Controlling Arsenic Accumulation in Rice Grain under Nanomaterials-Assisted Optimal Greenhouse Set-Up

ABSTRACT

Rice is being increasingly exposed to inorganic arsenic and this affects half of the world population because they are rice consumers. In this study, pot experiments were carried out to investigate the effect of two dose-dependent nanomaterials (silica and graphene) treatment on varied arsenic levels (2, 7 and 12 mg/kg). The results showed that both nanomaterials were affected significantly with 1 mg/mL of nanomaterial. Arsenic adversely affected the plant height, tillering, number of grains, and grain weight and when high concentrations of arsenic were applied at 12 mg/kg, the plant could not withstand it and died before 75 days even in the presence of graphene. Based on inductively coupled plasma mass spectrometry analysis, silica nanoparticles showed the highest inhibition on the total accumulation of arsenic as 93% (control plant), 84% (2 mg/kg), 67% (7 mg/kg) to 35 % (12 mg/kg), whereas graphene showed lower inhibition percentages. This outcome confirms that silica nanoparticles prevent arsenic uptake, because they translocate from the root to the grains and are able to offer a promising way to reduce consumer health risk.