ANALYSIS OF AQUACULTURE FEED USING NEAR INFRARED SPECTROSCOPY

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INTRODUCTION

Aquatic organisms have high protein requirements and consequently feeds rich in this nutrient are used for their feeding. The control of the protein concentration is needed because each aquatic specie has different nutrition necessities, being the most used method to determine the protein content in feed the kjeldahl. However, other alternative methods are being studied like Near Infrared (NIR) spectroscopy which is a non-destructive technique which allows to make multicomponent analysis in a few seconds without using reagents.

The aim of this work was to develop an analytical method based on NIR technology to quantify protein in aquaculture feed. Different systems of measure were used and a comparison between them based on the time of analysis and the errors of validation obtained was made.

MATERIALS AND METHODS

130 samples of aquaculture feed with considerably variability in their composition and physical aspect were used. Among them, 70 samples were used for calibration and the other ones for external validation.

The reference method used to determine the concentration of protein was the kjeldahl. The range observed was 41,20-48,22%expressed in dry weight.

The spectroscopic analysis were performed with a FT-NIR spectrometer (Bruker Optics) in a range of 12500 to 4000 cm^{-1} with a resolution of 8 cm^{-1}. Samples were analyzed intact and grind in a cup of glass by reflectance difusse. Intact samples were also analyzed with a fiber-optic probe in order to diminish the time of analysis.

The chemometric analysis of data was made using the Bruker-OPUS software. Calibration models were developed with spectra absorbance units applaying PCR analysis. To test the models cross-validation and external validation were made.

Image 1. FT-NIR spectrometer (Bruker Optics).

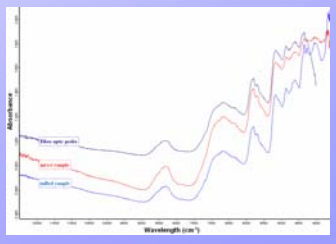

Image 2. NIR spectrums of an intact sample, a milled sample and sample analyzed with the fiber optic probe.

RESULTS

The model with the best predictive ability was selected by computing the RMSEE, the RMSECV and the RMSEP.

The statistical descriptors obtained with the different modes of measure in calibration and in validation are shown in the table.

MEASURE MODE	RMSEE	RMSECV	RMSEP
INTACT SAMPLES	0,57	0,80	1,80
GRIND SAMPLES	0,33	0,58	1,02
FIBER-OPTIC PROBE	0,85	1,03	1,34

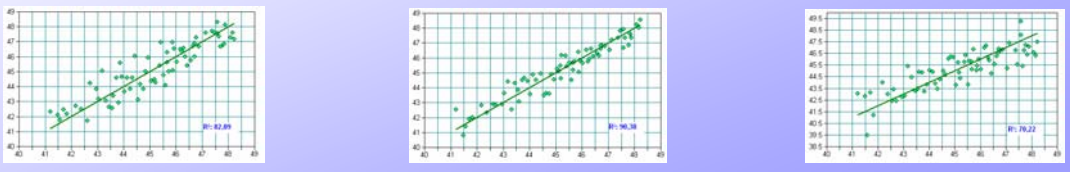

Imagen 3. Reference values vs values predicted in cross-validation of intact samples (left), milled samples (center) and samples analyzed with fiber-optic probe (right).

DISCUSSION

The results show that all the methods discussed are suitable for the determination of protein in aquaculture feed. The method developed with milled samples was the most accurate, however this is the most time-consuming because the preparation of the sample is required. The analysis realized employing the fiber-optic probe in direct contact with the sample are the most rapid. In conclusion, one or other method will be used in function of the accuracy required.

REFERENCES

- I. González Martín, J.M. González Cabrera, M. Bustamante Rangel, M. M. Delgado Zamarreño. Anal. Chim. Acta 558 (2996) 132.
- L.W.D. Van Raamsdonk, C. von Holst, V. Baeten, G. Berben, A. Boix, J. de Jong, Anim. Feed. Sci. Tech. 133 (2007) 63.