

Extract of the paper “Preliminary assessment of VIS-NIR-SWIR spectroscopy with a portable instrument for the detection of *Staphylococcus aureus* biofilms on surfaces”

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Abstract

Bacterial biofilms constitute a major source of sanitary problems and economic losses in the food industry. Indeed, biofilm removal may require intense mechanical cleaning procedures or very high concentrations of disinfectants or both, which can be damaging to the environment and human health. This study assessed the efficacy of a technique based on spectroscopy in the visible, near-infrared, and short-wavelength infrared range for the quick detection of biofilms formed on polystyrene by the pathogenic bacterium *Staphylococcus aureus*. To do that, biofilms corresponding to three *S. aureus* strains, which differed in biofilm-forming ability and composition of the extracellular matrix, were allowed to develop for 5 or 24 h, representing an active formation stage and mature biofilms, respectively. Spectral analysis of the samples, corresponding to three biological replicates of each condition, was then performed by using a portable device. The results of these experiments showed that partial least squares discriminant analysis of the spectral profile could discriminate between surfaces containing attached bacterial biomass and non-inoculated ones. In this model, the two first principal components accounted for 39 and 19% of the variance and the estimated error rate stabilized after four components. Cross-validation accuracy of this assessment was 100%. This work lays the foundation for subsequent development of a spectroscopy-based protocol that allows biofilm detection on food industrial surfaces.

Highlights

- A biofilm detection spectroscopy-based technique with a portable device was tested.
- *Staphylococcus aureus* biofilms of different strengths were scanned with the device.
- Spectral data showed correlation with crystal violet staining quantification results.

- Data from spectral analysis was suitable for prediction of biofilm contamination.

Citation

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Keywords

Biofilms; Spectroscopy; Detection; Food industry

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