Scientists find way to identify manmade biofuels in atmosphere

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Scientists at the University of Miami Rosenstiel School of Marine & Atmospheric Science discovered a technique to track urban atmospheric plumes thanks to a unique isotopic signature found in vehicle emissions. The team discovered that ethanol mixed in vehicle fuel is not completely burned, and that ethanol released in the engine's exhaust has a higher 13C to 12C ratio when compared to natural emissions from most living plants. In other words, the corn and sugarcane used to make biofuels impart a unique chemical signature that is related to the way these plants photosynthesize their nutrients. Ethanol's unique chemical signature can now be used during aircraft sampling campaigns to identify and track plumes as they drift away from urban areas. The findings were published in the journal *Environmental Science & Technology.* Air collected and analyzed from downtown Miami and the Everglades National Park and found that 75% of ethanol in Miami's urban air came from manmade biofuels, while the majority of ethanol in the Everglades air was emitted from plants, even though a small quantity of city pollution from a nearby road floats into the park. Credit: UM/RSMAS

(PhysOrg.com) -- Scientists at the University of Miami Rosenstiel School of Marine & Atmospheric Science have discovered a technique to track urban atmospheric plumes thanks to a unique isotopic signature found in vehicle emissions.

Brian Giebel, a Marine and Atmospheric Chemistry graduate student working with Drs. Daniel Riemer and Peter Swart discovered that ethanol mixed in vehicle fuel is not completely burned, and that ethanol released in the engine's exhaust has a higher 13C to 12C ratio when compared to natural emissions from most living plants. In other words, the corn and sugarcane used to make biofuels impart a unique chemical signature that is related to the way these plants photosynthesize their nutrients.

The team suggests that ethanol's unique chemical signature can be used during aircraft sampling campaigns to identify and track plumes as they drift away from urban areas. The results of their efforts, titled "New Insights to the Use of Ethanol in Automotive Fuels: A Stable Isotopic Tracer for Fossil- and Bio-Fuel Combustion Inputs to the Atmosphere" appears in the journal, Environmental Science & Technology.

Giebel collected and analyzed air from downtown Miami and the Everglades National Park and found that 75% of ethanol in Miami's urban air came from manmade biofuels, while the majority of ethanol in the Everglades air was emitted from plants, even though a small quantity of city pollution from a nearby road floats into the park.

Air samples from the two locations were subjected to a precise scientific process, first separating the elements using gas chromatography, and then burning each component. The resulting carbon dioxide was put through a mass spectrometer, where the researchers were able to measure the abundance of each carbon isotope.

"According to global emissions estimates, plants release three times as much ethanol as manmade sources," said Giebel. "However, if the amount of ethanol used in our fuel continues to increase, vehicle emissions should eventually exceed natural emissions. This is particularly critical in urban areas because the majority of ethanol in the atmosphere is converted to acetaldehyde, which is highly reactive and considered to be a toxin detrimental to human health."

Provided by University of Miami Rosenstiel School of Marine & Atmospheric Science