

Ability of *on site* near infrared spectroscopy to predict shelf life extension of the pork meat

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Introduction

Control of meat shelf-life includes the time that it remains in the exhibitor of sale (such as the supermarket) until its rejection for the consumer, or withdrawal due to expiry date. Oxidative damage, together with the microbial spoilage, are the most important factors in meat deterioration. Preservation involves a change in the meat that reduces the microbial count, or limits the growth of microorganisms. As a means of extending meat shelf-life, modified atmosphere packaging (MAP) has become a dominant retail meat packaging technology.¹ The optical properties of meat are an indication of the state of oxidation and microbial count, and hence the subsequent shelf-life.² Nowadays, the availability of commercial near infrared low cost instrumentation for *on site* analysis has provided a powerful tool for the prediction of meat shelf life on trays displayed on commercial exhibitors in supermarkets.^{3,4} The aim of this experiment was to investigate the microbiological status to define the shelf life of pork meat, using a portable NIR instrument, with a packaging of gas mixtures.

Materials and methods

Samples of pork meat slices (126) packed in a modified atmosphere consisting of a mixture of O₂:N₂:CO₂ were scanned, and their microbiological status analyzed on days 1, 3, 5, 7, 9, 12 and 15 after slicing and packaging. A portable NIR instrument, Phazir (Polychromix, Inc.) in reflectance mode (1600–2400 nm) was used for the scanning. The spectrum of each slice sample was the average of ten scans. Parameters used to quantify the shelf-life extension were those included in legislation concerning mesophilic bacteria as an indication of pork meat spoilage, on the basis of microbiological status. Discriminant analysis was developed using PLS2 and scatter correction with *SNVD*. The mathematical treatment applied to the spectra was (1,4,4,1), using WinISI software (Foss/ISI, Port Matilda PA).

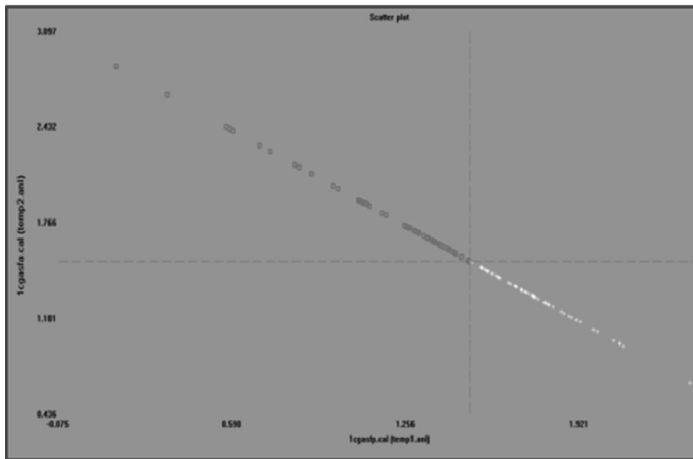


Figure 1. Scatter plot of scores to discriminate: □ pork meat acceptable for consumption, + pork meat unacceptable for consumption.

Results and discussion

Preliminary results, using principal component analysis of spectra, detailed in Figures 1 and 2 clearly indicated that pork meat allowed, and not allowed for consumption tended to group separately, suggesting that the NIR *on site* scanning would be able to discriminate between meats and assist in shelf life extension.

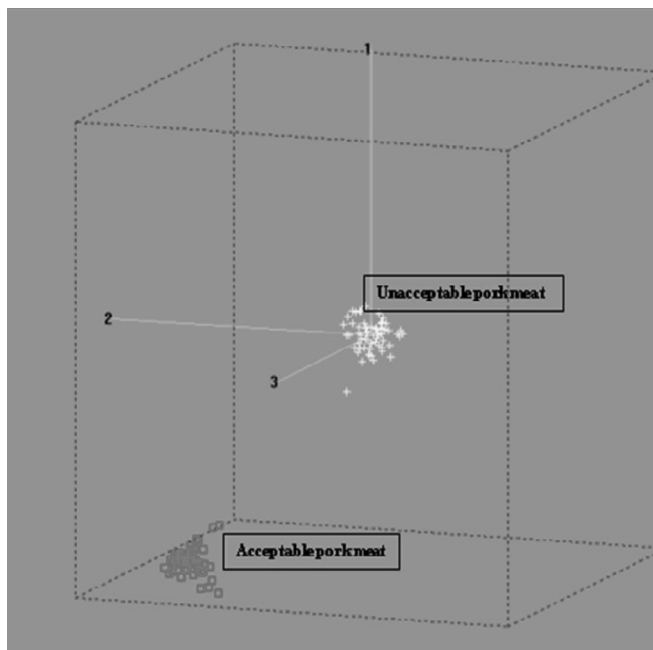


Figure 2. 3D graphic representation of pork meat population in base of 1, 2, and 3 PC.

Table 1. Cross validation results for PLS2 discrimination model to establish allowed or not allowed microbial status on intact pork meat for human consumption (N = number of samples).

Classification Analysis		
	N	% Hits
Level allowed	62	89.0
Level not allowed	64	92.9

The graph shows different spectral attributes among samples, that might be associated with meat deterioration. The first three principal components clearly separated both groups of samples. The results of the classification obtained by the discriminant PLS model are summarized in Table 1.

The samples with a microbiological level higher than the criterion established by legislation were correctly classified to the extent of 93%. The classification errors were identified as being related with samples included in the limit between allowed and forbidden, from 6.0 to 7.0 log cfu/gr mesophilic bacteria. In conclusion, results obtained in this study showed the potential of NIR *on site* spectroscopy to determine shelf life extension on commercial trays of pork meat slices exhibited in a supermarket.

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References

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