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Characterization of Formaldehyde Emissions from Tire Crumb Rubber in Small Environmental Chambers

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ABSTRACT

Concerns have been raised about the safety of recycled rubber tire crumbs used in synthetic turf fields and playgrounds in the United States. To support federal efforts to better characterize recycled tire-derived surface materials, dynamic small chamber tests were conducted at the US EPA National Risk Management Research Laboratory Small Chamber Facility to measure potential formaldehyde emissions from tire crumb rubber materials collected from nine tire recycling facilities and forty synthetic turf fields around the U.S. During tests, approximately 15 grams of tire crumb rubber materials were placed in the center of a 53 L dynamic emission chamber on an aluminum weighing pan for 24 hours before air samples were collected using 2,4-dinitrophenylhydrazine (DNPH) cartridges sampling at a rate of 200-400 mL/min for 90 minutes. The emission chambers were housed in temperature-controlled incubators. An OPTO 22 data acquisition system continuously recorded mass flow controller outputs, temperature, and relative humidity (RH) in the chamber and inlet air. Tests were conducted (N=82) under two chamber conditions, respectively. Formaldehyde concentrations were determined by solvent extraction and analysis by HPLC with Diode-Array Detector. Chamber background and field blank samples were collected for each test. DNPH-formaldehyde detection in selected samples was confirmed by LC/TOFMS. In addition, six duplicates and two time series tests were performed under each set of chamber conditions. The results show that measured formaldehyde concentrations in the chamber at 1 h^{-1} air change (ACH) rate, 25 °C, 46 % RH, were low and close to the chamber background level. Formaldehyde concentrations measured in the chamber at 1 h^{-1} ACH, 60 °C, 6.6 % RH, which may represent synthetic field surfaces under hot ambient conditions, were greater than the chamber background for most of the material samples. This research will provide important information for further human exposure study.