Characterization of intact cell microorganisms by MALDI-QTOF mass spectrometry

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Abstract:

The purpose of this work is to development a rapid and sensitive method to determinate bacteria using mass spectrometry (MS). **Method** For the study of intact cell microorganisms by MALDI-QTOF-MS, six bacteria from different strains were selected: *Staphylococcus aureus* (ATCC 06538), *Staphylococcus epidermidis* (ATCC 12228), *Escherichia coli* (ATCC 11775), *Pseudomonas aeruginosa* (ATCC 0927), *Pseudomonas fluorescens* (ATCC 13525) and *Micrococcus luteus* (ATCC 00147). Those microorganisms were cultured on Nutrient Agar medium plates during 24 h at 30ºC. After approximately 10 mg of several colonies of bacteria were colleted and placed in microcentrifuge tubes. Two methods for sample analysis were investigated. First method, a small quantity of cells was deposited on sample spots of MALDI stainless-steel plate, followed by application of the matrix on top of the cells. Second method the bacterial cells were washed with a 0.1% trifluoroacetic acid (TFA). The pellet of bacteria was resuspended in the same solvent and then mixed with a matrix solution and spotted onto target plates. **Results** The first part of the work consisted of a comparison between the two sample preparations methods presented. MALDI-QTOF mass spectra of spots prepared by both approaches demonstrated the presence of many ions derived from the bacterial cells, with m/z values spread along the selected mass range. However, analysis of samples in which cells were directly spotted onto the MALDI target plate gave a lower signal-to-noise ratio when compared with samples in which bacterial cells were washed with 0.1% TFA. As a result, a greater number of peaks was observed on mass spectra obtained when cells were solvent-treated with 0.1% TFA prior to being spotted onto target plates. Each sample preparation method was tested with two matrix compounds, DHB and SA. Best results were obtained when SA was employed as matrix, for which respective mass spectra had a higher signal-to-noise ratio. **Conclusions** This work demonstrates a rapid and reproducible method for analysing bacterial cells by MALDI-QTOF mass spectrometry after simple sample preparation methods. This approach is expected to be more straightforward than the more rigorous approaches used to determine the presence of bacteria in many different of samples, as well as allow distinction between species based on mass spectral data.

Key words: Mass Spectrometry, Intact Cell Microorganisms, MALDI-QTOF