Identification of Polycyclic Aromatic Hydrocarbons in the Particle-Phase Vehicle Emissions

Tione Grant
Undergraduate Student
University of the Virgin Islands, College of Science and Mathematics

Motor vehicles are well-known producers of polycyclic aromatic hydrocarbons. These mutagenic and carcinogenic compounds are products of the combustion process and are present in both gas and particle phases. Traditionally, particle-phase PAH emissions have been studied by collecting cumulative emission samples from tunnels and analyzing them via high performance liquid chromatography (HPLC). To our knowledge, there has been no investigation of vehicle-specific emissions to ascertain the dependence of PAH formation on vehicle model, age and fuel type. In this study, laser desorption time-of-flight mass spectrometry identified PAH's in the particle-phase exhaust of two vehicles. Mass spectra of pure PAH samples were collected by compressing samples and ablating them with a Nd: YAG laser in a mass spectrometer. Samples of particulate matter were collected from the tailpipes of a 2006 and 2016 Toyota 4Runner and analyzed. The results showed a presence of perylene and pyrene in both vehicular emissions, whereas, coronene and phenanthrene were found exclusively in the 2016 and 2006 models respectively. This data is interesting because it suggests vehicle-dependent PAH presence in vehicular emissions, even between vehicles of similar make and model. Future work on this project aims to expand the number and variety of vehicles sampled to reveal trends in PAH production.

Keywords: Polycyclic Aromatic Hydrocarbons , Mass Spectrometer.