Benzene Monitoring Using Laser Difference Frequency Spectroscopy

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There is considerable interest in the detection of volatile organic compounds (VOCs) in the atmosphere because of their atmospheric reactivity The need for identifying and quantifying VOCs levels in the atmosphere and industrial process control has led to the development of VOCs measurement techniques chromatography coupled with mass spectrometry, Fourier transform spectroscopy, and laser spectroscopy Laser absorption spectroscopy offers the advantage of highly selective in situ and real time measurements with detection sensitivities in the ppm to ppt range

In this paper the feasibility of benzene (C_6H_6) concentration measurements by using mid-infrared laser absorption spectroscopy is reported The spectrometer is based on laser difference-frequency generation (DFG) by mixing of two Ti Sapphire laser in a GaSe nonlinear crystal [1-2] The infrared radiation, with a output power in the range of some tens nW, was continuously tunable from 8 to 19 μm

A 10-liter glass flask was used for the preparation of benzene trace gas samples The flask was filled with ambient air at a pressure of ~250 mbar, and an accurately weighed sample of the liquid benzene contained in a microsyringe was injected into the flask The benzene gas mixture was then introduced into the absorption cell at a reduced pressure in the range of some tens mbar C_6H_6 absorption lines of the ν_4 R(6) and $\nu_4+\nu_{20}-\nu_{20}$ R(9) near 676 62 cm^{-1} were selected for the concentration measurements The signal-to-noise ratio of ~20 deduced from the spectroscopic measurement yields a minimum detectable path-integrated concentration of ~1 ppm-m

References

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