

## *Micro-Raman spectroscopic identification of single bacteria from clean room production*

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Microbial contamination is not only a medical problem, but also plays a large role in pharmaceutical production and food processing technology. For all these fields a fast and non-ambiguous identification of pathogenic and non-pathogenic microorganisms is required. Most of the hitherto applied identification methods are based on the microorganism's ability to grow in various media or the fermentation of different substances. Depending on the type of bacteria the identification process may take at least one day and generally much longer. [1] In order to shorten the identification time new analytical methods need to be developed. The analysis of microorganisms by means of vibrational spectroscopic techniques (IR and Raman spectroscopy) has a long tradition, since the vibrational spectrum displays a fingerprint of the chemical composition of each bacterium. While an IR spectroscopical investigation of microorganisms requires a large amount of cells and a drying step, this is not necessary when applying Raman spectroscopy. [2]

In this contribution we describe a technique for fast detection of biological contamination in clean room production. The particles from clean room environment are deposited on a target where the identification of the isolated particles can be performed. Only a small percentage of all particles is of biological origin (approx. 1 of 300 particles). Therefore a pre-selection is carried out by taking advantage of the fact that inorganic or polymer particles show a different fluorescence behavior than microorganisms. After presorting the remaining particles are automatically analyzed with micro-Raman spectroscopy and then identified with the help of a SVM algorithm.

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### **References**

1. S. F. Al-Khaldi, M. M. Mossoba, *Nutrition* **2004**, *20*, 32-38.
2. D. Naumann, D. Helm, H. Labischinski, P. Giesbrecht, in *Modern techniques for rapid microbiological analysis* (Ed.: W. H. Nelson), VCH Publisher, New York, 1991, p. 43-96.