1.117 Role of Automobile Exhaust on the Photoreductive Solubilization of Atmospheric Iron.

Early Career Scientist

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Abstract:

Atmospheric iron (Fe) plays an essential role in the carbon cycle, affecting the Earth's energy balance and human health. Fe catalyzes oxidations of organic carbon species and serves as a limiting nutrient for phytoplankton in about half of the world's oceans. Wind-blown dust is the major source of atmospheric insoluble Fe while urban areas are correlated with relatively high percentages of soluble Fe. The occurrence of elevated levels of soluble Fe near urban and industrial regions suggests a correlation between Fe solubilization and organic combustion products, including polycyclic aromatic hydrocarbons (PAH). Fossil fuel consumption for internal combustion engines produce atmospheric PAH as a major component of automobile exhaust. Under light, PAH transform into oxidized components such as ketones and carboxylic acids. For example, phthalic acid (formed from naphthalene) inhibits Fe oxidation reactions and therefore may contribute to Fe reduction and increased solubility. The wind-blown dust and PAH-containing combustion products undergo long-range atmospheric transport leading to mixing and metal-organic interactions. The current study focuses on how a saturated PAH suspension affects the production of soluble Fe. Reactions of soil-based Fe and saturated solutions of PAH are performed under controlled conditions simulating natural sunlight. Samples are analyzed by ICPMS for soluble Fe before and after solar exposure reactions; soluble Fe is separated from total Fe by filtration and total Fe by acid-assisted microwave digestion. Data indicate an increase in Fe solubility (1.2% to 4.2%) in the presence of PAH, as compared to soil in water alone, and an even greater increase in Fe solubility (4.2% to 8.4%) when exposed to solar radiation. Research is ongoing to determine the dependence of oxidized PAH on kinetic and overall Fe solubility.