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O4.5 Rapid microbiological spoilage assessment of chilled chicken meat using non-invasive spectroscopic sensors

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Over the last two decades, there has been a surge of research interest on the rapid assessment of microbiological quality of poultry meat through the use of different spectroscopic sensors. The objective of this study was to evaluate the potential of Fourier-transform infrared and fluorescence spectroscopy in tandem with machine learning algorithms and multivariate data analysis to quantitatively assess chilled chicken spoilage. Chicken breast fillets were stored aerobically at 4°C and were periodically analyzed: a) microbiologically (n=6, three batches) for the enumeration of total viable counts (TVC), Pseudomonas spp., Brochothrix (B.) thermosphacta, lactic acid bacteria (LAB) and Enterobacteriaceae, and b) spectroscopically (n=18) with a Fourier transform infrared spectrometer (FTIR) and a hand-held fluorescence (FreshDetect) spectrometer for the collection of spectral data from the surface of chicken samples. Spectral analysis, model development and validation were performed through two machine learning algorithms, i.e. partial least squares regression (PLS-R) and support vector machines regression with radial basis function kernel (SVM-R). The developed PLS-R and SVM-R models were externally validated through independent- and intra-batch testing, respectively. The square of the correlation coefficient (R^2) and root mean squared error (RMSE) were employed for performance evaluation. In general, the SVM-R models based on spectral data from FTIR sensor exhibited better performance than the respective PLS-R models on the estimation of the different microbial groups. Moreover, the SVM-R models predicted more satisfactorily TVC (R^2 0.879, RMSE 0.607), followed by B. thermosphacta (R^2 0.873, RMSE 0.654) and Pseudomonas spp. (R^2 0.793, RMSE 0.855) populations than LAB (R^2 0.686, RMSE 0.649) and Enterobacteriaceae (R^2 0.477, RMSE 0.801). Conversely, the developed models based on data from FreshDetect achieved poor prediction performance, irrespective of the algorithm applied and microbial group examined. Results of the current study confirm the potential of FTIR coupled with SVM-R algorithm to be exploited for the fast and accurate assessment of chicken meat quality and suggest the need for further investigating of the suitability of the hand-held fluorescence (FreshDetect) device to predict microbial growth.

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