

## Characterization of Tobacco stalk Ash

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During the production of 'tuibur', an indigenous 'liquid' nicotine delivery medium of Mizoram, India, the tobacco stalk ash ('spent' tobacco generated from the combustion of tobacco stem, petiole, and midrib) is typically dispersed in a haphazard manner. The tobacco stalk ash was investigated for the elucidation of particulate matter, polycyclic aromatic hydrocarbon (PAH) compounds and nicotine using field emission scanning electron microscopy with energy-dispersive x-ray spectroscopy (FESEM-EDX), x-ray powder diffraction (XRPD), SEM mapping, x-ray photoelectron spectroscopy (XPS), micro-Raman Spectroscopy and induction coupled plasma-atomic emission spectrometry (ICP-AES) methods. The concentration levels of Al, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, and S were determined using ICP-AES methods. XRPD analysis of tobacco ash samples indicated the presence of crystallites of calcite, magnesium calcite, potassium chloride, potassium aluminosilicate and calcium silicate hydrate. SEM analysis indicated the presence of sub-micron crystals of calcium carbonate, and calcium silicate hydrate in tobacco ash. XPS analysis indicated Al, C, Ca, Cl, Fe, Hg, Mg, O, and P species at different electronic environments. Micro-Raman spectroscopy analysis showed the vibrational frequencies corresponding to calcite, nitrate and metal oxides. With the detection of disordered and graphitic bands in the micro-Raman spectral features, the presence of PAHs was confirmed. Surface-enhanced Raman scattering (SERS) mapping of dried tobacco ash extract also revealed the distribution of nicotine at lower concentrations within the heterogeneous mixture. Nicotine was also detected in the aqueous and ethanol extract of tobacco ash using SERS method.

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