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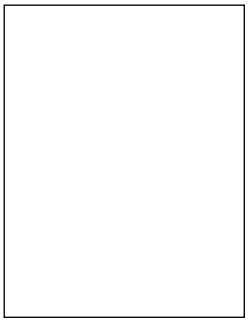

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Effects of Silicon on Arsenic Concentration and Speciation in Different Rice Tissues

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ABSTRACT

Rice is a main route of inorganic arsenic (iAs) exposure for billions of people worldwide. Therefore, strategies to reduce arsenic accumulation in rice should be adopted. It is found that silicon (Si) application can be an effective way to mitigate As accumulation in rice. However, few studies have investigated the effects of Si on arsenic species and distribution in different rice tissues. In this study, a pot experiment was performed to investigate how Si affects arsenic speciation and distribution in different rice tissues. Our results showed that Si addition could significantly increase As and Si concentrations in soil solution and Si concentration in iron plaque extraction around rice root surface, while As in the iron plaque extraction was significantly decreased. Total As concentrations in stem, leaf, husk and brown rice were remarkably decreased by 51.9%, 31.9%, 33.8%, 24.1% after Si addition, while iAs concentrations were reduced by 52.3%, 35.5%, 50.1%, 20.1%. Moreover, both dimethylarsinic acid (DMA) concentration and percentage in rice grain were significantly elevated by Si application. Therefore, Si application can be used a promising way to mitigate inorganic As accumulation in rice thereby reducing its health risk.
Key words: arsenic concentration, speciation, silicon, rice.

INTRODUCTION

Arsenic (As) contamination is ubiquitous in the environment and can pose risks to humans through water or food (Fendorf, 2010; Zhu *et al*., 2014). Inorganic arsenic (iAs), a non-threshold class one carcinogen, can cause skin cancer, various internal cancers and other health problems in humans (Smith *et al.*, 2002； Smith and Steinmaus, 2009). More recently, evidence has indicated that food, especially rice, is an important exposure route of iAs (Zhu *et al*., 2008a; Meharg *et al*., 2009; Li *et al*., 2011; Meharg and Zhao, 2012). In 2010, the Joint Food and Agriculture Organization (FAO)/World Health Organization (WHO) Expert Committee on Food Additives (JECFA) withdrew its provisional