

---

# BROADBAND CAVITY ENHANCED ABSORPTION SPECTROSCOPY A NOVEL DETECTOR FOR HPLC

L. Nitin Seetohul, Meez Islam and Zulfiquir Ali

School of Science and Technology, Teesside University, Borough Road, Middlesbrough TS1  
3BA, UK

Optical cavity methods are becoming more widely used as sensitive methods of absorbance measurements. The present work reports the first demonstration of a cavity enhanced absorption spectroscopy (CEAS) based technique applied to HPLC detection. Broadband cavity enhanced absorption spectroscopy (BBCEAS) has been used for detection in a HPLC system (HPLC-BBCEAS). The method relies on light being confined between two highly reflective mirrors, thereby resulting in the base path length being increased by many orders of magnitude. The methodology for the measurement of the absorption spectrum required a simple calibration and is conceptually similar to standard UV-visible absorption spectroscopy. Experiments were carried out on liquid-phase analytes in a conventional HPLC quartz cell placed at normal incidence to cavity mirrors. Measurements were made between 450 and 600 nm on two chemically similar species (rhodamine 6G and rhodamine B) with distinctive visible spectra and that co-elutes in an isocratic separation.

The sensitivity of the measurements as determined by the minimum detectable change in the absorption coefficient,  $\alpha_{\min}$ , were  $2.9 \times 10^{-5} \text{ cm}^{-1}$  at 527 nm and  $1.9 \times 10^{-5} \text{ cm}^{-1}$  at 556 nm, the peak absorption wavelengths of rhodamine 6G and rhodamine B, respectively. The limits of detection (LOD) for the two dyes were 426 and 271 pM respectively. The LOD of the HPLC-BBCEAS setup was found to be 77 times lower than a Perkin Elmer HPLC (series 200) comprising a 200EP photodiode array detector. The sensitivity compared favourably with previous single wavelength HPLC-CRDS studies whilst using a considerably lower cost experimental setup and simpler experimental methodology. We also show that our approach allows the discrimination of nearly co-eluting substances with isocratic HPLC separation.