Authentication and classification of strawberry varieties by analysis of their leaves using near infrared spectroscopy.

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It is well known now that near infrared spectroscopy (NIRS) is a fast, no destructive, and inexpensive analytical technique that could be used to classify, identify, and authenticate a wide range of foods and food items. Therefore, the main aims of this study were to provide a new insight into the authentication of five strawberry (*Fragaria* x *ananassa*) varieties and to correlate them with geographical zones and the propagating methods used. Three weeks plants of five different strawberry varieties (*F.* x *ananassa* Duch. cv Camarosa, Seascape, Chandler, *F. Chiloensis*, and *F. Virginiana*) were cultivated *in vitro* first and then transferred to pots with special soil, and grown in a greenhouse at CINVESTAV, all varieties were acquired from California (USA). After 18 months, ten leaves from each variety were collected. Transmission spectra from each leave were recorded over a range of 10,000-4,000 cm^{-1}, 32 scans of each strawberry leave were collected using a resolution of 4 cm^{-1} with a Paragon IdentiCheck FT-NIR System Spectrometer. Triplicates of each strawberry leave were used. All spectra were analyzed using principal component analysis (PCA) and soft independent modeling class analogy (SIMCA). The optimum number of components to be used in the regression was automatically determined by the software. Camarosa was the only variety grown from the same shoot but propagated by a different method (direct or *in vitro*). Five different classes (varieties) or clusters were observed among samples, however, larger inter class distances were presented by the two wildtype samples (*F. Chiloensis* and *F. Virginiana*). Camarosa direct and Camarosa *in vitro* displayed a small overlapping region between them. On the other hand, Seascape variety presented the smallest rejection percentage among all varieties (more similarities with the rest of the samples). Therefore, it can be concluded that the application of NIRS technique allowed the authentication of all strawberry varieties and geographical origin as well. It was also possible to form subclasses of the same materials. The results presented here demostrate that NIRS is a very powerful and promising analytical tool since all materials were authenticated and classified based on their variety, origin, and treatment. This is of a tremendous relevance since the variety and origin of a plant material can be established even before it gives its typical fruit or flower.