NIR spectroscopy and chemometrics against food fraud: spotting Mechanically Separated Meat (MSM) in processed meat products

Elena Cazzaniga[1*], Nicola Cavallini[1], Alessandro Giraudo[1], Marzia Pezzolato[2], Francesco Geobaldo[1], Francesco Savorani[1]

1 Polytechnic of Turin, Department of Applied Science and Technology, Corso Duca degli Abruzzi 24, 10129 Torino, Italy

2 Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, via Bologna 148, 10154 Torino, Italy

E-mail elena.cazzaniga@polito.it

Food fraud has been identified as an emerging risk to the food industry and as a significant concern to consumers [1]. Any food chain can be affected by food frauds, with no exception for the meat production chain: one of the most significant cases is represented by processed meat, where it becomes very difficult to distinguish the different meat source and it is therefore very easy to incur fraud. One product that shows evidence of such fraud are sausages produced from minced meat that can be mixed or replaced with Mechanically Separated Meat (MSM) [2]. The latter process works by exploiting high pressure to separate the still edible meat tissue, remaining after slaughter, from the bone, obtaining mashed meat which is then mixed with other ingredients, shaped in sausages and cooked. MSM products allow a reduction of the final price of the meat products, as it is of lesser food quality and safety if compared to selected meat cuts. The use of undeclared MSM in the production of sausages and bratwursts is therefore a fraud and may pose a safety risk.

Several analytical techniques have been tested with the aim of distinguishing products containing MSM from those only containing minced meat, but the main problem is the fact that those that proved successful are expensive and time-consuming [3]. In the present work, we inspected the use of NIR spectroscopy as a rapid and non-destructive tool for the investigation of MSM products. Three different NIR instruments were used for this purpose: a benchtop full range NIR spectrometer – MPA (Bruker), a pocket-size spectrometer – SCiO (Consumer Physics), and a portable one – MicroNIR (Viavi). The acquired data were processed with chemometric tools to elaborate explorative and classification models to enable the distinction between MSM and non-MSM products.

These models were built using Principal Component Analysis (PCA) and Partial Least Square–Discriminant Analysis (PLS-DA), respectively. Both explorative and classification models provided good results in distinguishing between MSM and non-MSM, with both classification and prediction accuracies in cross-validation (CV) higher than 95% for all the three analytical techniques.

References

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