

Exploring the Sources of PM₁₀ Burning-Season Haze in Northern Thailand Using Nuclear Analytical Techniques

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ABSTRACT

This study explored the sources of PM₁₀ in the smoke haze during the traditional burning season in northern Thailand by determining the characteristics of the atomic elements in PM₁₀ compared to known plant samples. The ambient air was collected from two sites (urban and peri-urban) in the Chiang Mai - Lamphun Basin. This was compared to the characteristics of the leaves from eight agricultural and forest plants predominant in the region: bamboo, grass, teak, yangna, corn, longan, lychee, and rice that were collected and burned in a combustion chamber to collect the resultant PM₁₀. The elements – Al, Si, S, Cl, K, Ca, Ti, Cr, Mn, and Fe – were analyzed by PIXE, SEM-EDS, and μ -SXRF. Morphologies of PM₁₀ particles were analyzed by SEM. The concentrations of the elements in the PM₁₀ of the ambient air samples correlated highly with the PM₁₀ from the combustion of teak, yangna, and corn leaves. The results of principal component analysis (PCA), correlations, and morphological characteristics analyzed by SEM also showed that the ambient air PM₁₀ belonged to the same group as the PM₁₀ from combustion of teak, yangna, and corn. A HYSPLIT trajectory model indicated that the ambient air PM₁₀ in the Chiang Mai - Lamphun Basin was derived primarily from hotspots on the Thai-Myanmar border driven by southwest winds, as well as some hotspots in the basin itself. This study has shown that open burning of plant sources, both forest and agricultural, particularly along the Thai-Myanmar border to the southwest, is a primary source of the smoke haze in the Chiang Mai – Lamphun Basin during the dry season.

Keywords: Smoke haze, PM₁₀, Elements, Plants, PIXE, μ -SXRF, SEM-EDS, Chiang Mai