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Effects of phosphate and thiosulphate on arsenic accumulation in Brassica juncea plants grown in soil and in hydroponic culture

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Arsenic is recognised as a toxic metalloid and a strong pollutant in soils of many countries. Thus, the reclamation of contaminated areas is fundamental in order to protect both human health and agricultural production.
This study is focused on the assisted phytoextraction, a technology for reclaiming polluted soils that takes advantage of the capability of some plants to extract inorganic elements from soils with the aid of additive agents. The nutrients phosphorus, as phosphate, and sulphur, as thiosulphate, can compete with the form more oxidised of arsenic, both in soil and plant.
This study examined the capability of thiosulphate (Th) and phosphate (Ph) to promote the release of As from soil surfaces in order to improve the phytoavailability and thus the absorption of As by Brassica juncea plants.
In the first experiment B. juncea plants were grown on a soil that had been sampled from an industrial area strongly contaminated by As (790 mg As kg-1 soil). The second experiment was carried out in hydroponics where As has been added at a concentration (100 microM) similar to the As available concentration measured in soil. In both trials ammonium thiosulphate (at the concentration of 0.27 M in soil, and 400 microM in hydroponics) and potassium hydrogen phosphate (at the concentration of 0.05 M in soil, and 112 microM in hydroponics) were added. The biomass of B. juncea was determined and the accumulation of P, S and As in root and in the above-ground tissues have been analyzed.
Our results showed that thiosulphate and phosphate acted either as nutrients and detoxifying agents, due to the stimulation of plant defensive systems, and influenced either the biomass production and the As accumulation in plant tissues.
In the plants grown in soil, As accumulated at higher levels in the above-ground part than in the roots and the addition of Th induced a higher biomass production and a higher total As accumulation (concentration x biomass) in the above-ground tissues. This might be due to the detoxifing capacity of sulphur and suggests the presence of interactions between the pollutant and the competitor elements both in soil and plant. Brassica juncea showed a potential as suitable specie in terms of assisted phytoextraction of As.
Further clarifications of the existing relations between nutrients and plants are future goals in order to develop a more efficient technique of phytoremediation.