Cocoa Origin's Identity card through chromatographic fingerprint: a fundamental step for authentication

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Introduction:

In cocoa production, an ever increasing attention is paid to sustainability. Tools to trace sustainable cocoa production are therefore necessary in particular in view of climate changes heavily affect cocoa production and quality. An important approach for monitor and authenticate food[1] are those based on fingerprinting. However, authentication of a food is often based on the determination of the degree of similarity of the fingerprint between the unknown sample and a representative reference. This step is known as food 'Identitation'[2] and the reliability of food authentication depends on its correctness. The fingerprint approaches require an adequate number of samples stated as authentic to establish a representative database of the genuine food population[1-3].
In this study, HS-SPME-GC-MS and HS-SPME-MS combined with chemometric tools were applied to the identitation of a set of cocoa samples of different origin to study their aroma chemical fingerprinting in incoming raw material and in intermediate chain products.

Methods:

100 samples of cocoa beans and paste were analysed by the above analytical methods. *U*ntargeted and *T*argeted (*UT*) *fingerprinting* data were used to extract relevant chemical information for origin discrimination and to cross-validate them. Untargeted heat map, PCA, partial least square-discriminant analysis (PLS-DA) and SIMCA were applied to the data set deriving from the analysis with the two methods.

Results:

Results indicate coherent clear clustering of samples in function of their origin both in raw beans and in the cocoa pastes. Targeted fingerprinting indicates some analytes such as 2-heptanol and 2-heptanol acetate and 3-methyl butanol for Ecuador, pentanone, 3-carene and propanoic acid for Colombia as discriminant markers. Prediction of cocoa beans classification with the untargeted fingerprint on an external validation set has resulted in a very distinctive clouds with global model sensitivity of 75% and specificity of 100%, while the clouds of cocoa paste samples are less defined although with a high specificity and sensitivity (78%).

Conclusions:

The fingerprinting approaches with the combined untargeted and targeted strategies enable to decode the information encripted in complex data set and to discriminate the origins studied until now often with good classification models. However, a higher number of representative samples are still necessary to build up a robust tool for a reliable origin identitation for authentication.

References

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