Geographic Authentication of Olive Oils using PTR-MS

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Headspace PTR-MS analyses were carried out on 192 olive oils which originated from
Cyprus, France, Greece, Italy, and Spain. Samples were obtained courtesy of the EU-
funded TRACE project (trace.eu.org). The mass spectral data were subjected to PLS-
DA in order to estimate a classification model for the olive oils samples (classification
by country of origin). After estimation of the classification model based on four
components, the performance of the fitted model was evaluated by cross-validation
using a leave-10%-out procedure. Two random permutations of the class labels were
carried out to verify the model. Cross-validation provided that 84% of the samples were
correctly identified by their country of origin. For Greece (80%), Spain (87%), Italy
(91%) and Cyprus (100%) high rates of correct classifications were observed. However,
only 10% of the French olive oils was classified correctly. The ten French samples
originated from the Paca region in the Bouches-du-Rhone province, but from seven
different towns. It appears that these oils have volatile characteristics in common with
especially oils from Greece and Spain. The group of French samples was relatively
small; it may be possible to improve classification success rates by using a larger
number of samples. In order to further explore which masses are specific for the
various countries, a two way ANOVA was carried out (Country X replicates) for each
mass, with subsequent LSD tests when a significant difference was observed ($P<0.05$).
45 masses showed significant differences between countries and divided them in three
groups. Additionally, 5 masses (M+1: m/z 31, 47, 60, 124, 145) divided the countries in
four groups. A similar approach was used for olive oils originating from various areas in
Italy, which resulted in 75% correctly classified samples. The present study showed
PTR-MS to be a promising technique for classification of olive oil samples by their
geographic origin.