Quantum Analytical Services Inc.

Technical Note: 105

Analysis of Sulfur Compounds

SCAQMD Method 307-91

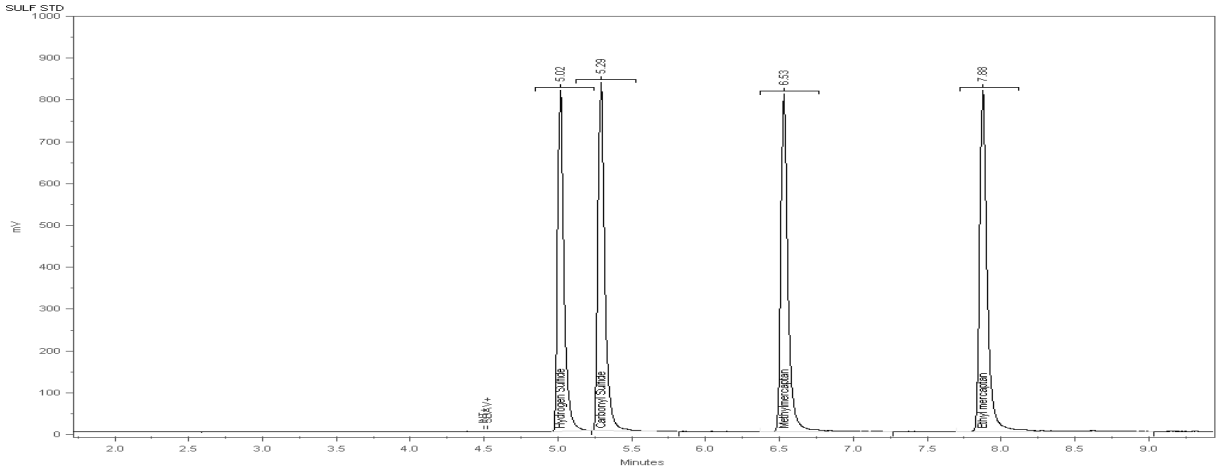
Applications

Refinery gas ***Flare gases***
Natural Gas ***Sulfur recovery Plants***
Sulfur in Fuel ***Hydrogen Production Plants***

Sulfur compounds are present in both oxidized and reduced forms, with oxidation state range from -2 to +6. Reduced sulfur compounds, once emitted into the atmosphere, are oxidized primarily to SO_2 (oxidation state +4). Emissions of sulfur dioxide are mainly anthropogenic, primarily from the combustion of fossil fuels that contain 0.05 to 0.14 % by weight. Once released into the atmosphere, SO_2 is converted into sulfuric acid in the presence of oxidants such as OH radical. The resulting acidic precipitation in the form of rain, fog, or mist has long been implicated in forest decline, and soil acidification resulting in release of toxic metals from soil into lakes and streams. In addition, acidic aerosols have adverse human health effect especially on the elderly and children. In the presence of ammonia (NH_3), sulfuric acid is neutralized to ammonium sulfate $(NH_4)_2SO_4$ that is responsible for the haze or the smog in the urban areas such as Los Angeles Basin.

Analysis of sulfur compounds is a challenge to analytical chemist because their affinity to metal surfaces. Sulfur compounds are not stable in metal containers such as Summa canisters, thus they are sampled in Tedlar bags or silica lined containers. Gas chromatography coupled with a flame photometric detector (FPD) has been used for the analysis sulfur compounds. However, the FPD is not linear in the presence of hydrocarbons and will result in negative interferences.

A new generation of detectors, including the sulfur chemiluminescence detector (SCD) and atomic emission detector (AED), have been used for the analysis of sulfur compounds. The SCD is very sensitive, has a wide linear range, and exhibits an equivalent response to mercaptans, hydrogen sulfide, carbonyl sulfide and sulfur dioxide. Reduced sulfur compounds and SO_2 are separated by gas chromatography. These compounds are then combusted under hydrogen-rich flare conditions to yield sulfur monoxide and other products. The sulfur monoxide is reacted with ozone to yield sulfur dioxide, oxygen and light. The light is detected with a photomultiplier and the response is calibrated against previously run standards. For more information about sulfur analysis, please contact Dr. Andrew Kitto.



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