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## **A three-channel thermal dissociation cavity ring-down spectrometer for the continuous measurement of ambient NO<sub>2</sub>, total peroxy nitrates and total alkyl nitrates**

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A newly constructed thermal dissociation cavity ring-down spectrometer (TD-CRDS) for simultaneous measuring NO<sub>2</sub>, total peroxy nitrates (ΣPNs) and total alkyl nitrates (ΣANs) was presented. NO<sub>2</sub> is detected directly at around 405.46 nm, ΣPNs and ΣANs are detected as NO<sub>2</sub> after thermal decomposition at 180 °C and 360 °C. The influences of the recombination reaction of RO<sub>2</sub> radicals in two different types of heated inlets were discussed and compared, and the thermal decomposition efficiency of PNs was found to be higher with the value of 96% at the heated inlet filled with glass beads than the other (72%). Possible interferences, mainly O<sub>3</sub> (including reactions of O<sub>3</sub> via NO and O<sub>3</sub> via NO<sub>2</sub>) and NO<sub>x</sub> (such as the recombination reactions of NO<sub>x</sub> and peroxy radicals at different thermal temperatures), were quantitatively characterised. The effects were found to be much weaker in the heated inlet filled with glass beads. Thus, a calibration method for measuring ΣPNs and ΣANs was established, especially to solve the accurate measurement of ΣPNs and ΣANs under high amounts of ambient NO<sub>x</sub> and O<sub>3</sub> in China. At the time resolution of 20 s, the detection limits of the TD-CRDS instrument for NO<sub>2</sub>, ΣPNs and ΣANs are 6 pptv (1σ), 15 pptv (1σ) and 15 pptv (1σ), respectively. Finally, we applied the instrument to the Hefei field campaign, obtaining the concentration distribution and variation characteristics of ΣPNs and ΣANs.