

QUANTIFICATION AND SPECIATION OF ARSENIC LEACHING FROM AN IN-SERVICE CCA-TREATED WOOD DECK AND DISPOSED CCA-TREATED WOOD TO LYSIMETERS SIMULATING DIFFERENT LANDFILL CONDITIONS

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ABSTRACT

Most studies report soil and leachate arsenic concentrations in terms of the total arsenic concentration. While arsenic toxicity is a function of speciation the total concentration may not accurately reflect true exposure risks. Predominant forms of arsenic detected in environmental samples are inorganic As(V) and As(III) and organoarsenic, MMAA and DMAA; with trivalent species being more toxic than pentavalent species and inorganic forms more toxic than organic forms. To provide insight into arsenic speciation and transformation in new and weathered CCA-treated wood, leachate from a constructed in-service CCA-treated wood deck and lysimeters containing disposed CCA-treated wood designed to simulate different landfill conditions were collected and speciated for arsenic using HPLC-ICP-MS. The landfill conditions tested were wood monofill, construction and demolition (C&D), and municipal solid waste (MSW). Results showed that the average arsenic concentration in the rainwater runoff impacting the new CCA-treated deck after 1 year was 0.73 mg/L and that both inorganic As(III) and As(V) were detected; although the form of arsenic in the chemical CCA is inorganic As(V). Arsenic concentration in the rainwater infiltrating soil 2 ft below the ground surface beneath the CCA-treated deck rose from 2 to 18 µg/L in one year. The ratio of inorganic As(III) to As(V) in the infiltrated rainwater was much higher than that observed in the rainwater runoff, suggesting biological/chemical transformation of inorganic As(V) to the more toxic inorganic As(III) or preferential sorption of inorganic As(V) by the soil. When weathered CCA-treated wood was disposed to wood monofill and C&D lysimeters, the predominant arsenic species observed in the leachate was inorganic As(V), whereas, for the MSW lysimeter it was inorganic As(III). Unlike the C&D and MSW lysimeters, there was no organoarsenic species detected in the wood monofill lysimeter suggesting that inorganic arsenic concentrations were too toxic for microorganism survival; which is necessary for the conversion of inorganic arsenic to organoarsenic species (a detoxification mechanism). The total mass of arsenic leached from the wood monofill, C&D, and MSW lysimeters after one year was 1,400, 120, and 85 mg, respectively. DMAA was the predominant arsenic species detected in the leachate from the three control lysimeters. After 1 year, the overall rate of arsenic leaching was greater from in-service CCA-treated wood deck (7%) than CCA-treated wood disposal to the wood monofill (0.8%), C&D (0.7%), and MSW (1.8%) lysimeters and both leached enough arsenic to qualify CCA-treated wood as a hazardous waste.