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Selenium speciation in Se-enriched wheat by XAS and HPLC-ICP-MS

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Selenium is an essential micronutrient for humans and it has been shown to be antioxidant, anti-tumoral, anti-viral and to contribute in the treatment of cardiovascular diseases. Therefore, appropriate selenium intake can benefit human health, but millions of people worldwide consume it at levels below the body's need for the correct expression of selenoproteins.

Se-poor soils around the world produce Se-deficient crops, resulting in deficient food for humans lacking selenoaminoacids. Soil Se enrichment in edible plants has been proposed as a solution for this problem. Selenium-enriched wheat may contribute to human welfare in the form of functional foods.

The properties of Se in wheat (bioavailability, toxicity, etc.) are strongly dependent on their chemical speciation. Consequently, characterization of the different species present is required in order to assess the potential health benefits as well as its safety. In this context, it is important to gain an understanding of the plant's mechanism of bioassimilation of Se, and its metabolism, where inorganic species are transformed to selenoaminoacids. It is also critical to determine the distribution of the species in the different plant tissues (roots, stems, leaves, and grain). Furthermore, the novel element in the research is the use of a chemical tuning of the Se species in the soil to obtain the desired ratio in wheat, to define the properties of the final functional food.

Oppositely, mercury is not an essential micronutrient, but its concentration in crops has risen, and mercury has been shown to change Se uptake and speciation. Its presence can hamper the health benefits of Se-enriched wheat crops. The interaction between the two elements is due in part to the formation of Se-Hg complexes.

Accordingly, we have measured Se content and speciation in wheat tissues by conventional speciation techniques as HPLC-ICP-MS and by direct X-Ray Absorption Spectroscopy with Synchrotron Radiation in CLAESS beamline at ALBA. The comparison of the results have provided reliable data that have allowed to study the distribution and speciation of Se in enriched wheat and the significance of the presence of Hg for the crops.

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Primary author: SUBIRANA, Maria Angels (Universitat Autonoma de Barcelona- ALBA synchrotron)

Co-authors: Mrs ROMERO, Andrea (UAB); Prof. VALIENTE, Manuel (UAB); Prof. LLUGANY, Mercè (UAB)

Presenter: SUBIRANA, Maria Angels (Universitat Autonoma de Barcelona- ALBA synchrotron)

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