

## Application of lab-on-a-chip Surface Enhanced Raman Spectroscopy (LOC-SERS) in Detection of Biologically Relevant Molecules

Izabella Hidi<sup>1</sup>, Dana Cialla<sup>1,2</sup>, Thomas Henkel<sup>2</sup>, Karina Weber<sup>1,2</sup>, Jürgen Popp<sup>1,2</sup>

<sup>1</sup>Friedrich Schiller University Jena, Institute of Physical Chemistry and Abbe Center of Photonics, Helmholtzweg 4, 07745 Jena, Germany

<sup>2</sup>Institute of Photonic Technology Jena, Albert-Einstein-Str. 9, 07745 Jena, Germany

In 2012, 463000 new cases of breast cancer and 131000 mortality cases due to the same disease were recorded just within Europe [1]. This high number of incidence requires optimized therapies in order to achieve the highest effectiveness with, at the same time, safe dosage of the administered drugs. Therefore, a fast and robust method for online monitoring of the drug concentration in body fluids is required.

Anthracyclines are a class of chemotherapy drugs with broad activity against a wide range of tumors, including breast and lung cancer. They inhibit DNA and RNA synthesis by intercalating between base pairs of the DNA/RNA strand, thus preventing the replication of rapidly-growing cancer cells [2]. There are several derivatives of this class, among which, epirubicin (EPI) proved to show the highest effectiveness with the lowest toxicity [3].

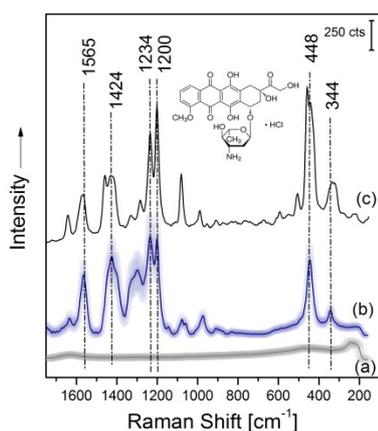


Fig. 1 Mean SERS spectra and double standard deviation of (a) KCl activated Ag colloid and (b) EPI aqueous solution of  $3 \cdot 10^{-5} \text{ M}$ ; (c) Raman spectrum of epi powder.

Within this contribution we present the determination of EPI by means of SERS combined with droplet based microfluidics. Therefore, in addition to the high sensitivity and specificity of SERS, high sample throughput and minimum sample requirement is also achieved. The microfluidic platform consists of a glass chip with six injection ports [4-5]. As SERS substrate Ag colloids prepared by the Lee-Meisel method [6] activated by 1M KCl were used. The aqueous mixture of analyte/colloid formed droplets within the continuous flow of mineral oil. Stem solutions of epirubicin of  $10^{-4} - 10^{-5} \text{ M}$  were supplied through one of the ports. The concentration gradients were achieved by varying the applied flow rates; at this time a detection limit of  $6 \cdot 10^{-6} \text{ M}$  is achieved.

### Acknowledgements

The funding of the PhD project of Izabella Hidi within the framework “Carl-Zeiss-Strukturmaßnahme” is gratefully acknowledged. The projects “QuantiSERS” and “Jenaer Biochip Initiative 2.0” within the framework “InnoProfile Transfer – Unternehmen Region” are supported by the Federal Ministry of Education and Research, Germany (BMBF).

### References:

- [1] J. Ferlaya et al., *Eur J Cancer*. **49**, 1374–1403 (2013).
- [2] G. Smulevich et al., *J Raman Spectrosc.* **32**, 565–578 (2001).
- [3] G. Zago et al., *J Chromatogr B*. **764**, 161–171 (2001).
- [4] A. März et al., *Anal Chem*. **83(21)**, 8337–8340 (2011).
- [5] A. März et al., *Anal Bioanal Chem*. **400(9)**, 2755–2761 (2011).
- [6] P. C. Lee, D. Meisel, *J Phys Chem*. **86**, 3391–3395 (1982).