Food Anal. Methods (2017) 10:3523–3530
DOI 10.1007/s12161-017-0913-3

Geographical Origin Identification of Moldavian Wines by Neutron Activation Analysis

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Received: 3 December 2016 / Accepted: 20 April 2017 / Published online: 5 May 2017

Abstract To get more data regarding the elemental transfer from soil to wine, the neutron activation analysis was used to determine 35 elements in vineyard chernozem soil and 18 elements in wines from Romanesti and Cricova, Republic of Moldova. Soil elemental content allowed evidencing more similarities between considered soils and the Upper Continental Crust and the World Average Soil as well as to calculate the soil-to-wine transfer factor for 18 of investigated elements. From all 28 trace elements evidenced in soil, only 13, the soluble ones, were found in all wine samples, which finally allowed determining the corresponding transfer factors whose values varied between 0.02 mg/l (U) and 38 mg/l (K). In this regard, all sorts of wines showed a significant concentration of potassium, varying from 370 to 700 mg/l. A subsequent discriminant analysis allowed discriminating all wine samples according to their types: red and white as well as their origin.

Keywords Moldova · Wines · Major elements · Trace elements · Soil · Transfer factor · Discriminant analysis

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Introduction

Wine is a beverage of great social and economic significance widely consumed around the world. It has a complex matrix, which, besides water, sugar, and alcohol, contains a great variety of organic as well as inorganic components (Fabani et al. 2010; Sperkova and Suchanek 2005). As in many wine-producing European countries, a controlled denomination of origin was established in the Republic of Moldova to guarantee the provenance and quality of its wines and also to prevent frauds. The main wine-growing zones in Moldova are Balti (northern zone), Codru (central zone), Purcari (south-eastern zone), and Cahul (southern zone) (Fig. 1), where the soil is typically of Eurasian steppe chernozem type (Anonymous 2017).

A great number of natural and anthropogenic factors such as soil characteristics, type of grape, area of production, environmental conditions, fertilizers, inorganic pesticides, wine-making practices, application of additives, transport, and storage could significantly influence the concentration of major as well as trace elements in wine (Gonzálvez et al. 2009; Fabani et al. 2010; Sperkova and Suchanek 2005; Geana et al. 2013; Grindlay et al. 2011; Moreno et al. 2007). Wines typically contain major elements such as Na, Mg, K, and Ca, whose concentration is greater than 10 mg/l; trace elements such as Al, Mn, Fe, Zn, or Pb, whose concentration overpass 10 μg/l; and ultra-trace elements such as Cr, Ni, As, or Cd, whose concentration is lower than micrograms per liter (Geana et al. 2013). Although the list of elements commonly