The effect of storage materials on the identification results of bacteria by means of Raman spectroscopy

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The Raman spectrum of a microorganism is given by the sum of the Raman spectra of different cell components. Therefore, the obtained spectrum profile will be dependent on the amount of the various substances presented in cells. The variation in the biochemical composition of different species or strains enables the identification of these microbes by means of Raman spectroscopy. Since numerous bacteria can produce and accumulate in the cells important amounts of storage materials, it is expected that the Raman spectra of these bacteria to be severely influenced by the presence of the storage materials. Therefore, an important question is, if this storage material will impede the spectroscopic identification.

A number of microorganisms are able to produce polyhydroxyalkanoates (PHA) as carbon and energy storage materials but also as an electron sink, usually under conditions of limiting nutrients. From the PHA class, poly(3-hydroxybutyrate) (PHB) is the simplest and the most common member. High amounts of these polymers were detected in some bacteria, even a PHB concentration in microorganisms up to 80% of the dry weight was reported[1]. It is likely that the Raman spectrum of the microorganisms will be dominated by the polymer signals at such concentration of PHB in cells which might impede the identification and differentiation of cells. Therefore, a study focused on the PHB effect on microbial identification using Raman spectroscopy is required. The goal of this research was to find the limits of the applicability of Raman spectroscopy in bacterial identification field, generated by the presence of storage materials in cells.

Five bacteria species were used for this experiment. The classification and identification of the Raman spectra was performed with Support Vector Machine (SVM). The outcome shows that single cell bacterial identification by means of Raman spectroscopy is achievable even if the microorganisms present various storage materials within the cell[2]. However, in some extreme cases, we were not able to identify the microorganisms using Raman spectroscopy.

References
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