

# Speciation and fate of toxic cadmium in contaminated paddy soils and rice using XANES/EXAFS spectroscopy

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The objective of the present study was to investigate the fine structures and oxidation states of Cd element accumulated in the contaminated soils and rice crops including their roots, stems, leaves, husks, and kernels using XANES/EXAFS spectroscopy. In the contaminated paddy soils and rice crops, the concentrations of heavy metals were considerably higher than those observed in non-contaminated ones. The result showed that all examined standards were prepared using Cd(II), the Cd K-edge XANES spectra of all standards demonstrated a similar absorption edge ranging between 26719 eV to 26722 eV as shown in Fig. 1(a) and 1(b). The EXAFS spectra of Cd in soil and rice kernels showed that cadmium oxides (CdO) in soil and rice kernels formed Cd clusters with Cd–O bond distances of 2.35 Å and 2.83 Å (coordination numbers of 2.3 and 4.2), respectively as displayed in Figs. 2(a and b). The bond distance of Cd–O in Cd-contaminated soils and rice crops were also fitted in EXAFS spectra, both of their first shells were found to fit well with the molecular structure of CdO. The distribution in the profile depth and accumulation mechanism of heavy metals in contaminated rice farming soils and rice crops were also studied. These results offered an insight into the accumulation mechanism and distribution of heavy metals in contaminated rice farming soils and rice crops.

**Keywords:** Rice crops, Cadmium contamination, Heavy metal, Bioaccumulation, XANES/EXAFS.

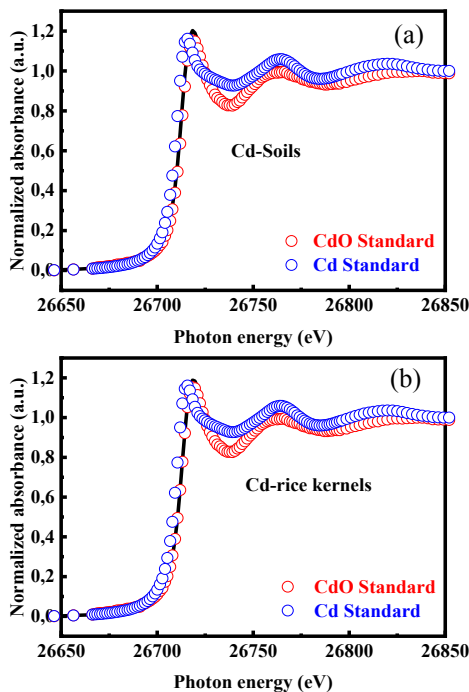


Fig.1 (a) XANES spectra of Cd contaminated (a) soils and Fig.1 (b) rice kernels compared with Cd standards

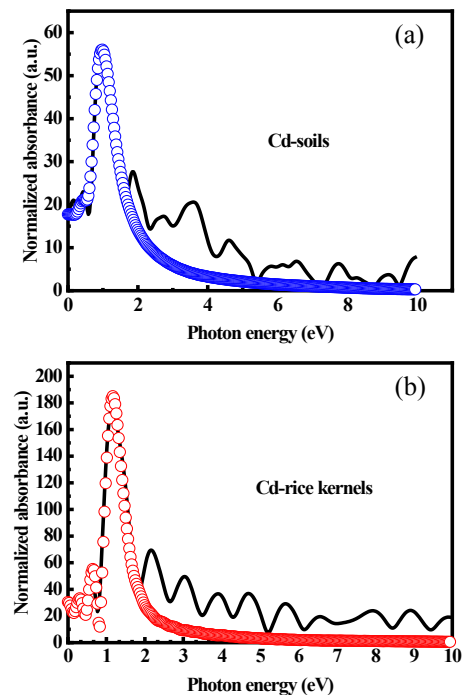


Fig 2(a) EXAFS Cd K-edge Fourier transformed spectra of Cd contaminated soils and Fig 2(b) rice kernels