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# Molecular mechanisms of arsenic uptake, bioaccumulation and biotransformation in plants

**Sayan Bhattacharya**[1] and **Suchetana Sarkar**[2]
[1]Rabindra Bharati University, India
[2]Asutosh College, India

Arsenic (As) is a metalloid of great environmental concern because of its highly toxic nature and colossal abundance. Several plant species such as ferns have been studied for their ability to accumulate arsenic. The Chinese brake fern (*Pteris vittata*) was reported as the hyper accumulator of arsenic and can remove arsenic from soil. High amount of arsenic can be accumulated in edible plants like rice, wheat, barley, maize, cumin, turmeric, arum, Kachu sak (*Colocasia antiquorum*) and *Ipomea* sp. (kalmi). The arsenic concentrations in the edible parts of a plant depend on the availability of the soil arsenic and the accumulation and translocation ability of a plant. In general, plants uptake and metabolize As (V) through the phosphate transport channels. In rice plants, As (III) is taken up at high rates of influx which follows the Michaelis-Menten kinetics. Rice is a strong accumulator of silicon which may allow efficient uptake and translocation of arsenite (AsIII) in the shoots. The aquaporin Lsi1 (protein) which is responsible for the influx of silicon into the root cells is permeable to arsenite. Inside plant tissues, arsenic is reduced from pentavalent to trivalent state or is bio-transformed to less toxic organic compounds such as DMA, MMA. Trivalent arsenic can form complex with thiol groups inside the plant tissues. Many plants can synthesize arsenic reductase, which can convert the pentavalant arsenic into trivalent form. Trivalent arsenic is the predominant species in the plant tissues and 50-65 % of the total arsenic accumulated in stem or leaf parts are trivalent. The effect of arsenic toxicity in plants increase in low pH, but the uptake mechanism can enhance in higher pH soil. Rice plants are generally grown in submerged soil condition, where arsenic bioavailability is generally high. Iron plaque formed in the rhizosphere zones can efficiently bind arsenic and can reduce its translocation to the above ground tissues (straw, husk and grain) of rice plants. Experiments proved that arsenic causes quantitative changes in the level of RNA, soluble proteins, free amino acids and proline and inhibits the activities of RNase and protease and retard photosynthesis rate in rice plants. As arsenic species are very much toxic to plants, they can affect the overall production of rice and other vegetables and can affect the agricultural economy of a country as whole. Detailed investigation on the molecular behaviors of plants in response to arsenic should be done for future prospects of arsenic bioremediation.

## Biography

Sayan Bhattacharya is currently working as an Assistant Professor in Department of Environmental Studies, Rabindra Bharati University, India. He has completed his MSc and PhD in Environmental Science from University of Calcutta. He has completed two years Post Doctoral Research in Department of Chemistry, Presidency University, India. He has published 25 international journal papers, 10 book chapters, 40 international conference proceedings and many national conference proceedings. He has also received Young Researcher Award from Government of India international conference. He is in the Reviewers' Committee of many international journals and in the Editorial Boards of international journals with high impact factors. He has over 9 years of teaching experiences in 6 colleges and universities of West Bengal.

sayan_evs@yahoo.co.in
sayan.evs@gmail.com