

Effects of soil properties and Mo speciation on the availability of Mo to rice plant

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Abstract

Molybdenum is an essential trace element to plants while high Mo concentration could be toxic. The Mo availability in soils plays an important role in its accumulation in plants. Previous studies had indicated that the bioavailability of Mo is affected by soil pH, iron oxides, organic matter and phosphate availability. While the soil Mo speciation also plays an important role in Mo accumulation in plants, it is relatively less studied previously. Therefore, the aim of this study is to investigate the effect of soil properties and Mo speciation in soil and plants on the bioavailability of molybdenum to rice. Pot experiment was carried out on rice. One mill molar Mo was added into three kinds of soils with different pH and texture. Soil, soil solution and plant samples were collected. The concentrations of Mo, Fe, Ca and Al in soil solution and Mo speciation of soils and plants were analyzed with ICP-OES or ICP-MS and X-ray adsorption spectroscopy, respectively. The results showed that Mo was bound relatively loosely by sandy soil and the Mo concentration in soil solutions were mainly influenced by soil pH. However, Mo concentration in rice plant did not show the same trend as soil solution Mo concentration or pH. Instead, poorly crystalline iron content in soils greatly influence the accumulation of Mo in rice plants. The soil Mo speciation showed that the iron-bound Mo could be the most available to rice plant under long-term incubation. Iron-bound Mo was the main Mo species in rice plants and was followed by sulfur-bound Mo. It was concluded that the concentration of Mo in soil solution did not directly refer to the Mo availability to rice, soil amorphous iron content and Mo speciation in soil and plants should be taken into consideration.

Keywords – Molybdenum, Rice, poorly crystalline Fe oxide, X-ray adsorption spectroscopy