

## **Silicon-rich Rice Residue Impacts on Arsenic in Soil Pore- water, Solid-phase Fractionation, and Rice**

PARAPOND LEKSUNGNOEN, WORACHART  
WISAWAPIPAT\*, DAOJARUS KETROT AND  
SURACHET ARAMRAK

Department of Soil Science, Faculty of Agriculture,  
Kasetsart University, Bangkok 10900, Thailand  
(\*correspondence: worachart.w@ku.th)

Understanding the impacts of silicon (Si)-rich rice residues on arsenic (As) solubility in soil is of immense importance in providing an effective approach for the sustainable alleviation of As uptake in rice. Here, we investigated the amounts of As in soil pore-water, solid-phase fractionation, and rice. A naturally As-enriched paddy soil was treated with rice husk ash (RHA) and rice husk biochar (RHB) at the respective rates of 3.13, 6.25 and 12.50 ton/ha. The acid-washed biochar (AWB) treatment (12.50 ton/ha) was also included to study an effect of Si in the RHB treatment. The results demonstrated that the three amendments clearly increased dissolved As levels in soil pore-water relative to the control in the following order: RHB > RHA >AWB. Nonetheless, at all rates, both RHA and RHB treatments decreased grain-As levels, with the highest rate of the RHB treatment substantially reducing grain-As levels by 78% compared to the control (141  $\mu\text{g}/\text{kg}$ ). The levels of As in the straw and iron plaque also decreased with the RHB application rates. The sequential extraction results demonstrated that residual phases were the dominant As phase of the soils before the experiment, which constituted 91% of the total soil As. At the end of the pot experiment some of the residual phases were transformed into the As fractions associated with specifically sorbed (5.9%), organically bound (3.4%), Mn oxides (0.88%), and crystalline (5.8%) and micro-crystalline (11.3%) Fe oxides. Our findings suggest the beneficial role of RHA and RHB produced from the traditional kiln in reducing As accumulation in paddy rice.