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EFFECT OF NANPARTICLES ON PHOTOTAXIS PROCESS IN PLANT CELLS

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INTRODUCTİON

Over the past decade, the use of nanomaterials and nanoparticles in consumer products has significantly increased the likelihood of their impact on water, soil and air. Organisms suffer the most, especially in aquatic ecosystems. In addition, due to the intensive development of nanotechnology, the use of nanoparticles is widespread in various fields. As a result, it can cause significant complications for human health at the end of the food chain. Therefore, the study of the ecotoxicological and biological effects of nanomaterials in aquatic ecosystems remains relevant. The impact of nanoparticles on the human body, animals and plants has been widely studied. The consequences of the accumulation of nanomaterials in living systems and their participation in metabolic processes are interesting and require research.

Due to their small size, nanoparticles provide access to cells and intracellular exchange through various mechanisms [1]. Studying the interaction of nanoparticles with plant cells makes it possible to clarify their phytotoxic nature and assess the risk of changes in cellular metabolism. The most interesting direction in studying the effect of nanoparticles at the cellular level in plants is experiments to determine the nature of their interaction with the cell wall and plasma membrane, their absorption into cells, their movement, distribution, and accumulation in tissues. Due to their small size, nanoparticles provide access to cells and intracellular exchange through various mechanisms. Therefore, the study of the interaction of nanoparticles with the plasma membrane makes it possible to clarify their phytotoxic nature, structural and functional changes in biological membranes, and also to assess the risk of changes in cell metabolism [3]. The main goal of our study is to study the effect of metal nanoparticles on the process of phototaxis in plant cells.

Keywords: nanoparticles, TiO2, phototaxis, plant cell.

MATERIALS AND METHODS

Elodea (lat. Elodea canadensis) was used as an object of study. Canadian elodea (Elodea canadensis; family - Hydrocharitaceae) - aquatic plant. This plant plays an important role in the formation and stability of ecosystems in both freshwater and marine basins. Plants play the role of aquatic habitats for invertebrates, insects and fish, organize their food reserves, weaken the movement of water, accelerate the deposition of dust, soil particles and clay in the water, and ensure the movement of nutrients in the water. The optimal conditions for Elodea are 10-25°C and medium lighting. The tips of the trunk grow, and individual representatives can reach a length of 3 m or more. The leaves are bright green, 6-17 mm long and 1-4 mm wide. The fruit is an ovoid capsule about 6 mm long, consisting of several seeds germinating under water. Seeds 4-5 mm long, fused, glabrous (round) and narrow-cylindrical [2]. TiO_2 10–30 nm in size was used as metal nanoparticles.

The leaves of the plant are separated with 2-3 tweezers. It is placed in a Petri dish containing IPV (artificial pond water) and TiO2 metal nanoparticles. IPV contains 1 mM NaCl, 0,1 mM KCl, 0,1 mM CaCl. It was kept in the dark for a day. In the Carl Zeiss optical microscope with magnification 200x was taken the elodea lives cells images. The next time it was kept in the light for 24 hours and examined under a microscope. The effect of TiO2 nanoparticles on the phototaxis process of plant chloroplasts was observed under a microscope.

RESULTS AND DISCUSSION

Elodea leaves are exposed to TiO_2 nanoparticles in 2 groups. In group 1, the effect of nanoparticles was studied by keeping the leaves in the light for 24 hours (Fig. 1). In the 2nd group, the effect of the nanoparticle was studied when the leaves were kept in the dark for 24 hours (Fig. 2).

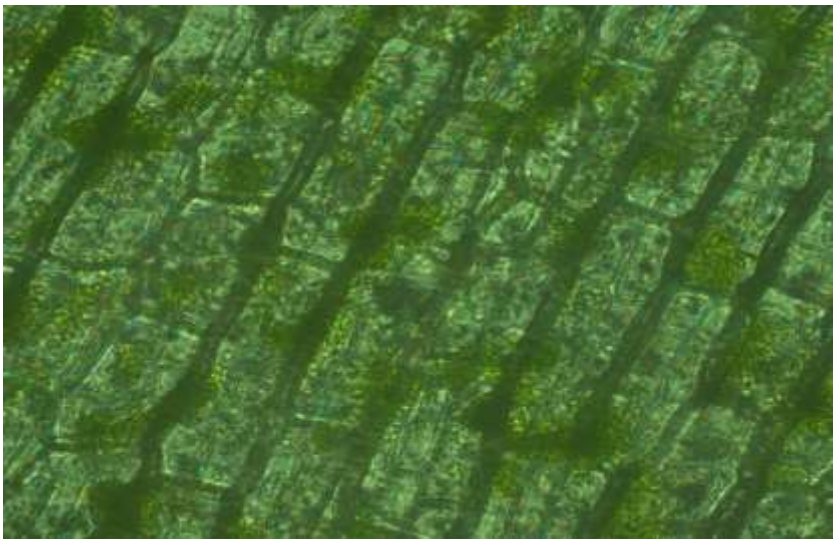

Figure 1. Effect of TiO2 nanoparticles on the phototaxis process in Elodea leaves exposed to light

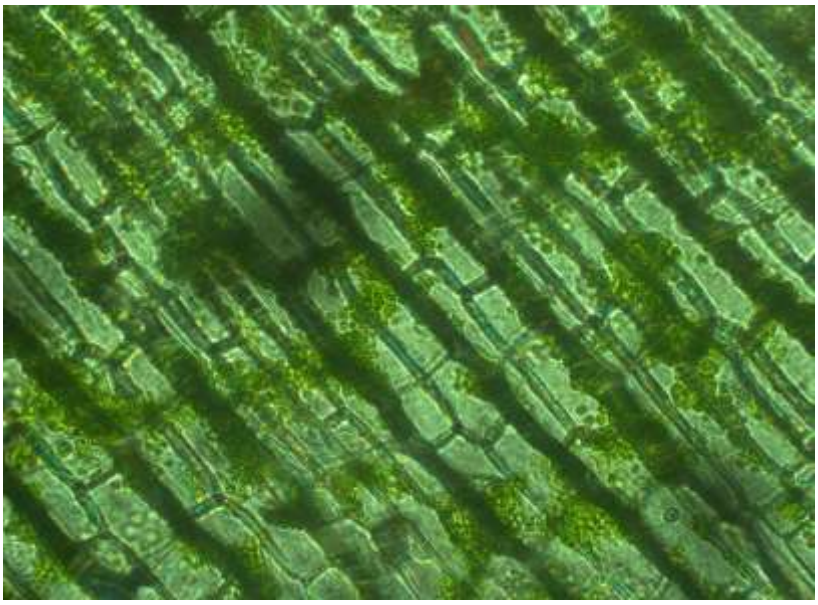

Figure 2. Effect of TiO2 nanoparticles on the phototaxis process in Elodea leaves exposed in the dark

Based on the results, it was proved that the nanoparticles did not affect the movement of chloroplasts in plants. This shows that nanoparticles are not toxic to plants. Due to the low concentration of nanoparticles used in the study, no harmful effects on the plant were found.

LİTERATURE

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