BIOCOMBUST: Health impacts of particulate matter from biomass combustion

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Particulate Matter (PM), including that emitted from biomass combustion, is considered harmful to public and environmental health. $PM_{2.5}$ (<2.5 μm across) can penetrate into the deep parts of the respiratory system. The EU-funded BIOCOMBUST project assesses the possible link between physical and chemical properties of $PM_{2.5}$ and effects on human lung cells.

$PM_{2.5}$ was sampled by using a Dekati Gravimetric Impactor (DGI) at four different biomass combustion sites equipped with small- and medium-scale boilers (40 kW and 400 kW). The fuel types were Miscanthus, beech wood chips and a mixture of wood chips from soft wood, mainly spruce. Reference materials were coal fly ash (CFA) and diesel exhaust particulate (DEP) matter. $PM_{2.5}$ from biomass burning is a heterogeneous mixture of mineral and carbonaceous matter. Mineralogical characterizations were performed by Scanning Electron Microscopy with Energy Dispersive X-ray spectroscopy, X-ray Diffraction, Atomic Absorption Spectroscopy, X-ray Fluorescence, and Ion Chromatography. The carbonaceous content was characterized in terms of residual carbon, Water Soluble Organic Carbon (WSOC), HUmic LIke Substances (HULIS), and Polycyclic Aromatic Hydrocarbons (PAH). Possible health impacts were evaluated in human lung cells (A549, BEAS-2B) in terms of cytotoxicity (WST-1 assay), genotoxicity (DNA-Alkaline Unwinding Assay), necrosis/apoptosis (flow cytometry using Annexin V-FITC/PI staining) and cellular uptake of PM using confocal microscopy.

Results reveal strongest effects on lung cells for $PM_{2.5}$ from softwood chips, low effects for $PM_{2.5}$ from beech wood chips, and no effects for $PM_{2.5}$ from Miscanthus.