

Nanochemistry and Nanobiotechnology

Impact of nanoform biogenic metal colloidal solution on the adaptive potential of plants

**N.Y. Taran¹, L.M. Batsmanova¹, M.S. Kovalenko¹, E.O. Konotop¹,
O.I. Kosyk¹, N.V. Nowicki², S.M. Kalensky²**

¹ *Taras Shevchenko National University of Kyiv*

E-mail: tarantul@univ.kiev.ua

² *National University of Life and Environmental Sciences*

The unique properties of nanomaterials and their nanoclusters formed are widely used in various fields nowadays. Metastable unbalanced nanoparticle (NP) condition cannot predict the physiological and biochemical processes in plants. The very existence of this phenomenon creates a very urgent problem of identifying the degree of NP stress impact in a wide range of concentrations. Thus, the purpose of our research was to study the effect of nanoform biogenic metal colloidal solution (Ag, Cu, Fe, Zn, and Mn) of different concentrations (120 mg/l and 240 mg/l) on the development of adaptive reactions of plants under field experiment. Treatment of plants of soybean variety “Annushka” was held according to the scheme: 1 control treated with water, 2 presowing treatment with complex metal bass at a concentration of 120 mg/l, 3 presowing treatment with complex metal NP at concentration of 240 mg/l, 4 presowing treatment and spraying at budding stage (vegetative) with metal complex NPs at concentration of 120 mg/l. Analysis of the results shows that oxidative processes develop in variant treated with solution of colloidal nanoparticles of metals in concentrations of 120 mg/l, as indicated by the increase of TBA-active product content in photosynthetic tissues by 12%. Presowing treatment with double concentration (240 mg /L) resulted in oxidative process decrease (19%) and presowing treatment combined with vegetative treatment also contributed to the reduction of TBA-active products (10%). In the variant with the TBA-active product content enlarged increased activity of superoxide dismutase (SOD) was observed, while in two other variants SOD activity was at the control level. Catalase activity decreased in all variants. Most revealing factor for characterization of the adaptive responses of plants is the level of antioxidant status, which was the highest (0.3) for dual treatment of plant with complex metal nanoparticles at a concentration of 120 mg/l (variant 4). So, colloidal metal nanoparticle solution in small doses used with a certain time interval can be considered as low level stress factor which according to hormesis basis promotes adaptive response reaction.