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VOC emissions of light duty vehicles in Mexico City

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Vehicles are the major source of volatile organic compounds (VOC), which are the main precursors of tropospheric ozone. This atmospheric pollutant exceeds the national air quality standard more than 200 days every year, representing an important threat to health; additionally ozone has been classified among the short lived climatic pollutants due to its short stay in the atmosphere, thus, its reduction is an important target to face global climatic change. From the last year, Mexico opened the border for the introduction of gasolines from other countries, mainly from the US, then multiple additives with variable oxygenated and volatile compounds are expended, and PEMEX (the Mexican governmental petrochemical) became only another gasoline supplier, thus, the gasoline emission profiles determined several years ago are no longer the same, consequently the potential ozone formation from the emissions has changed.
In this research, sampling campaigns were developed in two tunnels of Mexico City to determine VOC emission profiles from duty gasoline vehicles as well as the potential ozone formation of the photochemical mixture after the gasoline changes in Mexico.
VOC in the ambient air and in the tunnels were collected with stainless steel Summa canisters during two hours at peak times. Samples were analyzed employing a gas chromatographic system (HP 6890) coupled with a flame ionization detector (GC/FID) to identify the individual VOC. A certified VOC mixture standard, diluted with ultra-high purity nitrogen was used for calibration. 64 VOC were identified and quantified.
The most abundant VOC were propane and butanes in the ambient air and the tunnel, which is related to the residential use of liquefied petroleum gas (LP gas). Other abundant compounds were acetylene accounting around 10%, since is a gasoline emission marker, followed by toluene and xylenes which are used for increasing octane number in fuels. Saturated hydrocarbons accounted around 50%, olefins with around 20% and aromatics with around 16%. Branched alkanes have increased their contribution since 2005 due to them are included also for octane number increasing; the benzene content with around 2% is worrisome by its negative health implications. Xylenes, ethylene, propylene and toluene were the major contributors to potential photochemical ozone formation. The identification of main VOC emitted by gasoline duty vehicles is useful to determine the presence of most photochemical reaction species and could be applied for dispersion photochemical models. As the changing in gasoline types is beginning in the country, more studies like this will be necessary to have a better knowledge about the impact of different types of gasolines that use several oxygenated compounds, other VOC, such as carbonyls which are highly reactive should be measured also.