STUDY OF SILVER NANOPARTICLES UPTAKE BY *Helianthus annuus* CROP IN SALINITY CONDITIONS

C.E.I dos SANTOS
Physics, Statistics and Mathematic Institute, Federal University of Rio Grande Santo Antonio da Patrulha, Brasil

A. KAVČIČ
Biotechnical Faculty, University of Ljubljana Ljubljana, Slovenia

M. KELEMEN
Low and Medium Energy Departament, Josef Stefan Institute Ljubljana, Slovenia

P.F.C. JOBIM
Departament of Basic Science/Phisilogy, Federal University of Health Science of Porto Alegre Porto Alegre, Brazil

P. PELICON, P. VAVPETIC
Low and Medium Energy Departament, Josef Stefan Institute Ljubljana, Slovenia

K. VOGEL-MIKUS
Biotechnical Faculty, University of Ljubljana Ljubljana, Slovenia

Engineered nanoparticles (NPs) are used in different industrial products, including cosmetic, pharmaceutics, clothes, electronic and agriculture products. In the past years the use of silver nanoparticles (AgNPs) expanded significantly, especially due to their antibacterial and antifungal properties. Despite the benefits in using AgNPs for different purposes, they enter in the environment can be problematic and have different mechanisms of accumulation, internalization and toxicity in plants [1]. Moreover, plant growth and development is limited by salinity conditions, an abiotic stress parameter, especially in arid, semi-arid and irrigated areas in tropical and sub-tropical place. In general, the germination, seedling and plant growth and, consequently, the productivity of the plants decrease, causing economic and social impacts [2]. In this context, the aim of this study was to track the uptake of AgNPs by sunflower (*Helianthus annuus*), a metal hyperaccumulator plant [3], and the possible translocation of them in those plants. For this, experiments were conducted in soil and hydroponic mediums where plants were treated with different concentrations of AgNPs and salinity. Four groups were studied: control (without exposure to AgNPs and NaCl), salinity (group exposed to 100 mM of NaCl), AgNPs (group exposed to 5 and 100 $mg.kg^{-1}$ of AgNPs (the lowest concentration was used only in hydroponic experiment) and AgNPs plus salinity (group exposed to 5 and 100 $mg.kg^{-1}$ of AgNPs and 100 mM of NaCl). At the end of the experiments, plants were harvested; roots, shoots and leaves were separated, and samples were prepared for micro-PIXE, XRF, XANES, lipid peroxidation and pigment analysis. Results showed the internalization of Ag in the cortex of roots from sunflower crop in hydroponic medium. K content in roots was negatively affected by nanoparticles and salinity treatments. Moreover, a translocation of silver to leaves of plants cultivated in soil was observed. In this case, the combination of AgNPs and salinity seems to intensify silver accumulation in leaf and root tissues.

REFERENCES

[1] SARMAST, M.K., SALEHI, H., Silver nanoparticles: an influential element in plant nanobiotechnology. Molecular Biotechnoly (2016).

[2] ESCHEMBACK,V., BERNERT, M.R., SUCHORONCZEK, A., JADOSKI, S. O., LIMA, A. S., Characteristics of soil salinity in agricultural crops in Brazil. Brazilian Journal of Applied Technology for Agricultural Science 7 (3) (2014), 115-124.

[3] DHIMAN, S.S., ZHAO, X., LI, J., KIM, D., KALIA, V.C., KIM, I.W., KIM, J.Y., LEE, J.K., Metal accumulation by sunflower (*Helianthus annuus* L.) and the efficacy of its biomass in enzymatic saccharification. PLOS ONE (2017).