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CONTRIBUTION OF FUNGI TO PRIMARY BIOGENIC AEROSOLS IN THE ATMOSPHERE: ACTIVE DISCHARGE OF SPORES, CARBOHYDRATES, AND IRGANIC IONS BY ASCO- AND BASIDIOMYCOTA.

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Spores and related chemical compounds from actively spore-discharging Ascomycota (AAM) and actively spore-discharging Basidiomycota (ABM) are primary biogenic components of air particulate matter (characteristic size range: 1-10 m, characteristic boundary layer concentrations: ~10^3-10^4 m^-3). Measurement results and budget calculations based on investigations in Amazonia (Balbina, Brazil, July 2001) indicate that the forcible discharge of fungal spores may account for a large proportion of coarse air particulate matter in tropical rainforest regions during the wet season (0.7-2.3 g m^-3). For the particle diameter range of 1-10 m, the estimated proportions are ~ 25 % during day-time, ~ 45 % at night, and ~35 % on average. For the sugar alcohol, mannitol, the budget calculations indicate that it is suitable for use as a molecular tracer for actively discharged basidiospores (ABS), and that the literature-derived emission ratio of about 5 pg per ABS may be taken as a representative average. ABM emissions may account for most of the atmospheric abundance of mannitol (10-68 ng m^-3), and can explain the observed diurnal cycle (higher abundance at night). ABM emissions of hexose carbohydrates might also account for a significant proportion of glucose and fructose in air particulate matter (7-49 ng m^-3), but the literature-derived ratios are not consistent with the observed diurnal cycle (lower abundance at night). AAM emissions appear to account for a large proportion of potassium in air particulate matter over tropical rainforest regions during the wet season (17-43 ng m^-3), and they can also explain the observed diurnal cycle (higher abundance at night). The results of our investigations and budget calculations for tropical rainforest aerosols are consistent with measurements performed at other locations.

Based on the average abundance of mannitol in particulate matter, which is consistent with the above emission ratio and the observed abundance of ABS (~10^3-10^4 m^-3), we have also calculated a value of ~ 17 Tg yr^-1 as a first estimate for the global average emission rate of ABS over land surfaces. Comparisons with estimated rates of emission and formation of other major types of organic aerosol (~ 47 Tg yr^-1 of anthropogenic primary organic aerosol; 12-70 Tg yr^-1 of secondary organic aerosol) indicate that emissions from actively spore-discharging fungi should be taken into account as a significant source of organic aerosol. Their effects might be particularly important in tropical regions, where both physicochemical processes in the atmosphere and biological activity at the Earth's surface are particularly intense, and where the abundance of fungal spores and related chemical compounds are typically higher than in extratropical regions.