PM_{10} characterization from 3 polluted sites impacted by oil extraction and refinery activities in Amazon and Pacific Coast regions of Ecuador

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Abstract

Crude oil reserve in Ecuador is essentially located in the Northeast Amazon region (NAR). During production, oil is extracted with formation water and gas and then separated in a central plant. On each drilling platform, waste gas is continuously burned in open flares, with basic emissions controls. These practices still damage the environment and also represent a potential risk to inhabitants' health, who are exposed, by particles inhalation, to a cocktail of heavy metals and hydrocarbons (PAHs).

Literature dealing with aerosols chemical composition in Ecuador is dramatically poor. For that reason, low-rate air samplers were installed in two locations in the NAR, close to open flares and on the Pacific coast, in front of the Esmeraldas National Refinery. Particulate matter (PM_{10}) was collected monthly on quartz fiber filters, during one year. Aerosol speciation was addressed by analyzing trace metals (ICP-MS), elementary and organic carbon EC/OC ratios (thermal/optical analyzer), speciation of soluble species (IC) and organic speciation (HPLC-PAD). PAHs contents were also measured. Oxidative potential of PM_{10} was assessed (DTT assay) in order to determine their ability to generate reactive oxygen species which are key parameters to explain their biological effects.

Preliminary results revealed that Mo and Ti present the highest concentrations in PM_{10} for the 3 sites, followed by Ba and Zn (in NAR) and Cr (in Esmeraldas). No regulated metal exceeded PM_{10} European or Ecuadorian limitations. The origin of these metals are natural (soil dust) and anthropogenic (gas burning, catalyzers, oil refinery process, thermoelectric emissions, traffic). The EC/OC ratios indicate that OC is probably originated from biomass combustion in NAR. Soluble species are dominated by sulfates, Na and K ions.

Further studies are in progress to assess local population's exposure to the Heavy Metals-PAHs' cocktail.