

CAVITY RING-DOWN SPECTROMETER FOR NITRIC OXIDE AND S-NITROSOCOMPOUNDS DETECTION

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S-nitrosocompounds have received much attention in biological research [1,2] and determination of S-nitrosylated proteins is of great importance for fundamental biological research and medical applications. Here we report development of a continuous-wave cavity ring-down (cw-CRD) spectrometer in mid-IR range ($\sim 5.2 \mu$) for nitric oxide (NO) and S-nitrosocompounds detection [3].

Cavity ring-down spectroscopy (CRDS) has been demonstrated to be a powerful method of trace gas detection with ultra high sensitivity and specificity. The CRDS technique determines the optical absorption of a sample contained inside a low-loss optical cavity from an increase in the decay ("ring-down") rate of light leaking through the cavity as it travels between highly reflective mirrors (with reflectivity $R > 99.9\%$). Use of low loss and, therefore, high finesse cavities allows an increase in the effective pathlength of light in the sample up to several kilometers. It is important to note that intensity fluctuations of the light source do not influence measurement accuracy since changes in the decay lifetime of light in the ring-down cavity (rather than changes in light intensity) are measured.

We demonstrated sensitivity down to ~ 2 pmol of S-¹⁴NO groups (Fig.1) and ~ 5 pmol of S-¹⁵NO groups (Fig.2) for S-nitrosocompounds in aqueous solutions. We have found that quantitative measurements are possible only in a flow mode. The dynamic range of S-nitrosothiols measurements reaches 3 orders of magnitude and extends from pico- to nanomoles. The advantages of the proposed method to assay S-nitrosylated proteins are: 1) high sensitivity and large dynamic range; 2) ability to detect and metabolically track ¹⁵N-labeled S-nitrosothiols in cells and organisms.

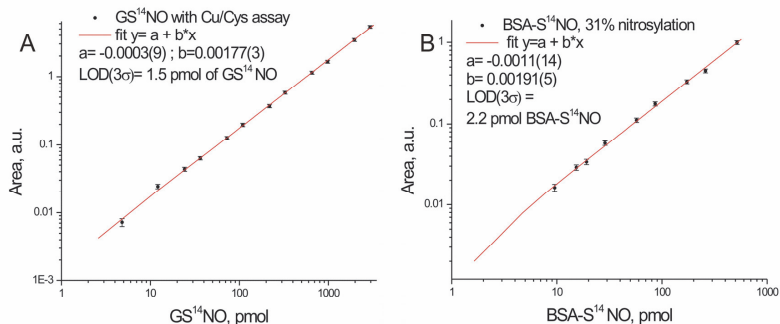


Figure 1. Limit of GS¹⁴NO (A) and BSA-S¹⁴NO (B) detection using CRDS-technique. Carrier gas flow 116 sccm, pressure – 20 torr.

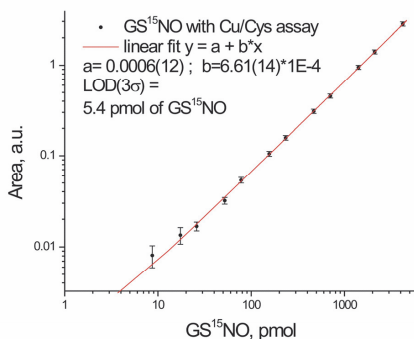


Figure 2. Limit of GS¹⁵NO detection using CRDS technique. Carrier gas flow 116 sccm, pressure – 20 torr. Laser was locked to the ¹⁵NO transition at 1899.4 cm⁻¹.

References

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2. Mayer, B.; Pfeiffer, S.; Schrammel, A.; Koesling, D.; Schmidt, K.; Brunner, F. *J Biol Chem.* – 1998. – V. 273, – P. 3264-3270.
3. [Stsiapura, V. I., Shuali, V. K., Gaston, B. M., Lehmann, K. K. *Analyt Chem*, 2015. – V. 87, – P. 3345-3353.