Chemometric tools for the selection and stability tests of spectroscopic/chemical markers in feed

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Introduction

The scientific conditions to complete regarding the amendments of the total feed ban are the development and validation of analytical methods and tools for the detection of the presence of species-specific animal proteins in animal feed. Actually, the existing methods do not allow species-specific identification and lead to the impossibility to lift the total ban and to implement the anti-cannibalism ban. The SAFEED-PAP project aimed to complete the scientific conditions that should allow the repealing of the extended feed ban. The research presented here focussed on the discrimination of fish meal against terrestrial animal meals.

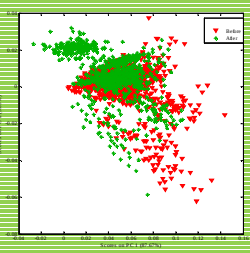
A marker is defined as a substance – or a group of substances - that is present in one of the two classes of animal meals concerned and which causes a significant difference of the measured NIR spectra at specific wavelengths. The verification of the existence of such a marker is required to demonstrate that the identification of animal meals by means of NIR microscopy is based on sound scientific reasoning. It could help in selecting characteristic wavelengths, when the final method protocol foresees the identification of the target animal meal (e.g. fishmeal) by applying predefined rules for specific wavelength ranges.

Experimental part

A previous study revealed specific wavelengths that are suitable for the separation of animal meals. In addition, the interpretation of the specific wavelengths hinted at two major factors responsible for the separation, namely (1) the water content and (2) the composition of the fat portion in the animal meals. Based on these results, some studies have been conducted using wet chemical techniques for water and fat extraction. Chemometric analysis of the obtained spectra has been done by applying PCA and Fisher test before and after water and fat extraction in order to study their influence.

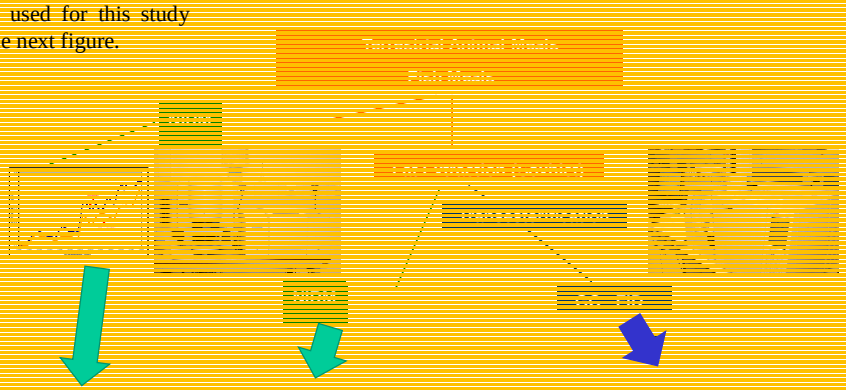
water content

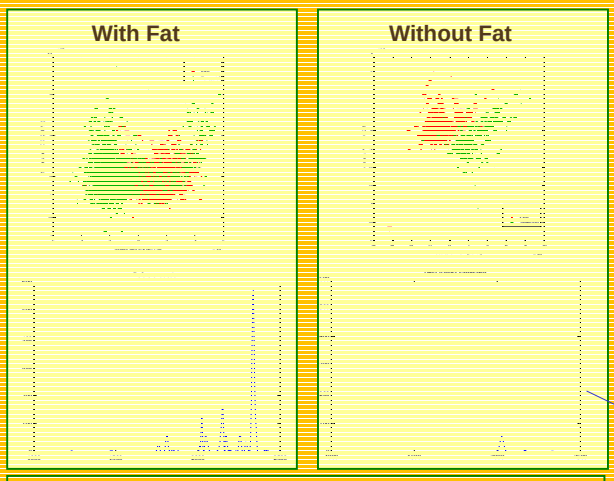
An experimental scheme to measure the NIR spectra of a group of animal meal samples with different percentages of water was performed. The samples were dried and re-measured. The PCA plot demonstrates that the moisture content has little effect on the NIR spectra and it can not be considered as a marker for species discrimination.



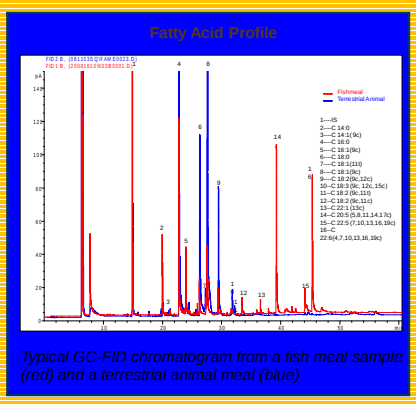
fat content

The experimental design used for this study has been represented in the next figure.





PCA and Fisher Test values for terrestrial and fish meal samples



Typical GC-FID chromatogram from a fish meal sample (red) and a terrestrial animal meal (blue)

Fisher test has been applied to the data set to better understand which are the NIR bands that better indicate the differences between the two classes, terrestrial and fish.

Conclusion

The results indicate that, before defatting, NIR bands characteristics of fat absorption (2300-2400, 2120-2150) are highly contributing to the discrimination of the two classes (terrestrial vs. fish), even though when the samples are defatted the discrimination is still possible and the results of the fisher test indicate that the NIR band corresponding to protein (2020-2040) can be the key for the discrimination of the two classes.

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Walloon Agricultural Research Centre