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Synchronous Fluorescence Spectroscopy and Trace Elements for Authentication of Cow Milks

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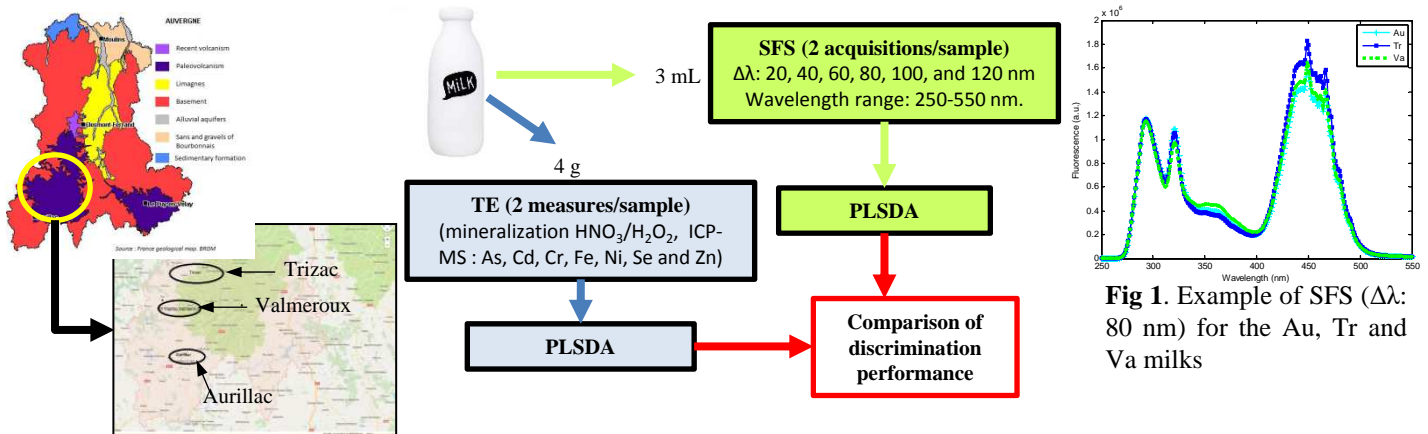
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Introduction : Authentication of food is a major concern not only for consumers but also producers and distributors. The market for foods with a distinctive sign of quality, as it is the case for cheese with a Protected Designation of Origin (PDO) or Protected Geographical Origin (PGO), has been growing steadily in recent years. It currently serves consumers with a real enthusiasm for so-called traditional food relying on the concept of region to assert their typicality. This experiment aims to study the potential of Trace Element (TE) contents to authenticate milk products used for Salers cheese production and to compare its performance to a more classical method used in different studies, Synchronous Fluorescence Spectroscopy (SFS).

Materials and methods

A total of 19 bulk-tank milk samples (approximately 60 mL/tank) were collected in three towns (Au: Aurillac, Va: Valmeroux and Tr: Trizac) located in the Auvergne-Rhône-Alpes Region during the 2014 production season (June to September) when the major eating ration of cow is grass and just before farm cheese manufacturing. After collection, milk was transported to the laboratory at 4°C and frozen at -20°C until SFS and TE analysis.



Results and discussion

Table 1. Correct Classification (CC), Recall, Specificity, and Error of the best PLSDA models carried out on SFS ($\Delta\lambda$: 20 nm) and TE data (*SD*: Standard Deviation)

Discrimination data	Cross-validation							
	LV	Tr	Va	Au	CC(%)	Recall(%)	Specificity (%)	Error (%)
Fluorescence ($\Delta\lambda$: 20 nm)	Tr	57	0	0	97.22	95.00	100.00	2.78
	Va	0	18	0	100.00	100.00	100.00	0.00
	Au	3	0	30	97.22	100.00	96.15	2.78
	<i>mean</i>				98.15	98.33	98.72	1.85
	<i>SD</i>				1.60	2.89	2.22	1.60
Trace Elements (TE)	Tr	13	0	0	71.05	65.00	77.78	28.95
	Va	3	4	2	79.41	66.67	82.14	20.59
	Au	4	0	10	77.14	71.43	80.95	22.86
	<i>mean</i>				75.87	67.70	80.29	24.13
	<i>SD</i>				4.32	3.34	2.26	4.32

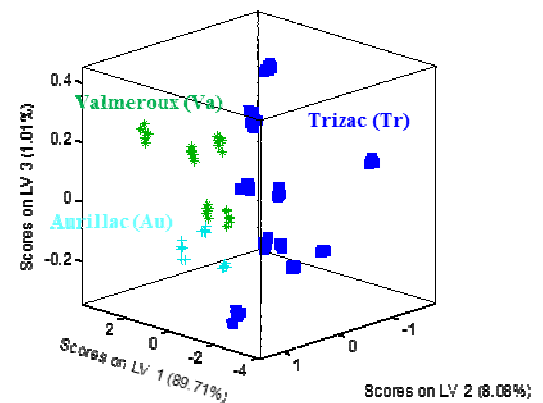


Fig 2. Samples scores on the first 3 LV after PLSDA applied on the SFS recorder at $\Delta\lambda=20$ nm

Cross-validation results obtained (table 1) demonstrated that SFS is more accurate than TE for discrimination of milk product based on their regional origin. The results show also that the milk from Valmeroux (100 % for all the discrimination parameters) is well reclassified compared to the milks from the other regions. The same observation was noted for the model using the TE data. This could demonstrate that the Valmeroux region presented a higher specificity (e.g. floral, grass) compared to the other regions and that this specificity is recovered in milk samples.

Conclusion : This study demonstrated the potential use of SFS and TE coupled with PLSDA to authenticate milk depending on its regional origin. Nonetheless, we noted that SFS has a triple advantage compared to Trace Elements for authentication, higher accuracy, faster to implement and non-destructive for samples.