Oxygenated and nitrogenated polycyclic aromatic hydrocarbons in atmospheric particulate matter collected in the Amazon region

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The Brazilian Amazon region has been negatively affected by advancing economic development, resulting in deforestation and biomass burning. Forest fires are the most important sources of atmospheric pollution in the region. The majority of forest fire hotspots in the Amazon takes place in the deforestation arc, an area of roughly 500 000 km^2, with a population of over 10 million inhabitants. In this study we characterize western Amazonia biomass burning emissions through the quantification of Organic Carbon (OC), Elemental Carbon (EC), Polycyclic Aromatic Hydrocarbons (PAHs), oxygenated-PAH (oxy-PAH) and nitrogenated-PAH (nitro-PAH). The sampling was conducted during two distinct periods: the dry season (August–October/2011) and wet season (November/2011– March/2012) using a high volume sampler. The results show that PM_{10} was relatively constant throughout the wet season indicating an overall stable balance between aerosol sources and sinks within the filter sampling resolution. Similar behavior is identified for OC and EC components. Retene was the most abundant PAH with an ambient concentration ranging between 0.01 – 4.91 ng m^{-3}, followed by the ANT, PHE and DahA. Retene accounted on average to 25% of the total PAH mass, being up to 50% during biomass burning peak. The ensemble of carcinogenic PAHs (BaA, CHRY, BbF, BkF, BaP, IcdP and DahA) are responsible for 37% of the PAH mass found during all analyzed period. The species 2-metylanthraquinone and 7,12-benzo[a]anthracenequinone, suspected to be a major driver of pulmonary oxidative stress and consequent cardiovascular disease, were the most abundant oxy-PAHs, depicting 192.2 pg.m^{-3} and 145.9 pg.m^{-3}, respectively. The 6-nitrochrysene was the most abundant nitro-PAH (119.0 pg.m^{-3}), followed by 9-nitroanthracene (82.5 pg.m^{-3}) and 6-nitrobenzo(a)pyrene (73.8 pg.m^{-3}). Real-time ozone measurement allowed the study of the role of photochemistry on the concentration of the analyzed PAHs. As expected, all oxy-PAHs have shown a fair correlation with ozone (pearson correlation of roughly 0.3). Other correlations of nitro-PAH with ozone were 3-Nitrofluoranthene (p=0.31), 2-Nitrofluoranthene (p=0.29) and 6-Nitrochrysene (p=0.24). This study presents the PM10 composition allowing to understand the role of forest fires on aerosol life cycle and furthermore, on human health.