4.058 Molecular Composition of Biomass Burning Aerosol from Household Cookstoves in Rural Haryana, India.

Early Career Scientist

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Abstract:

Exposure to PM2.5 is associated with cardiopulmonary and allergic diseases, and it is known to increase mortality and morbidity in the general population. Emissions of air pollutants, such as PM2.5, from biomass-burning cookstoves in India have proven to be significant on regional scales. However, the extent of competition between the primary particle evaporation, which reduces the PM2.5 mass, and chemical oxidation of VOC components in smoke, which increases the PM2.5 mass by forming secondary pollutants, is poorly understood. To better constrain the contribution of primary and secondary aerosols to the aged cookstove smoke, we collected particulate matter and whole air samples from prescribed cooking activities using traditional cookstoves in Palwal District, Haryana, India. In addition, aerosol samples were collected under controlled cooking conditions in a village home. The fuel sources included brushwood and dung. Moisture content of the fuel was controlled for; other variables included the stove type and meal cooked. The whole air samples were analyzed using gas chromatography methods to determine the distribution of non-methane volatile organic compounds (NMVOCs) in fresh smoke. Dung fuel resulted in a significantly lower modified combustion efficiency with simultaneously larger emissions of measured VOCs. The molecular composition of the particulate organic compounds was characterized using nanospray desorption electrospray ionization (nano-DESI) high-resolution mass spectrometry. Nitrogen-containing compounds dominate the nano-DESI-MS signal in dung smoke samples, while the majority of detected compounds from brushwood smoke do not contain nitrogen. Both levoglucosan and potassium biomass-burning tracers were abundantly detected in brushwood samples, while only some dung smoke samples contained levoglucosan. The results of this study will be used as an input to a model that describes secondary chemical processing of smoke, and will serve as basis for determining the effect of replacement of traditional cookstoves with more modern alternatives.