

## Differences in the Elemental Composition of Airborne Particulate Matter Collected in Bangladesh, Ghana, Kenya, and NYC

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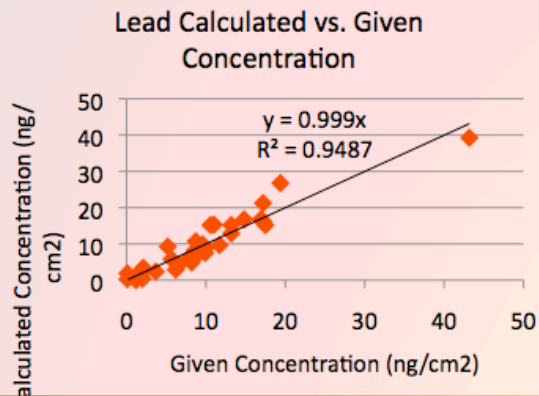
Public health investigators have carried out a number of small pilot studies focused on exploring exposures from combustion of solid biomass fuels for cooking in relatively poorly vented kitchens and collecting preliminary health data. Archived air samples of fine particulate matter (PM<sub>2.5</sub>) exist from pilots in Ghana, Kenya, and Bangladesh where different biomass fuels are burned: wood in Ghana, corn cobs at the time of collection in Kenya, and a mixture of dried dung, mud, and hay in Bangladesh.<sup>3</sup> Public health investigators observed that the lung function of women who cooked in Bangladesh was impaired differently than the lung function in Ghana, and it was hypothesized that this might be due to the different fuel used, specifically different metals within the combusted biomass emissions.<sup>1</sup> Collection of PM<sub>2.5</sub> on a Teflon filter matrix, as in most health studies, allows for elemental analysis via high resolution inductively coupled plasma mass spectrometry (ICP-MS) and energy dispersive x-ray fluorescence (XRF). ICP-MS is the gold standard, but is an expensive, time consuming, destructive technique, whereas XRF under a helium atmosphere is relatively rapid and non-destructive.<sup>2</sup>

A total of 54 filters (20 blanks, 11 Bangladesh, 11 Ghana, and 12 New York City) filters were used to calibrate an XRF instrument for analysis of Teflon filters. They were first analyzed using the XRF, then using ICP-MS, and calibration curves were created. A total of 67 Bangladesh filters, 81 Ghana filters, 11 Kenya filters, and 12 New York City filters were then measured with the XRF, and the concentration of each element in the airborne particulate matter was compared. The calibration suggests that the XRF is a reliable way to analyze filters of airborne particulate matter for 17 of 24 elements investigated. The particulate matter released during the burning of different biomass fuels varies in composition for some elements, including some of known toxicity such as Ni, As, and Pb.

### References:

1. D'Armiento, personal communication.
2. Landsberger, Sheldon and Creatchman, Marsha (ed). 1999. *Elemental Analysis of Airborne Particles*; Gordon and Breach: Newark, NJ, 1999.
3. Yan, Beizhan; Chillrud, Steven; Parvez, Faruque; and van Vliet, Eleanne. 2008. Calibration of energy-dispersive x-ray fluorescence spectrometer for PM<sub>2.5</sub> filters and comparison of elemental composition of biomass emissions from four countries. Proposal for NIEHS CEHNM.

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