Wood burning releases high amounts of secondary organic aerosols - current emission estimates too low

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Aerosol emissions from logwood combustion increase significantly when the emission ages in ambient air. A significant increase occurs already within three hours of aging, according to a new study from the University of Eastern Finland. The emission increase was caused by the formation of secondary organic aerosols (SOA) in which gaseous organic compounds, released during the combustion, oxidise and condense on aerosol particles. This observation is very important, because current emission inventories do not take SOA emissions into consideration at all.

The analyses were carried out in the ILMARI research laboratory at the University of Eastern Finland in collaboration with the Finnish Meteorological Institute, and they constituted part of the activities of the European HICE Helmholtz Virtual Institute network. The laboratory experiments showed that plenty of organic gaseous compounds get released especially during the ignition and fuel addition phases in batch combustion, and these compounds form secondary aerosols in the atmosphere. Furthermore, the ignition method greatly impacts the emission level: a slower ignition significantly increased the emissions of organic compounds.

The researchers also found that there are differences in secondary emission levels during the day and night, and lower levels of SOA emissions formed during nighttime ageing. However, a substantial fraction of the particulate emissions were organonitrates during

nighttime aging experiments. Organonitrates are an important but so far poorly characterized nitrogen-containing chemical group in the atmosphere. Out of the nitrate compounds present in the atmospheric particle phase, 34-44 per cent are organonitrates. A detailed analysis of the emission ageing process in a smog chamber revealed that the majority of primary organic aerosols (POA) released during wood combustion oxidized during their atmospheric ageing, unlike previously thought.

The transformation process during aerosol ageing is important when considering the health and climatic effects of emissions, and these changes are currently being studied by an international multidisciplinary research network.

More information: Petri Tiitta et al. Transformation of logwood combustion emissions in a smog chamber: formationof secondary organic aerosol and changes in the primary organic aerosol upondaytime and nighttime aging, *Atmospheric Chemistry and Physics* (2016). DOI: 10.5194/acp-16-13251-2016

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