

## Influencing wavelength comparison in pls models for the prediction of pork meat quality by VIS-NIRS (#613)

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### Introduction

For the needs of a running project dealing with hyperspectral imaging, we wanted to define the spectral range specifications of the device being built. The reference parameters we expect to predict on pork meat cover a wide diversity parameters: pH, drip loss, cooking yield and intramuscular fat. In previous studies focusing on VIS-NIRS (Visible and Near Infra Red Spectroscopy) prediction of the meat quality, we mainly used the 350-1800 nm spectral range of a Labspec4 spectrometer (ASDI). Because this spectral range seems to be too wide for a single ready-to-use hyperspectral camera, we decided to take another look on our previous NIRS studies and investigate which wavelength are the most predictive. The objective was to make a comparison of the influencing wavelength that are included in the PLS prediction equations, for each of the meat quality parameters we had studied.

### Methods

A spectrum data base was built with the help of 3 previous studies concerning the prediction of ham cooking yield (n=170, [1][3]), ultimate pH of the *Semimembranosus* (Sm) (n=155, [1][3]), drip loss of the *Sm* (n=45, [3]) and intra muscular fat (IMF) of the *Longissimus Thoracis* (LT) (n=100, [2]). Drip loss was determined according to EZ method [4] and IMF was obtained following free fat content analysis (NFV-04-403). Ham cooking yield was performed following "Jambon Cuit Superieur" standards [5]. The partial least-square (PLS) models developed previously were loaded in the Eigenvector PLS Toolbox 7.5 running on MATLAB 7.9.0 R2009b software. The determination of the most influencing wavelength was performed with the Selectivity Ratio procedure [6].

### Results

There is a strong gap in the selectivity ratio curves between the IMF prediction model and the other meat quality parameters models (figure 1). IMF selectivity ratio curve has 2 peaks from 950 nm to 1400 nm and from 1550 nm to 1700 nm. These peaks are in agreement with the spectral absorption of the C-H bonds of fatty acids [7]. For the other variables, 3 peaks could be reported but in the 600-1300 nm range. The visible part of peaks (600-800nm) is in accordance with the high correlation level found between the meat color and its ultimate pH and water holding capacity. As for the 1100 nm and 1300 nm peaks, it could be linked with a combination of absorption bands of water (O-H bond; 980 and 1450 nm) and proteins (stretching harmonics of N-H bond; 1350 to 1610 nm).

Three types of selectivity ratio curves can be distinguished in the 600-1300

nm range. Concerning the prediction of ultimate pH, the shape of the curves from 2 different studies [1][3] are very similar. This indicates a high level of robustness of the NIRS models. The same conclusion can be released regarding the influencing wavelength of the cooking yield models: the curves are different from the pH curves with a stronger peak in the visible spectrum (700 nm), but the shape is also highly repeatable between the 2 studies [1][3]. Finally, for the drip loss prediction we can notice that visible spectrum is less influencing the model than what we found for ultimate pH and cooking yield.

### Conclusion

The analysis of the most influencing wavelength of VIS-NIRS models previously developed gave us an overview of the spectral range involved in the prediction of the meat quality. For upcoming developments with hyperspectral imaging, we can conclude that we need to keep the full VIS-NIR spectral range (350-1800 nm). The next acquisition system we are working on will certainly need the fitting of 2 hyperspectral cameras (Specim FX10 and FX17) to cover this spectral range.

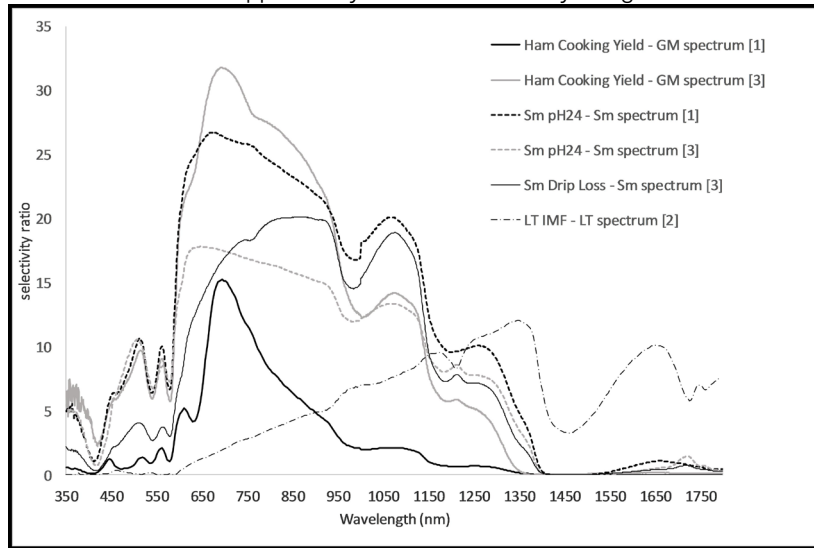
### References

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## Notes

## Acknowledgement

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**Figure 1.** Comparison of selectivity ratio curves from PLS models of prediction of cooking yield, drip loss, ultimate pH, and intramuscular fat. (GM: *Gluteus Medius*, Sm: *Semimembranosus*, LT: *Longissimus Thoracis*). [Reference number]

## Notes