

Study of selenium speciation in Se-enriched wheat plants.

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Selenium is an essential micronutrient for humans. It is an important constituent for proteins, where substitutes Sulphur atoms and acts as the active center of enzymatic processes. Appropriate selenium intake can be beneficial for human health due to its antioxidant, anti-viral and anti-carcinogenic properties. The Selenium present in our diet comes indirectly from the content found in soils, mainly via cereals and/or meat. Thus, regions with low Se level in soils would produce Se deficient diets. The elaboration of functional foods from edible plants through Se-enrichment processes has emerged as a solution to this problem. Nowadays, selenium biofortification practices are gaining popularity in regions with Se-poor soils. However, a proper systematic study of the Se uptake, metabolization, translocation and accumulation in the plants was still missing.

In this work, wheat has been chosen as an ideal candidate due to its large consumption worldwide. Wheat plants have been cultivated hydroponically and have been exposed to different Se(IV)/Se(VI) conditions. Although these Se inorganic species are toxic to both plants and humans in excessive amounts, they are taken up and transformed by the plant into seleno-amino acids, which are incorporated into proteins. However, Se substituted proteins do not accomplish any metabolic function for the plant, which implies a reduction of plant growth and grain yield which translates into economic losses. In order to avoid this drawback, a plant biostimulant based in Keggin structure has been used to enhance the nutrition efficiency and to improve the abiotic stress tolerance and crop quality. As a result, spikes were larger and the plant senescence was delayed.

The combined HPLC-ICP-MS and XAS study have demonstrated that wheat is able to transform inorganic Se into 3 types of seleno-amino acids: Selenomethionine (SeMet), SelenoCystine (SeCys) and Se-methylselenocysteine (SMSCys). The transformation occurs to a different extend depending on the conditions during the hydroponics (with/without plant biostimulator), and the species of selenium used in the fortification. X-ray fluorescence mapping was performed on the grains at different energies around the Se K-edge, in order to unravel the distribution of different species. In addition, XANES spectra were measured in several points of interest inside the grain, including germ, bran and endosperm. The nonhomogeneous distribution of the selenium species is clearly depicted, which provide novel significant results on wheat physiology and selenium enrichment.

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