

Distribution of atmospheric particulate bound mercury in biomass burning

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Abstract

Forest litter was burned in a combustion chamber. Particulate matter (PM) emitted during the fire was sampled on a multistage impactor with particles nominal cut size ranging from 10000 nm (inlet) to 10 nm (last stage). The PM mass and the Hg concentration were determined for each stage.

Introduction

Several studies have indicated forest fires as an important mechanism to re-emit previously atmospherically deposited mercury (Hg) to the atmosphere. Burning results in a loss of Hg from vegetation and soils as gaseous elemental Hg (GEM) and particulate-bound Hg (PBM). Particulate Hg released in smoke during burning has the potential for local redeposition, whereas gaseous Hg becomes part of the global Hg cycle.¹ Transport of PBM depends on particle size and mass. In Brazil, atmospheric Hg emissions due to the Amazonian forest burning have been estimated to 6-7 ton yr⁻¹, but more data are needed to assess the impact on the regional Hg biogeochemical cycle.²

Results and Discussion

The experiment was performed in a large combustion chamber (2.5x2.5x2.5 m³) inside of which fuel can be burned on a 1 m² inox plate placed on a balance. A hole in the chimney allows the smoke sampling. Litter (leaves+twigs) was sampled in the Amazonian forest (Alta Floresta, MT) and air dried. PM was sampled on quartz filters in a 13 stages impactor (Model 125 NanoMoudi-II, MSP Corporation), connected to the chimney; sampling flow rate was 10 L/min. The total sampling duration was 22 min (12 min flaming+10 min smoldering). The burned litter sample and the remaining ash were weighed. Hg concentration in litter and ash samples and in filters was determined by Direct Mercury Analyzer (DMA-80, Milestone). Previously decontaminated quartz filters (500 °C, 1h) were weighed before and after the experiment in order to obtain PM mass sampled.

Table 1. Experimental data of burning experiment

	Litter	Ash
Mass (g)	5006	812
Hg concentration (ng g ⁻¹)	16.8	4.7
Total mass of Hg (µg) in the burned sample	83.1	3.8

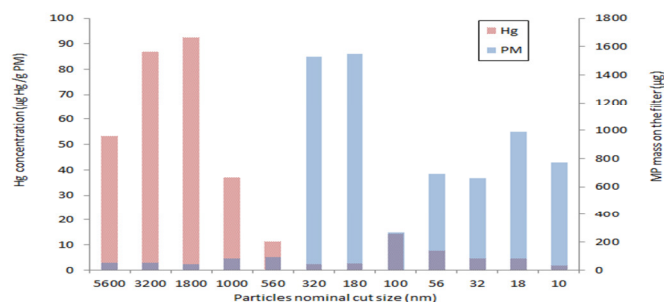


Figure 2. Mass of PM and Hg concentration on each stage/particle size (inlet nominal cut size = 10,000 nm).

Discussion

Data (Tab.1) show that 95.5% of the Hg initially stored in the litter was emitted during the burning. According to Fig.2, the highest Hg concentrations were found on particles > 560 nm. Nevertheless, as the main part of the PM (96%) was < 560 nm, the total mass of Hg bound with fine particles was twice the total mass bound with coarser particles (>560 nm). The results show that the main part of PBM emitted during forest burning should likely be regionally (not locally) deposited, because fine particles are transported to longest distance than the coarsest.

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¹ Witt, E.L et al. *Environ. Sci. Technol.* **2009**, 43, 1776–1782

² Michelazzo, P.A.M. et al. *Geophys. Res. Letter.* **2010**, 37, L09809