A novel approach for identifying mechanically separated meat by means of ICP-MS determination of trace elements/oligoelements and multivariate analysis

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Mechanically separated meat (MSM) is the product obtained by removing meat from bones using mechanical means resulting in the substantial modification of the original meat structure. Poultry and swine carcasses are usually processed in such a way, and the process can be carried out at high and low pressure. The identification of meat obtained by mechanical process is important for evaluating the overall quality of the product and for assuring food safety. Indeed, the high degree of muscle fiber destruction caused by mechanical separation makes the product more perishable than the traditional minced meat. This is why the presence and the percentage of MSM have to be declared on the product label.

Although many analytical approaches have been proposed for this type of identification, none is still considered as fully reliable.

In this study, a novel approach for identifying MSM, based on multivariate analysis of 43 trace elements (composed of 27 trace elements and 16 rare earth elements) in meat products, detected by ICP-MS after sample mineralization, is described.

Overall, 100 meat samples, composed of different percentages of MSM, obtained at low and high pressure, and without MSM, were analyzed and the results were processed for method optimization. The chemometric classification models were rigorously validated, both internally and externally. A cross-validation strategy with six cancellation groups was applied for an internal validation, achieving a total prediction rate in cross validation of 97.2 %. Then, the final validation of this approach was completed by analyzing and classifying 10 'blind' meat samples, obtaining a method accuracy equal to 90%.

Thus, the described method is applicable for the discrimination of meat products containing mechanically separated meat, even if the processing is carried out at low and high pressure, representing a significant improvement in field and a useful tool for laboratories in charge of food inspections [1].

[1] Oto Miedico, Valeria Nardelli, Teresa D'Amore, Monica Casale, Paolo Oliveri, Cristina Malegori, Giuseppe Paglia, Marco Iammarino. (2022). Identification of mechanically separated meat using multivariate analysis of 43 trace elements detected by inductively coupled mass spectrometry: A validated approach. Food Chemistry, 397, 133842.