❖ FOOD ENGINEERING AND TECHNOLOGY

A comparative study on the in vitro and in vivo toxicity of Gadolinium on Stevia rebaudiana

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Abstract
Lately, there is growing interest towards the potential toxicity effects that different nanoparticles or chemicals extensively used in everyday life applications could exert on the environment and edible plants. Gadolinium (Gd)-based contrast agents are extensively used for diagnostic purposes in magnetic resonance imaging. After administration, these molecules are excreted unmetabolized and a significant amount is present in hospital effluents and, consequently, in wastewaters. Gd presence in surface and ground waters all over the world, as well as in tap water and tap water-based beverages has been documented [1,2]. Our research is focused on potential risks associated with plants exposure to Gd and aims at assessing the in vitro vs in vivo toxicity of gadobutrol.
In our study, we have assessed effects of Gd on Stevia rebaudiana plants grown in vitro and in soil, by quantifying the plant growth and relevant plant metabolites (steviosides, chlorophylls, carotenoids, ascorbic and dehydroascorbic acids). The plants were exposed to gadobutrol in concentrations up to 3 mM.
The results showed that root and plant length, also plant biomass had a statistically relevant decrease upon Gd exposure at high concentrations. The effects were much more pronounced for the in vitro grown plantlets.
The plant metabolites were quantified using high performance liquid chromatography (HPLC). The concentrations stevioside and Rebaudioside A, chlorophylls A and B, lutein, zeaxanthin, and beta-carotene showed the same trend upon exposure to increased Gd levels. Their concentrations increased up to 0.1 mM Gd doses, while for the highest exposure level of 1 mM and 3 mM, the concentrations of all investigated analytes were significantly decreased compared to controls.
In all cases, the in vitro grown plantlets were more severely affected. The variations in metabolites levels are clearly related to a stress response of the plant, which is more pronounced under in vitro growth.
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