
Iodine in Soils: Geochemical Dynamics and Availability to Plants

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Abstract

Despite the concerted global effort to reduce iodine deficiency (ID) over the past decade, approximately 1.9 billion people are currently at risk of developing Iodine Deficiency Disorders (IDD). Iodine is an essential micronutrient required during the production of thyroid hormones. Severe ID during pregnancy increases the risk of stillbirths, abortions and neurologic and myxedematous cretinism; ID is often identified from swelling of the thyroid gland, a condition known as goitre. The recommended nutrient intake for adults is 150 $\mu\text{g}/\text{day}$; almost all iodine in food is bioavailable. By understanding the geochemical processes that control iodine availability to plants our knowledge of the link between geochemistry and health can be greatly improved.

The aims of the current project are, briefly, to:

- develop methods for identifying organically-bound species in soil solution using size exclusion chromatography (SEC)-ICP-MS;
- investigate the effects of aqueous iodine speciation on plant availability, and assess whether plant uptake of iodine is active or passive;
- investigate the factors controlling iodine assimilation into humic acid and soil humus;
- model experimental outputs characterising the dynamic cycling of iodine in soils to predict soil-iodine availability to plants in the field.

The biogeochemical cycling of iodine is governed by many complex interactions. Recent evidence appears to confirm a dual role for soil humus and Fe/Al/Mn hydrous oxides in influencing iodine interception from drainage water, speciation changes and fixation into intractable forms in soils. This project aims to develop a predictive model assessing soil-iodine availability to plants; soils with a range of relevant characteristics will be studied. The results from the proposed experiments will enhance our understanding of iodine geodynamics and will be used to develop a variety of strategies to increase iodine concentrations in crops, thereby providing evidence as to suitable interventions to decrease the incidence of IDD.

Keywords: Iodine, IDD, Geodynamics

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