

**Detoxification of Cadmium in Tobacco Plants: Formation
and Active Excretion of Crystals Containing Cadmium and
Calcium Through Trichomes**

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Long and short types of tobacco trichomes can be morphologically distinguished. The established function of long trichomes is to exude a sticky gum containing diterpenes, whereas that of short trichomes is not known. When tobacco seedling were exposed to toxic levels of cadmium (Cd), growth was significantly retarded, but trichome number was increased up to 2-fold in comparison with untreated samples. Observation with variable-pressure scanning electron microscopy (VP-SEM) indicated that large crystals of 150 μm in size were formed on head cells of short trichomes, and to lesser extents, of long trichome. An energy dispersive x-ray analysis system fitted with VP-SEM revealed the crystals contain high amounts of Cd and Calcium (Ca), at much higher concentrations than in the head cells themselves. Transmission electron microscopy demonstrated crystal formation in amorphous osmiophilic deposits in vacuoles. When seedling were treated with Cd in the presence of Ca, tolerance was increased proportionally to the increase in Ca concentration. These results indicates that tobacco plants actively exclude toxic Cd by forming and excreting Cd/Ca-containing crystals through head cells of short trichomes.

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