

Non-destructive non touch Visible-NIR transmittance spectroscopy for identification of Fresh and Frozen-thawed Fish

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Introduction

The online evaluation of the quality and freshness of the seafood is usually done through the employment of trained operators. This practice is costly in economic terms and requires a period of training of technicians. For certain frauds (eg. defrosted as fresh) also are not yet available objective assessment criteria, particularly for products already processed, sliced or filleted. The handling of the product reduces the shelf-life by making the fish susceptible to microbial growth.

Aim - to evaluate the discrimination power of a portable Visible-NIR transmittance (Vis-NIR T) spectroscopy on fresh and thawed fish products

Materials and Methods

- Two products: whole red mullet (*Mullus barbatus*; Fig.1) and swordfish cutlets (*Xiphias gladius*; Fig 2)
- Calibration set: 80 fresh (F) and 80 frozen –thawed (T) samples
- Validation set: (F = 71; T= 71) $N = (1.96/e)^2 \vartheta (1 - \vartheta)^*$
- *when e is the accepted error of 0.07% and ϑ is a presumptive sensibility (se) and specificity (sp) value of 0.9.
- Cold treatment: at -80 °C and then stored at -20 °C for 6, 5 and 4 weeks.
- Spectrometer: in house diode array spectrometer MMS1 (Zeiss) (Transmittance 300-1100nm and gap 2 nm)
- Mathematical processes: MSC (Multiplicative scatter correction); derivative treatment of 2nd degree with a gap of 5 nm and a 5 points smoothing treatment
- Discriminant models: PLS2 (partial least square)

Results

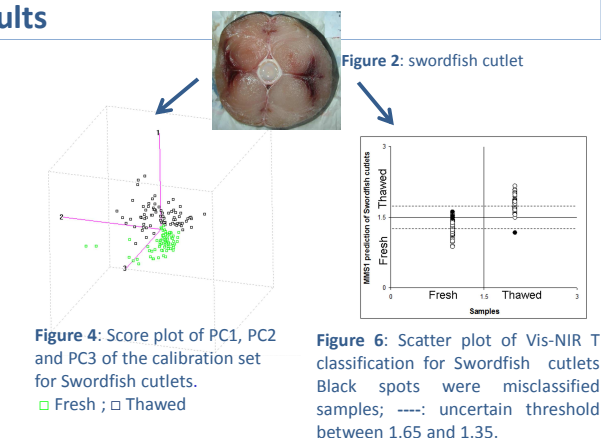
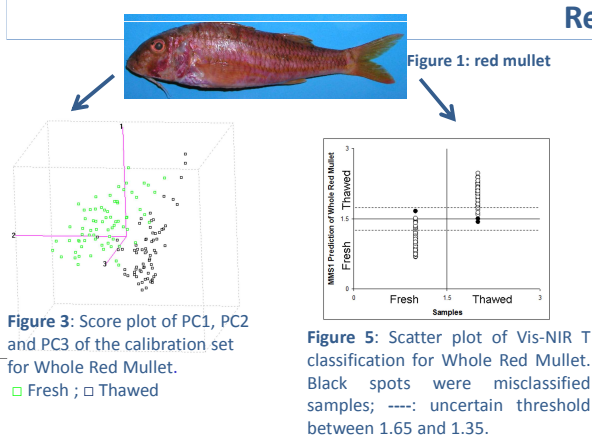


Table 1. Performances of validation on whole red mullet

Groups	Number of samples				Validation parameters (%) At 95% confidence interval	
	C	F	U	T	PPV	NPV
Fresh	70	1	9	71	98.6	97.2
Thawed	69	2	6	71	(90.3-99.7)	(92.4-100.0)

C: correct; F: False; U: Uncertain; T: total samples analyzed; PPV: Positive Predictive value; NPV Negative Predictive value.

Table 2. Performances of validation on swordfish cutlets

Groups	Number of samples				Validation parameters (%) At 95% confidence interval	
	C	F	U	T	PPV	NPV
Fresh	64	7	20	71	98.6	90.1
Thawed	70	1	14	71	(92.3-100.0)	(80.7-95.9)

C: correct; F: False; U: Uncertain; T: total samples analyzed; PPV: Positive Predictive value; NPV Negative Predictive value.

Conclusions

These results show the feasibility of Visible-NIR non touch non destructive analysis in authentication of fresh and frozen fish products. The validation parameters suggest that Visible-NIR could be utilized as a screening method for the quality control on-line.

The authors would like to gratefully acknowledge University of Padova and the Ministero delle Politiche Agricole e Forestali for the financial support of the project "M.A.R.I.P.A.", within which this work was carried out. The work was also partly funded by the Ministry of Public Health as part of the research program IZSPV 06/07 RC.