as the efficiency of the photosynthetic apparatus. These indicators include the maximum fluorescence quantum yield (F_v / F_m), the effective fluorescence quantum yield (F_{PSII}), and the non-photochemical quenching coefficient (*NPQ*). All of them can be quickly measured both in the laboratory and in the field, which allows them to be used as an express method for environmental monitoring or for predicting crop yields.

This work aims to study the fluorescent and physiological parameters of plants exposed to salts of heavy metals that have a negative effect on plant growth and development.