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Characterization and Ice Nucleation of Smoke/Soot Aerosols emitted from Biomass burning

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In the present scenario of climate change prevailed that aerosols contributes a key role. Burning of bio fuels such as agricultural waste, wood and cow dung is of main concern had been recognized as a major source of atmospheric aerosols. The seeding effect of smoke aerosols on heterogeneous ice nucleation and cloud condensation in an aqueous environment is also of our interest. An experiment was conducted at cloud temperature varying from –20 °C to 0 °C in a walk-in cloud chamber where lowest attainable temperature is –33.5 °C. For specific total water content seeding was done by smokes generating from two types of sources: (i) combination of cow dung, coal, wood and kerosene, (ii) combination of grass and leaves. It was observed that nucleation is better by (ii) than (i). Because of hydrogen bonds on an ice nucleus reduce the free energy for embryo formation [1], they make carbonaceous particles a very potent source of contact ice nuclei. X-ray diffraction, Scanning Electron Microscope (SEM), Fourier Transform Infrared (FTIR) spectroscopy, UV-VIS-NIR spectroscopy and Optical microscope techniques was used for their structural, chemical, optical and morphological characterizations. FTIR spectra of the sample show significant absorptions coincident with the water absorption around 1620 cm-1, as well as near 1400 cm-1 (O- H and C-H bond vibration) and 2950 cm-1 (alkyl C-H). The FTIR spectra also indicate the presence of aromatic C-H and aromatic hydrocarbon band around 900 cm^{-1} and 1900 cm-1 respectively [2]. These analyses also confirmed the presence of polycyclic aeromatic hydrocarbon (PAH), carbonaceous, and water-soluble organic carbon (WSOC) particles in the smoke sample. The SEM micrographs of the aerosol sample collecting from biomass burning from conventional used Chula consist of aggregates of size generally greater than 1 μm in diameter with many of smaller size as well. The aggregation is formed from the coalescence of primary particles, which are spheroids of 0.05 μm – 0.1 μm in diameter, during their long-range transport from burning regions. The optical studies conclude that nearly 80% of total incoming solar radiation was transmitted into the Earth.

Keywords: Smoke aerosols, Heterogeneous nucleation, and Chemical characterization.

References:

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