



Iodine and selenium in natural water, their fixation on geochemical barriers in soils and rocks and explanation of I and Se behavior in water-solid phase system using thermodynamic modeling

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Iodine and selenium are essential for normal functioning of thyroid gland. Their natural deficiency in areas subjected to radioiodine contamination during nuclear tests and accidents may increase the risk of thyroid cancer among the most sensitive groups of population. Deficiency is caused by both the low abundance of microelements in the environmental components of the local food chain and their fixation on geochemical barriers due to such processes as chemical transformation, sorption, chemisorption, complexing.

The studies of iodine and selenium distribution in soils, herbs and drinking water in rural settlements of the Bryansk oblast' confirmed low level of iodine and selenium content in local soils, plants and water and revealed different character of their distribution in soils and waters formed in geochemically different conditions of water migration in areas of fluvio-glacial, moraine and loess-like soil forming rocks (the polesje, moraine and opolje landscapes correspondingly). Iodine content in top horizons of the soils developed on loess-like sediments and rich in organic matter was considerably higher as compared to those formed on sandy moraine or fluvio-glacial sediments. For selenium the difference was not pronounced. Iodine was noted for positive correlation with Corg and fixation in the soil profile on carbonate barrier. A negative correlation was found between selenium content in grasses and in topsoil of subordinated elementary landscapes characterized by waterlogged and reduction conditions in soils.

Thermodynamic modeling performed for 47 water samples on the basis of their chemical composition helped to explain the established patterns of iodine and selenium behavior in soil-water system. It demonstrated the possibility of existence of CaI^+ and MgI^+ complexes in water and sedimentation of $\text{FeSe}(\text{cr})$ in presence of a considerable amount of Fe^{2+} . Iodine complexation with Ca and Mg ions may explain its further fixation on carbonate barrier in soils, and selenium sedimentation may decrease its availability to plants in gley kinds of soils elsewhere. It may be suggested that the organic water-soluble iodine complexes typical for polesije landscapes and the mineral ones in opolje landscapes could have increased the mobility of radioiodine isotopes and their transfer to food chains in the contaminated areas.

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