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FLUOROMETRIC METHOD FOR THE DETERMINATION OF GAS-PHASE HYDROGEN PEROXIDE

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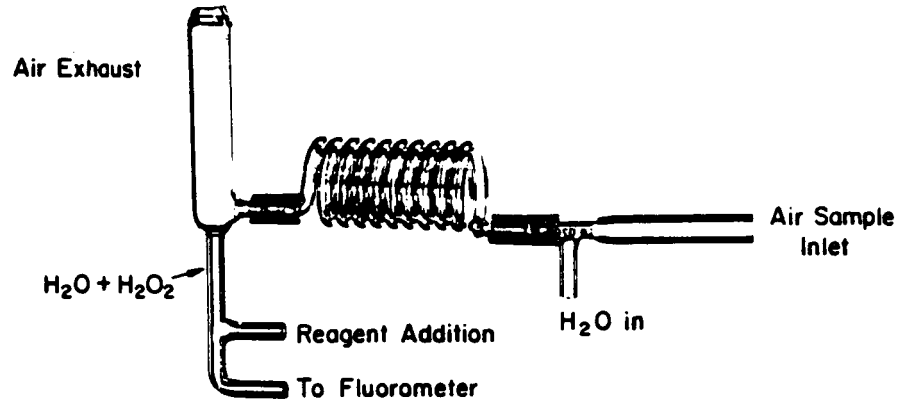
The fluorometric gas-phase hydrogen peroxide procedure is based on the technique used by Lazrus et. al. (1) for the determination of H_2O_2 in the liquid phase. The analytical method utilizes the reaction of H_2O_2 with horseradish peroxidase and p-hydroxphenylacetic acid (POPHA) to form the fluorescent dimer of POPHA. The analytical reaction responds stoichiometrically to both H_2O_2 and some organic hydroperoxides. To discriminate H_2O_2 from organic hydroperoxides, catalase is used to preferentially destroy H_2O_2. Using a dual-channel flow system the H_2O_2 concentration is determined by difference.

For the determination of H_2O_2 in the gas-phase, the liquid-phase analytical procedure is used with an inlet system which concentrates H_2O_2 in the aqueous phase. The following figure details the inlet system.



Sample air at 2 slpm along with .042 ml/min of aqueous solution is drawn through the scrubbing coil. The H_2O_2 is extracted into solution and analyzed directly using the fluorometric procedure. The detection limit for gas-phase H_2O_2 is better than 50 pptv. The system has been tested for potentially interferring species commonly found in the atmosphere. Minor interferences from sulfur dioxide (SO_2) and ozone (O_3) are observed. Sulfur dioxide gives an interference at a level of 1% of the H_2O_2 signal for each 10 ppbv of SO_2. The O_3 interference generates a H_2O_2 signal equivalent of 30 pptv for each 100 ppbv of O_3.

The gas-phase analytical system has been used on a number of ground and aircraft based field studies in the past year. Measured levels of H_2O_2 range from the detection limit to several ppbv.

[1]A. L. Lazrus, G. L. Kok, S. N. Gitlin, J. A. Lind, and S. E. McLaren, Analytical Chemistry 57, 917 (1985).

Comments

This instrument has received much flight time and appears capable of detection limits < 50 ppt with minimal interference (chief culprits are SO_2 and O_3). Future improvements include the inlet system, the response time, and the ability to separate H_2O_2 from RO_2H. A calibration between this instrument and the tunable-diode laser determination has been performed at the 3-5 ppb level, which was near the detection limit for the diode system. It was reported at the workshop that satisfactory agreement between the two instruments was observed. This is important in that the spectroscopic method is very specific for H_2O_2 but not as sensitive as the fluorometric method.