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Multi purpose air quality monitoring photoacoustic system for aerosol, NO_2 and ozone detection: laboratory and field test.

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During recent years, the possibility of man made changes of the atmosphere has raised increasing concerned. The well-known phenomena such as ozone-hole, greenhouse effect and the global climate change have shown that man's activities can cause significant effect not just on our present life quality but the next generation as well. Measuring the NO_2 and ozone concentration and determining the composition of the aerosols in the air is crucial in further investigation of these effects.

The requirements of an instrument suited for atmospheric monitoring are as follows: high sensitivity, high selectivity, fast response time, mobility.

Presently, various method are utilised for NO_2, ozone and aerosol monitoring, but none of them fulfil all these requirements stated above. For measuring NO_2, ozone and the aerosol simultaneously, in this work, we are demonstrating a multi-purpose three wavelength photoacoustic system (MUWAPAS) based on the diode laser pumped, high repetition rate, Q-switched Nd:YAG laser and its frequency converted high harmonics.

This system is proved to be very promising, providing the detection limit in the order of $1\mu g/m^3$ in aerosol, in ppm range for ozone and in ppb range in NO_2 concentration, a time resolution below one minute, insensitivity of scattering particles as well as relatively small dimension of the portable developed system. It is designed to make an *in situ* measurement at three wavelengths (1064nm, 532nm and 266nm) simulta-

neously. The three wavelengths are generated via frequency doubling (532nm) and quadrupling (266nm) of the fundamentals of Nd:YAG laser (1064nm) by means of nonlinear crystals (LBO, BBO). The retrieval wavelength (266nm) for ozone concentration relies on ozone is being the primary absorber of ultraviolet radiation in the region of the Hartley band (200-300nm). The wavelength gap and the different absorption coefficient between these three wavelengths are sufficient to take distinction between the main carbonaceous fractions: organic carbon (OC), Black or elemental carbon (BC or EC) and inorganic carbon (e.g. carbonates). The present system was successfully tested and compared with a large set of recently developed or common instrumentation both under the laboratory and field circumstances. The results of these studies indicate that this sensor has the potential to characterise different minerals (Illit, Kaolinate, Hematite), different type of dust and make the difference between soot arises from traffic and from domestic wood burning.

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