



Geochemical fingerprinting of lemon juices and cultivation soils for authentication and traceability of geographical provenience

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Food habits or more generally food consumption, especially agro-food products, have always been linked to the territory of production. The Sorrento lemon (*Citrus limon* (L.) Burm. f. cv. *Ovale di Sorrento*), is known for its characteristic cultivation on terraces in Sorrento peninsula of Campania (south Italy). In this environment, the peculiar soil and climatic features and the traditional cultivation on terraces have contributed not only to high-quality lemon productions but also to protect the landscape. Indeed, in terms of soil and climatic features, the Sorrento peninsula is very heterogeneous. The geographical conformation of the territory, along with the rainfall increase with elevation and in more inland areas, leads to different microclimates and habitats, even at a very small scale. Main aim of this work was to develop a chemometric discriminant model to authenticate and track Sorrento lemons at a small geographical scale by multi-element fingerprinting and Linear Discriminant Analysis (LDA) in order to protect the PGI lemon from lemons of other geographical origins. The variability of the total and bioavailable mineral contents in soil (top and subsoil) and their relationship with lemon juices were analysed. The multi-element fingerprinting of different areas are different for mineralogical and geochemical composition. The array of inorganic elements of agrofoods is greatly affected by the soil features, such as mineralogy, pH, moisture, and organic constituents. The LDA model was developed and cross-validated with the cultivar "Ovale di Sorrento". External validation with other cultivars (Femminello Zagara Bianca, Femminello Siracusano 2KR, Femminello Sfusato Amalfitano, Femminello Adamo, and Femminello Cerza), grown in the same areas, was carried out. The LDA model was applied to 102 samples of "Ovale di Sorrento" lemons, cross-validated (96.08% of correct classification) and validated with external validation of 67 lemons juices from other cultivars (94.03% of correct classification) according to geographical origins. Pearson correlation analysis of the total and bioavailable element content of cultivation soils (top and subsoil) and lemons juices was performed.