

Raman Spectroscopic Identification of Pathogens – A cultivation-free Approach

Petra Rösch¹, Stephan Stöckel¹, Susann Meisel¹, Sandra Kloß¹, Ute Münchberg¹,
Dragana Kusić¹, Vinay Kumar¹, Bernd Kampe¹, Jürgen Popp^{1,2}

¹) Institute of Physical Chemistry, Friedrich-Schiller-Universität Jena, Helmholtzweg 4,
D-07743 Jena, Germany.

²) Institute of Photonic Technology Jena, Albert-Einstein-Straße 9, D-07745 Jena, Germany

The fast monitoring of pathogens is not only crucial for medical diagnosis but also in the field of pharmaceutical or food processing technologies. Applying Raman microspectroscopy allows analyzing single bacterial cells and has therefore a time advantage over various cultivation based techniques.

Nevertheless, for a cultivation-free Raman spectroscopic identification destruction-free isolation techniques are mandatory. In addition, the chemical alteration of the bacterial cells correlated to the isolation procedure has to be kept to an absolute minimum in order to omit spectroscopic artifacts. [1]

Depending of the sample composition the isolation techniques have to be adapted carefully. For powder material, density centrifugation is the most appropriate isolation technique. [2,3] Beside such physical separation methods also the sample matrix can be altered, e.g. in combination with an inactivation process. [4] For more heterogeneous samples like e.g. meat a combination of different techniques might be necessary. [5] In total the method should enable the identification of pathogens within the first few hours.

Acknowledgement

Financial support of the Federal Ministry of Education and Research, Germany (BMBF) (Projects: 13N11168, 13N11350) and the German Science Foundation (JSMC; Graduate School 1257/2 “Alteration and element mobility at the microbe-mineral interface”) are greatly acknowledged.

References:

- [1] S. Meisel, S. Stöckel, M. Elschner, P. Rösch and J. Popp, *Analyst* **136**, 4997-5005 (2011).
- [2] S. Stöckel, S. Meisel, M. Elschner, P. Rösch and J. Popp, *Anal. Chem.* **84**, 9873–9880, (2012).
- [3] S. Stöckel, S. Meisel, M. Elschner, P. Rösch and J. Popp, *Angew. Chem. Int. Ed.* **51**, 5339-5342, (2012).
- [4] S. Meisel, S. Stöckel, M. Elschner, F. Melzer, P. Rösch and J. Popp, *Appl. Environ. Microbiol.* **78**, 5575-5583, (2012).
- [5] S. Meisel, S. Stöckel, P. Rösch and J. Popp, *Food Microbiol.* 10.1016/j.fm.2013.08.007.