DEVELOPMENT OF A RAMAN LIDAR SYSTEM FOR AEROSOL AND METHANE MONITORING EMISSIONS OF INDUSTRIAL FLARES

Fábio J. S. Lopes[1], Eduardo Landulfo[2], Carla C. Kato[3], Roberto Guardani[4]

[1] Department of Environmental Sciences, Institute of Environmental, Chemical and Pharmaceutical Sciences (ICAQF), Federal University of São Paulo (UNIFESP), Campus Diadema, São Paulo, Brazil.

[2] Center for Lasers and Applications (CELAP), Institute of Energy and Nuclear Research (IPEN), São Paulo, Brazil

[3] Ouronova Soluções Inovadoras, Rio de Janeiro, Brazil

[4] Department of Chemical Engineering, Escola Politécnica, University of São Paulo - USP, São Paulo, Brazil

Contact: fjslopes@unifesp.br

Abstract

Recent studies indicate that human-induced emissions of non-CO2 greenhouse gases (GHGs), particularly methane (CH4) and nitrous oxide (N2O) from agricultural activities, constitute a progressively larger share of total GHG emissions, even in the presence of stringent mitigation measures. These findings underscore the possibility that the objectives outlined in the Paris Agreement, aimed at limiting the global temperature rise to 1.5 to 2°C, may prove challenging to achieve. Within the framework of GHG reduction strategies, an additional obstacle emerges in effectively monitoring CH4 emissions from flares employed in the fossil fuel industry. Studies reveal that due to the low burning efficiency of flares, approximately 90% of methane destruction is achieved. This inefficiency translates to an estimated 4 to 10% increase in methane emissions beyond the projections, particularly noteworthy in the context of the United States. To establish a robust mitigation process for methane and greenhouse gas (GHG) emissions, the implementation of an efficient emissions monitoring system is imperative. Addressing this need, the Flare And Methane Emission System (FAMES) project is currently in progress, aiming to monitor greenhouse gas and particulate matter emissions in flares installed on FPSO (Floating Production, Storage, and Offloading) platforms. This is achieved through the utilization of a Rayleigh-Mie and Raman scattering lidar system. The primary objective of the FAMES project is to provide near-real-time monitoring of the optical properties of particulate matter and GHGs such as methane and CO2. This allows for the estimation of methane concentration, contributing to the optimization of the burning process and facilitating an assessment of operational processes in industrial production lines. In this work we intend to present the development of the conceptual design and initial quality tests of the lidar system.

Keywords: Raman Lidar; Methane; aerosol.

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