



Arsenic migration and transfer in soil-plant system at the Jiaodong Peninsula in China

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Arsenic (As) known for its highly toxic and carcinogenic properties, the mechanism of migration and transfer in soil-plant systems have received considerable attention in recent years. The previous studies reported the biogeochemical behavior of As in soil-plant system under different exposed conditions especially for crops and vegetables (Jia et al., 2014; Linquist et al., 2015; Tomic et al., 2016), while the information are limited in fruit. In this paper, the concentration and chemical speciation of As in soil-apple trees system at Jiaodong Peninsula in China were investigated. According to the characteristics of soil development, 8 research areas were selected with different geological background, and the samples included soils vertical section, root soils, several kinds of plant tissues (roots, stems, leaves, fruits). For the vertical section of the soils, concentration of As is upward trend from underground to surface (1.67 and 10.85 mg kg⁻¹). Only inorganic forms (As(III) and As(V)) was detected in the vertical section of the soils. As(V) was the dominating species accounting for 77-96%, and the proportion were increased trend from bottom to top for each individual section. The results indicated that total As was migrated to the top soils, and more likely to present an oxidation state (As(V)), due to the influence of Fe-Mn oxides layer and the good air permeability of the soils. In the soil-plants transport process, the concentration of As in roots (0.78-1.53 mg kg⁻¹) was less than that in root soils (5.32-10.85 mg kg⁻¹), and the transfer factors (TF) was 0.10-0.19. Meanwhile, the proportion of the dominating species (As(V)) was decreased from 90% in soils to 54% in roots, and a negative correlation ($r^2 = 0.66$) was found between As(V) levels in the root and the available P values in the root soils. The results show that a competitive relationship was existed between As(V) and P, and the proportion of As(V) inside plants is increased with the deficiency of available P in root soils. The distribution of As concentration in the plants tissues were highest in root > leaf > stem > fruit, which indicated that apple trees had peculiar ways to protect their fruit from high toxic heavy metals coming from the soil. What's more important, the proportion of As(III) with higher toxicity was decreased during transmission in the plants tissues.

References

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