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The influence of biogenic metal nanoparticles on aquatic plants

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The potential risk of using engineered nanoparticles, especially in the natural environment, which may conceal a potential danger to the ecosystems, is not always understood. The presence of nanoparticles in natural water pools reduces the productivity of aquatic organisms, gives them a variety of physiological changes, behavioral disorders and increases mortality. The aim of present study was to clarify the features of impact of biogenic metal nanoparticles on the growth, morphology, productivity, and intracellular processes of hydromacrophyta and to estimate the potential risk of metal nanoparticles for aquatic plant.

The study involved two types of floating on the surface of aquatic plants: *Limnobium laevigatum* (Humb.& Bonpl.Ex Willd.) and *Pistia stratiotes* L. Plants were exposed 14 days in the vessels of 0.5 liters on a settled tap water with the addition of non-ionic colloidal solutions of biogenic metal (Mn – 1,51 mg/l, Fe – 1,32 mg/l, Cu – 0,75 mg/l, Zn – 0,89 mg/ l) in controlled conditions. Colloid solutions of metal nanoparticles which are obtained by dispersing of the granules of iron, copper, manganese, zinc and silver by pulses of electric current with an amplitude A 100-2000 in water were studied.

Results of cytological, morphological and physiological research as well as studying of growth parameters were of the same type. Namely, the effect of nanoparticles of metals Mn, Fe, and their binary composition Fe-Mn were favorable for the aquatic plants, on the other hand, Zn, Cu nanoparticles, and binary composition Cu-Zn showed deleterious effects. In response to the action of biogenic metals nanoparticles in root cells of *Limnobium* disturbance of sediments of vital dyes in granules, formation of non-specific to the cells cubic and needle crystals, diffuse staining of

protoplasm, and in some cases (Zn, the composition CuZn) staining of cell nucleus, features of different stages of plasmolysis were admitted. Furthermore, volume of chloroplasts in root cortex cells of *Limnobium* increased, that evidenced of disturbance of semi-permeability of cell membrane and chloroplast membranes and impaired ion balance of cell.