Rapid characterization of industry-type tomato using mid-infrared spectroscopy

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Rapid characterization of processed tomato purees using mid-infrared spectroscopy

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Improving quality control of processed tomato could lead to 1) enhance the raw tomato quality delivered to plants when price corrections according to quality level is adopted and 2) optimise the use of raw material by better adapting the processing routes to tomato characteristics, and obtaining the most suitable final product. Mid-infrared spectroscopy (ATR-FTIR) offers the advantages of analysing homogeneous plant materials such as liquids or purees, using a rapid and simple data acquisition, as soon as a calibration with reference measurements for traits of interest has been validated.

The objective of our study was to investigate the accuracy of the mid-infrared spectroscopy to predict internal quality traits in purees of processed tomatoes. In 2014, tomatoes were harvested at different ripening stages, from mid to overripe, in two production areas, south-west and south-east of France, and cultivated with different irrigation practices to take into account the representative fruit variability of tomato cultivated in France. Tomato purees were characterized by both infrared spectroscopy (4000-650 cm^{-1}) and by reference measurements. The potential of this method coupled with chemometrics based on partial least square (PLS) regressions was assessed for the determination of soluble solids content (SSC), titratable acidity (TA), dry matter, glucose, fructose, malic acid and citric acid. The performance of this method was evaluated by the coefficient of determination (R^2) and the root mean square error of prediction (RMSEP).

Mid-infrared spectroscopy showed a good ability to estimate not only soluble solids content (SSC) (error of 3.5%), titratable acidity (TA) (error of 4.4%) and dry matter (4.3%) but also individual sugars (glucose 4.7% and fructose 7%) and citric acid (7%). For malic acid, the high error of prediction (14%) was probably in relation with its low level in the studied tomatoes.
This trial has been repeated in 2015 in order to evaluate the effect of harvesting year on fruit quality and mid-infrared performance. In addition, this year, processed samples and new quality traits such as texture-related parameters of tomato purees have been added to the experimental design, in order to test the ability of mid-infrared spectroscopy to predict such quality parameters on processed products.

The infrared spectroscopy allows 1) a considerable reduction of time of analysis compared to the current methods, and 2) a more detailed prediction of parameters than only global measurements such as SSC or dry matter. As it is already the case for other food industries, we believe that mid-infrared spectroscopy and appropriate models specifically developed for processed tomatoes such as those developed in this study may play a role for the improvement of quality control in tomato industry.