

Chemometrics Applied for Traceability Studies

Abstract

The European and American markets are the major consumers of herbal spices, as they are excellent sources of natural antioxidants, which also yield complex secondary effects such as salt and sugar reduction. The interest for the cultivation of organic herbal spices is increasing rapidly, due to the premium price offered on international markets for herbs grown without any pesticide or chemical residues. The quality and appearance of herbs also depends on the pedo-climatic conditions specific to the country and even to the region of origin, harvesting time, vegetative stage, plantation establishment, cutting frequency, etc.

Another important issue is related to the danger of genetic erosion. When these herbs were harvested from the wild, the balanced supply and demand allowed the plant stock to regenerate seasonally. The strong commercial pressures of food and pharmaceutical industries has now disrupted the balance in regions where unregulated gathering took place systematically, leading to severe genetic erosion.

In response to this growing need of certifying the origin and quality of herbs, authenticity and traceability requirements have been established worldwide. In Europe, quality minima for herbal spices have been developed by the European Spice Association (ESA). In this study we are presenting several pattern recognition applications designed to perform detailed (regional) authenticity and traceability assessments in the case of herbal spices, i.e. Principal Component Analysis (PCA), Hierarchical Cluster Analysis (HCA) and Artificial Neural Networks (ANN). The modeling challenges are related to: i) the significant variability of the physico-chemical properties of samples originating from the same region; ii) the relative similarity of these properties in the case of samples harvested in regions with similar pedo-climatic characteristics; iii) the need of fast and cost-effective data processing systems, able to classify new samples based on as few properties as possible.

The results indicate that these artificial intelligence techniques are efficient and cost-effective tools for detailed (regional) traceability assessments. The advantages and limitations of these techniques are also discussed.

Keywords: traceability, herbal spices, physico-chemical properties, pattern recognition techniques.