

CONCORSO PUBBLICO, PER ESAMI, PER N. 1 POSTO DI CATEGORIA D, POSIZIONE ECONOMICA D1, AREA TECNICA, TECNICO-SCIENTIFICA ED ELABORAZIONE DATI, CON CONTRATTO DI LAVORO SUBORDINATO A TEMPO DETERMINATO, DELLA DURATA DI DODICI MESI (COD. RIF. 2315), IN ATTUAZIONE DEL PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) E IN PARTICOLARE DEL PROGETTO DI RICERCA *STRENGTHENING OF THE ITALIAN RESEARCH INFRASTRUCTURE FOR METROLOGY AND OPEN ACCESS DATA IN SUPPORT TO THE AGRIFOOD-METROFOOD-IT* - CODICE IR000033 - CUP I83C22001040006, RELATIVO ALLA MISSIONE 4, "ISTRUZIONE E RICERCA" - COMPONENTE 2, "DALLA RICERCA ALL'IMPRESA" - LINEA DI INVESTIMENTO 3.1, "FONDO PER LA REALIZZAZIONE DI UN SISTEMA INTEGRATO DI INFRASTRUTTURE DI RICERCA E INNOVAZIONE", BANDO INFRASTRUTTURE DI RICERCA - AVVISO N. 3264/2021 DEL MUR (COD. RIF. 2315), INDETTO CON DECRETO DEL DIRETTORE GENERALE N. 1129 DEL 29.09.2023

GRUPPO QUESITI NON ESTRATTI PROVA ORALE DEL 13.12.2023

GRUPPO QUESITI 1

- 1 Illustrare i principi dell'analisi multielemento per scopi di tracciabilità dei prodotti agroalimentari.
- 2 La matrice dati riporta come varia l'assorbanza di soluzioni standard a differenti concentrazioni di fosforo dopo reazione colorimetrica. Creare un grafico con la retta di calibrazione evidenziando l'equazione della retta e il coefficiente di determinazione. Inoltre stimare la concentrazione di fosforo in una soluzione con assorbanza 0,1250

	concentrazione P (mg/l)	assorbanza
Std-1	0,05	0,0246
Std-2	0,10	0,0515
Std-3	0,15	0,0825
Std-4	0,20	0,1035
Std-5	0,25	0,1302
Std-6	0,40	0,2053
Std-7	0,50	0,2518
Campione x		0,1250

QUESITO IN LINGUA INGLESE DA LEGGERE E TRADURRE

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Authentication of the geographical origin of Guizhou green tea using stable isotope and mineral element signatures combined with chemometric analysis

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ABSTRACT

Guizhou green tea is a provincial-scale protected geographical indication (PGI) product with high value and good reputation. However, induced by economic benefit, deliberate origin mislabeling and adulteration of Guizhou green tea become significant in the market. Reliable methods for authenticating the origins of green tea are therefore needed to counteract deliberate mislabeling and protect genuine Guizhou green tea. In this study, we analyze the signatures of four stable isotope and thirty-one mineral element in green tea samples collected from different provinces of China (Guizhou, Hubei and Guangdong) and different counties of Guizhou province (Duyun, Leishan and Meitan). We show that the $\delta^2\text{H}$ and $\delta^{18}\text{O}$ values are significantly higher in green tea samples collected from Hubei, which may be attributed to the strong secondary evaporation induced by low relative humidity. We also show that mineral element contents in green tea samples exhibit obvious regional differences, e.g. Fe, Mn, Cu, rare earth elements. These differences are mainly explained by the soil environment (i.e. soil properties, geological background and mineral resources) and are probably correlated with climate change. Moreover, we investigate the possibility of authenticating Guizhou green tea at the provincial and prefectural scales, using stable isotope and mineral element signatures combined with principal component analysis (PCA), linear discriminant analysis (LDA), and orthogonal projection to latent structures discriminant analysis (OPLS-DA). The prediction accuracies of the LDA and OPLS-DA methods are all greater than 97% under the validation by cross-validation and external validation. The $\delta^2\text{H}$ value and the contents of K, V, Co, Cu, Zn and Ce, are identified as important variables for discrimination between green tea samples collected from the three different provinces. The contents of Dy, Er, Gd, Ho, Sm, Tb, Tm and Yb are key factors for secondary classification of Guizhou green tea samples collected from the three different counties. This strategy combining stable isotope and mineral element analysis is thus a powerful tool for authenticating Guizhou green tea from green tea with differing geographical origins, including those from nearby regions.

1. Introduction

Tea made from fresh leaves of the plant *Camellia sinensis*, is one of the world's three most popular beverages. Tea is rich in various health-promoting active components such as tea polyphenols, caffeine, theanine, and theaflavin. Previous studies have shown that consumption of tea polyphenols reduces the risk of cancer and cardiovascular disease (Higdon & Frei, 2003) (Khan & Mukhtar, 2007). China is one of the world's major tea producing and consuming countries, and green tea accounts for larger production and market share. Tea quality is the

dominating demand of consumers during tea trade. It is generally believed that the quality of a tea is correlated strongly with its geographical origin and the environmental conditions under which it is grown (Ye, 2012). Consequently, reputable tea products with protected geographical indication (PGI) label are highly favored and are sold at high prices. Guizhou green tea is a well-known tea with high water extracts and amino acids, and is the first tea product with provincial-scale PGI label. It is reported that the export value of Guizhou green tea is about 16 million dollars at 2019 and the retail price is more than 20% higher than ordinary tea products (Guizhou Daily, 2019).



GRUPPO QUESITI 3

- 1 Descrivere l'analisi di un prodotto agroalimentare mediante impiego della spettroscopia nell'infrarosso.
- 2 Calcolare media, mediana e deviazione standard dei contenuti di stronzio in pomodori prodotti in due diversi areali e valutare mediante test T di student a due code la significatività della differenza in contenuto di stronzio tra i due areali ipotizzando uguale varianza.

stronzio $\mu\text{g}/\text{kg}$	
Areale 1	Areale 2
889	6918
864	5643
757	5342
842	5307
743	5416
835	6252

QUESITO IN LINGUA INGLESE DA LEGGERE E TRADURRE

Mass spectrometry in food authentication and origin traceability

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Abstract

Food authentication and origin traceability are popular research topics, especially as concerns about food quality continue to increase. Mass spectrometry (MS) plays an indispensable role in food authentication and origin traceability. In this review, the applications of MS in food authentication and origin traceability by analyzing the main components and chemical fingerprints or profiles are summarized. In addition, the characteristic markers for food authentication are also reviewed, and the advantages and disadvantages of MS-based techniques for food authentication, as well as the current trends and challenges, are discussed. The fingerprinting and profiling methods, in combination with multivariate statistical analysis, are more suitable for the authentication of high-value foods, while characteristic marker-based methods are more suitable for adulteration detection. Several new techniques have been introduced to the field, such as proton transfer reaction mass spectrometry, ambient ionization mass spectrometry (AIMS), and ion mobility mass spectrometry, for the determination of food adulteration due to their fast and convenient analysis. As an important trend, the miniaturization of MS offers advantages, such as small and portable instrumentation and fast and nondestructive analysis. Moreover, many applications in food authentication are using AIMS, which can help food authentication in food

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