

Near-infrared spectroscopy applied to sensory analysis of Ragusano Cheese PDO

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Introduction

Ragusano PDO is a cow raw milk pasta filata cheese produced by farmhouses in the South East part of Sicily, Italy. The CoRFiLaC mission is to protect and establish value to the traditional Sicilian cheeses. CoRFiLaC is also officially appointed to give the Protected Denomination of Origin (PDO) certification to Ragusano cheese, considering the composition analysis as well as sensory analysis, by a trained panel group. Since 2006 NIRS has been used to determine the main composition parameters of Ragusano Cheese. Yet, the most important parameters of the evaluation of any Ragusano cheese is the assignment of a quality score assigned by sensory analysis, using a trained panel. The aim of the present study was to compare the sensory profile by the Near Infrared spectroscopic technique, NIRS, with the classic sensory analysis by a human trained panel for organoleptic evaluation of Ragusano cheese at different stages of aging, for PDO certification.

Materials and methods

Approximately 700 cheese samples received for evaluation were analysed for total solids, total protein, soluble proteins (soluble with TCA 12%=sp TCA12; soluble at pH 4,6=sp pH46), pH and salt content, using reference methods. On 130 cheese samples sensory analysis, was also performed by a human trained panel. The tested cheeses were scored for 21 weighted sensory attributes for odour, taste, and consistency (texture). The cheeses were classified into two different quality classes according to the intensity of the perception of features in A (score range 80–90) and in B (score range 91–100).

Cheese samples were ground using a Grindomix GM 200 and scanned with a NIRFlex N-500 (spectral range 4.000–10.000 cm⁻¹ and resolution of 8 cm⁻¹) in the reflectance mode. The software WinISI version III was used for the chemometric analysis of NIRS data.

Statistics used to select the best calibration equations were: standard error of cross validation (SECV); coefficient of determination R^2 in cross-validation (RSQcv). A spectral range of between 1000 and 2500 nm, was used to develop the prediction model. Scatter correction (SNV-detrending), and first derivative was calculated with gap and segment (smoothing) of 8 nm. Modified partial least squares (MPLS) regression was performed to develop models for prediction of the chemical parameters, and sensory score.

Results and discussion

Prediction of chemical and sensory parameters by NIR spectroscopy gave the best results for dry matter, proteins and salt contents respectively. Prediction of soluble nitrogen, both in acetate buffer at pH 4.6 and in 12% TCA, also showed good prediction (Table 1).

The sensory analysis had the lowest performance of prediction, as indicated by the lowest RSQ in cross validation. Yet considering the fact that sensory scores are affected by human evaluation, the prediction error of 2.66 can be considered acceptable for a rough screening of samples that are needed to be classified. A sensory panel for Ragusano PDO cheese will be still needed, but the introduction of NIR screening could limit the use of the panel to samples with uncertain classification, allowing the extent of sensory evaluation to include a larger number of cheese samples received.

Table 1. Calibration performance for Ragusano Cheese.

Constituent	<i>N</i>	Mean	<i>SD</i>	<i>SECV</i>	<i>RSQcv</i>
Total Solids	725	65.64	6.03	0.68	0.99
PROTEIN	579	29.74	3.35	0.59	0.97
NaCL	700	3.09	1.05	0.14	0.98
SP TCA 12%	578	2.36	1.07	0.28	0.93
SP PH 4.6	584	3.26	1.18	0.50	0.82
PH	619	5.34	0.14	0.07	0.78
SENSORY SCORE	117	93.62	4.87	2.66	0.71