MEASUREMENTS OF ATMOSPHERIC POLLUTIONS BY THE DIFFERENTIAL ABSORPTION TECHNIQUE

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ABSTRACT

Using the differential absorption technique atmospheric NO_2 concentrations were investigated. The laser used in the set-up was a flashlamp pumped dye laser. Frequency narrowing and tuning was achieved by either a grating or an interference filter. NO_2 shows strong absorption between 4550 and 4700 Å, therefore 7-diethylamino-4-methyl-coumarin was used as the dye. The energy of the laser pulses was about 1 mJ with pulse duration of 300 nsec, and repetition rate of 1 Hz. The width of the spectral distribution of the laser was about 1 Å.

The output beam of the laser passes through a ten-fold beam expander giving a beam divergence of 10^{-4} radians, and is emitted along the axis of the receiving optics, so that the field of view of the receiver and the laser beam overlap independently of the distance.

The backscattered light is collected by a Cassegrain optics of 60 cm diameter and focussed onto the entrance slit of a monochromator with a concave holographic grating giving a linear dispersion of 70 Å/mm. Photon counting was used to measure the signal.

Quantitative results were obtained by tuning the laser to five wavelength positions between 4610 and 4680 Å. Concentration values of about 0.05 ppm were still detectable at distances of up to 4 km.

Using a TEA laser operating at various wavelengths in the infrared the measurements have also been extended to other pollutants besides NO_2.