



Cadmium Release from Peat and Accumulation in Aquatic Ecosystem after Experimental Wood Ash Treatment

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Abstract. Wood ash produced as a by-product in paper mills and heating power plants contains many toxic heavy metals. Cadmium (Cd) concentrations in wood ash typically vary between 1-20 mg/kg. The addition of wood ash on drained and forested peatlands to improve nutrient balance also increases the cadmium concentration in the soil and the risk of its release into recipient waters. Leaching of Cd was experimentally studied using mesocosms where peat was treated with three different ash doses (300, 600 and 1200 g ash m⁻²). The effects of Cd on the aquatic ecosystem were studied in microcosms where run-off water from mesocosms was added into aquariums containing humic lake water (dissolved organic carbon > 10 mg l⁻¹), lake sediment, bryophytes and benthic animals. The mesocosm studies showed that all ash treatments clearly lowered pH and dissolved organic carbon concentrations in the run-off water during an 11 week experiment. The treatment of peat with 300 g or 600 g ash m⁻² did not increase Cd leaching, however, the application of the highest dose, 1200 g ash m⁻², increased the Cd concentrations in the run-off water significantly. After the experiment we measured high pH values (varying between 6.5-7.5) and Cd concentrations only in the upper layers of all ash treated peat, which clearly indicated that most of Cd was tightly retained in the surface soil. The microcosm experiments showed that only the run-off water received from the highest ash treatment clearly increased the Cd concentration of water. Greater Cd concentrations were found in benthic animals, *Asellus aquaticus*- isopod, in treatments with higher ash doses but accumulation of Cd was not observed in the bottom material or in the bryophytes (*Fontinalis antipyretica*). We found a significant negative correlation between Cd concentration in *Asellus aquaticus* and water pH and thus the bioavailability of Cd for isopods seemed to be dependent on the water acidity rather than on the dose of ash. According to the results the risk of Cd release from peat a few months after ash application is low especially when ash doses between 300-600 g ash m⁻² are used. Higher doses decrease pH of the discharge water, increase Cd loading and the risk for bioaccumulation in aquatic environments.

Keywords: cadmium, wood ash, peat, leaching, accumulation, aquatic ecosystems