Raman through original food packaging – Authentication of the milk origin by animal species of sliced cheeses

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**Abstract**

The animal origin from which some types of foodstuffs are produced is a determining factor leading to a higher or lower quality of the product. As a consequence, these foods can be subject to fraud and require adequate authentication. In this sense, dairy products such as cheese are susceptible to fraud. The main ingredient is milk, which can be obtained from cows, goats, sheep or buffalo, among other animals. The mammal from which the milk used to produce cheese is obtained gives this product different characteristics and qualities. One of the reported frauds in this type of food is, for example, the substitution of milk with cheaper lower quality milk or misleading labeling statements. The methodologies used for the milk/cheese authentication are complex, especially as they require pre-treatment of the sample. Moreover, they are based on the study of specific compounds (chemical markers), without taking into account that the final composition can be affected by many factors. Therefore, it would be advisable to develop new analytical methods for assessing the authenticity according to the animal species from which it was produced. This research presents the application of a portable device with the ability to perform non-invasive measurements through the original food packaging. The spatially offset Raman spectroscopy (SORS) technique was used to acquire rapidly and easily the instrumental fingerprint of 105 sliced cheese samples measured through their original packaging. The application of chemometrics to the Raman data allowed the development of a machine learning model to differentiate the animal species providing the milk used in production of cheese samples studied and thus reliably verify the labeling conformity of these products.

**Keywords:** Spatially offset Raman spectroscopy (SORS), cheese authentication, milk origin by animal species, machine learning methods.

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