A laser-based technique for the classification of milk samples based on their animal origin

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The raw milk production of EU farms used for dairy products, in 2020, was about 160.1 million tonnes. Of that, 154.4 million tonnes were cow milk, 3 million tonnes were ewes' milk, 2.5 million tonnes were goats' milk and 0.3 million tonnes were buffalos' milk. On the opposite side, in Greece, being the largest producer of non-bovine milk in EU, 57% of the Greek farms' raw milk delivered to dairies is coming from ewes and goats. Usually, non-bovine milk is of higher cost value than bovine milk, as it originates from farming under geographical and climatic constraints, e.g., in high altitude or arid areas found mostly on islands or provincial areas. Moreover, ewe and goat milk are more nutritious than bovine milk and are frequently used to produce different dairy products, as e.g., cheese, yogurt, etc. Therefore, the rapid, in-situ and reliable identification/determination of the animal origin of milk is of high interest.

Laser Induced Breakdown Spectroscopy (LIBS), a laser-based technique, is proposed for the first time for the discrimination of raw milk samples from different animal origins, i.e., cow, goat, and sheep. In principle, a pulsed laser is used to create a micro plasma on the sample's surface. The spectral analysis of the plasma radiation can provide valuable information about the elemental composition of the sample. The measurements can be carried out in-situ, on-line and/or remotely. In addition, the combination of LIBS with machine learning allows the fast classification of the milk samples based on their animal origin.

In this work, the principles of LIBS technique will be presented, and its application for the determination of milk elemental composition and for the discrimination of milk samples of different animal origins, will be demonstrated and discussed. Finally, the general potential of the technique for food science and for food quality control will be discussed, as well.

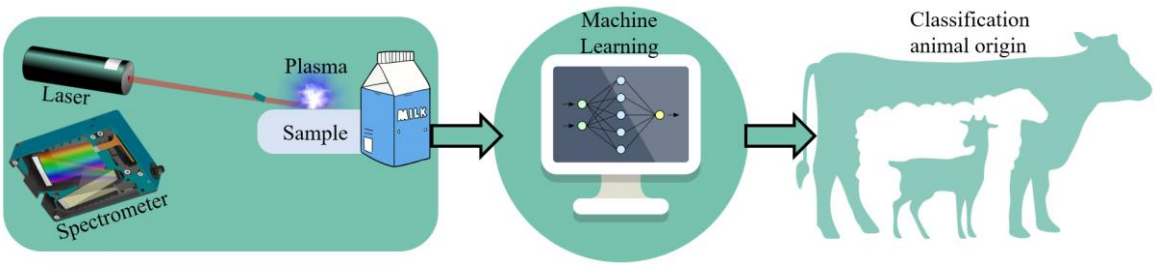

Figure: LIBS assisted by machine learning for the determination of milk's animal origin.

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