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VII INTERNATIONAL CONGRESS VII

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY EEM2021

BOOK OF ABSTRACTS

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IMPACT OF CARBOHYDRATE-COATED CERIUM OXIDE NANOPARTICLES ON SEMI-VOLATILE COMPOUNDS IN TWO CROPS

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Abstract

Plants accumulate and synthesize various compounds, which are involved in plant-environment interaction. Among them are semi-volatile organic compounds of which 1700 are currently known to be emitted by plants. These compounds present 1% of plant secondary metabolites. The effect of cerium oxide nanoparticles ($nCeO_2$) on semi-volatile organic compounds in plants was not investigated. Redox properties of $nCeO_2$, based on their facile transition between Ce^{3+} and Ce^{4+} oxidation states are the main reason for their increased usage in the pharmaceutical industry, paints, cosmetics, electronics, and fuel additives. For that reason, $nCeO_2$ can be found in the environment so there is a need to analyze their ecotoxicity. To improve their solubility, $nCeO_2$ were coated with monosaccharide - glucose and microbial exopolysaccharides – levan, and pullulan. The main aim of this research was to study the effect of 200 mg/L glucose-, levan-, and pullulan-coated $nCeO_2$ (G-CeO_2, L-CeO_2, and P-CeO_2) in the shoot extracts of wheat and pea by screening the semi-volatile compounds with comprehensive two-dimensional gas chromatography (GC×GC-MS). The $nCeO_2$ were applied at a concentration of 200 mg/L during three weeks of plants' growth in hydroponics. The semi-volatile organic compounds were extracted from plant shoot extracts with methylene-chloride. Noticed coated $nCeO_2$ effect was compared with the effect of uncoated ones. Nonlinear principal component analysis (NLPCA) with optimal scaling was used for the evaluation of wheat and pea GC×GC chromatograms and the confirmation of differences in chemical composition between untreated and treated plants. Results revealed that wheat samples had a higher number of chemical compounds than a pea. The chemical composition of wheat was less affected by the treatments with coated nanoparticles compared to pea. Most compounds which content was significantly different compared to the control compounds were detected in wheat after the treatment with L-CeO_2 and P-CeO_2, and in pea after L-CeO_2 treatment. A semi-volatile profile was presented only as categorical variables, while unique fingerprint images were used for the inter-cultivar recognition. These results showed that GC×GC-MS as a screening method may be useful for monitoring the effects of various abiotic factors on different plant species.

Key words: *CeO_2, gas chromatography, nanoparticles, plant, screening.*