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Identification of foodborne bacteria using mid infrared spectroscopy

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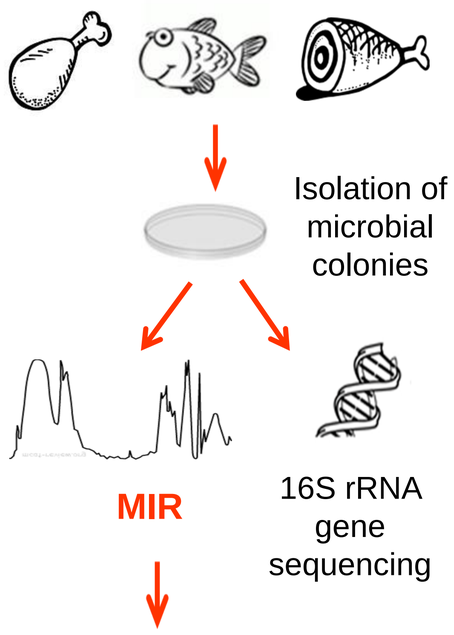
BACKGROUND

The accurate and reliable detection and identification of microorganisms in food is critical to public safety, as the microbial growth and metabolism in foods can result in foodborne diseases. It is extremely important to develop rapid and inexpensive methods for the detection of food microorganisms to replace traditional analysis methods that are expensive and time consuming.

Mid-infrared spectroscopy (MIR) is a powerful, inexpensive and fast tool for food quality analysis and control, being one of the most promising techniques for the food industry. It has been successfully used to study microorganisms, since each bacterial species has a complex cell membrane/wall composition which gives a unique spectral fingerprint. The analytical information of the spectra can be interpreted using multivariate analysis relating the spectra obtained with the properties of the object of study.
The aim of this work was to develop a rapid method to identify bacteria isolated from food samples (fish, meat and cooked ham), in order to replace the traditional microbiological methods. Multivariate techniques (PCA and HCA) were applied in order to assess the feasibility of using this approach to address the problem of bacterial identification.

METHODS



RESULTS

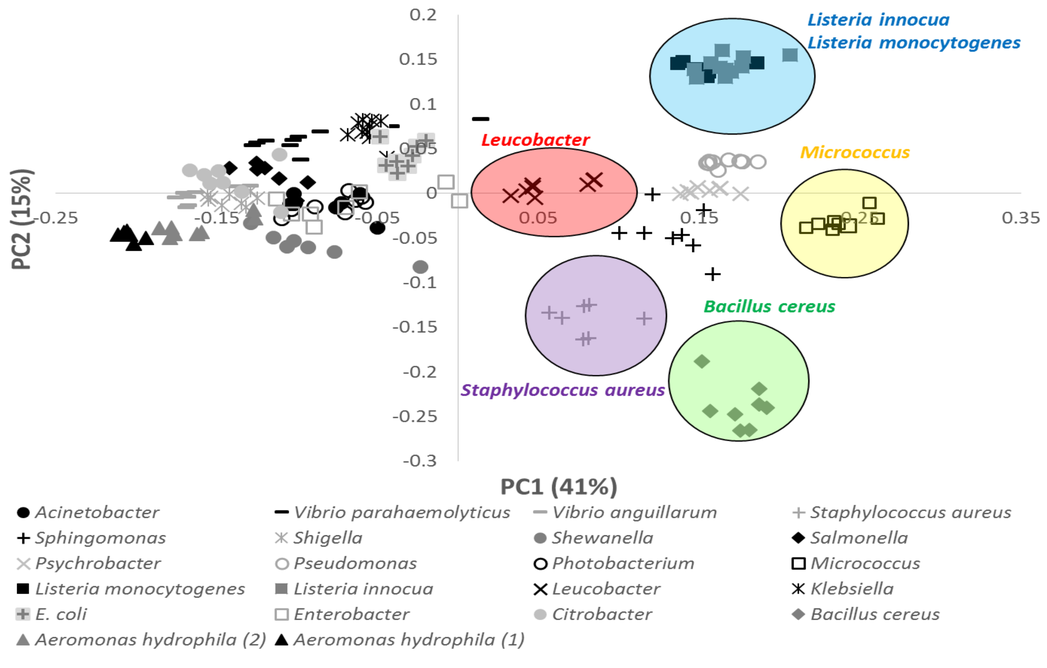


Fig. 1: Principal component analysis of the bacterial spectra in the region between 3000-2400 cm^{-1} and 1900-700 cm^{-1}

- MIR and multivariate analysis (PCA and HCA) allow the identification of foodborne bacteria after growth in solid media.

- All of the bacteria were well discriminated with these two techniques, with the exception of *Acinetobacter* and *Photobacterium* (Fig. 2). These two genera can be discriminated if another PCA is applied in other spectral region (data not shown).

- The more bacteria are involved, more challenging is the distinction with just one multivariate tool – necessity to use different approaches.

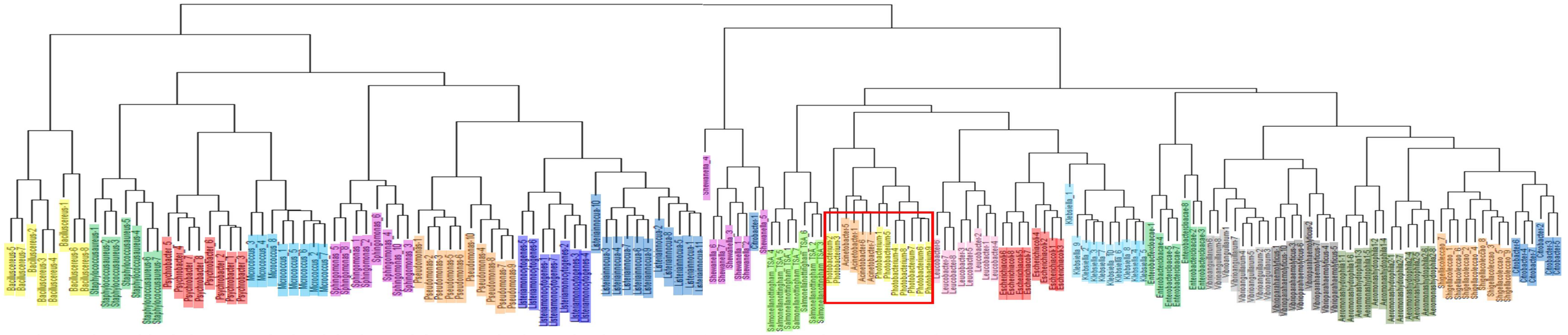


Fig. 2: Hierarchical cluster analysis of the bacterial spectra in the region between 3000-2400 cm^{-1} and 1900-700 cm^{-1}

CONCLUSIONS

MIR spectroscopy, in tandem with multivariate analysis tools, allows the identification of bacteria isolated from food samples, being a rapid, cost-effective and efficient technique.

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