

IMPLEMENTATION OF CH₄ (METHANE) RAMAN LIDAR DETECTION SYSTEM FROM ANTHROPIC SOURCES

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Keywords

CH₄, LidarRaman, Remote Sensing, Biomass Burning, Green House Gases

Impact statement

Innovative technology that studies the presence of various compounds of interest, like fugitive emissions, allowing further development in the study of pollutants dispersion and interactions between different chemical species under different climatic conditions.

Highlights

Methane remote sensing monitoring.

System that will assist and identifying methane sources.

The Raman technique provides the development of a less complex and lower value-added system.

The use of CRDS for CH₄ primary characterization in the metropolitan region of São Paulo was enriching, guiding the acquisitions and supporting its quantification.

Abstract

Fugitive emissions, defined as unintended or irregular leaks of gases and vapors, are an important source of air pollution that is difficult to monitor and control. Within industrial facilities such as oil and gas processing plants, fugitive methane emissions can be a significant source of greenhouse gas emissions. In Brazil, as in other countries, there are specific regions with high concentration of industrial activities, and showing high population density. These sites, including megacities like São Paulo, are growing in size and economic activity. At the same time, there is a remarkable growth in concerns about the environmental issues associated with these activities. In a constantly changing world, with increasing concentrations of greenhouse gases (GHGs), among them methane (CH₄) and volatile organic compounds (VOC), mitigation of atmospheric emission these gases to contain global warming, is of key concern, gas data suggest that fugitive emissions accounted for more than 5% of global greenhouse gas emissions over the past 5 years. Optical remote sensing techniques as lidar can attend the need for real time and trustable information on fugitive emissions. These techniques are non-intrusive, of relative simple construction, thus demanding less maintenance, and are able to provide data from distant locations with a high spatial resolution, typically up to 20 km from the measuring local, and 3 to 4 m long segments. Besides, information on different pollutants can be obtained simultaneously by adequate optical arrangements and data treatment methods. The technique can supply adequate information at lower costs and less effort than other techniques. The Cavity Ringdown Laser Spectroscopy (CRDS) technique was adopted because it is widely used in the detection of gas samples that absorb light at specific wavelengths and also for their ability to detect mole fractions up to the parts per trillion level. The correlation of the data between the techniques of real-time detection becomes interesting, since practical operations, fast and with a high level of sensitivity and precision are made. The mixing ratio of CH₄ can be observed within the planetary boundary layer. The measured methane profiles correlate with the acquisitions made with the CRDS, however, an additional contribution of control data in which the Raman lines detect with high sensitivity.