Sensory properties of a cup of coffee: possibilities and limitations of flavoromic approach for routine controls

SENSORY PROPERTIES OF A CUP OF COFFEE: POSSIBILITIES AND LIMITATIONS OF FLAVOROMIC APPROACH FOR ROUTINE CONTROLS

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1. – Introduction

Flavor perception is a multi-modal evaluation of the interaction between different and complex chemical stimuli (ortho retro-nasal, taste, texture, etc.) and the (bio)chemical and physiological responses.
This work deals with the study of a flavoromics approach to describe and predict the sensory quality of coffee and its potential and limits in routine control.

2. – Body

The cup tasting is nowadays the most important criteria to define the coffee quality, although it is time-consuming requiring panel training and alignment, often it cannot be implemented at-line for an immediate feedback and/or a critical objective evaluation. Due to the ever-increasing demand of coffee, there is a need for screening techniques suitable for routine control. Flavoromics is an "-omic" and "-holistic" approach focused on low molecular mass compounds (volatile and non-volatile) that links them to a sensorial perception through chemometric approaches [1-3]. Coffee cupping considers both aroma and taste and its evaluation implies the use of different attributes at the same time [4-5]. However, bitter and acid are stimuli normally perceived trough the taste, while other such as fruity and flowery are detected as aroma so the definition of the flavor quality require two complementary analytical techniques. Chemical information from coffee samples was obtained by analyzing both volatile and non-volatile profiles with HS-SPME-GC-MS and HPLC-UV/DAD. Sensory data are collected by an expert panel in monadic way through a quantitative descriptive analysis. Multiple Factorial Analysis was used to study the relationship between the observations (volatiles, non-volatiles, and sensory scores). Figure 1 shows that aroma and taste data matrix are closely correlated, and that the relative position of the observations on the Cartesian plane coherently distributed.

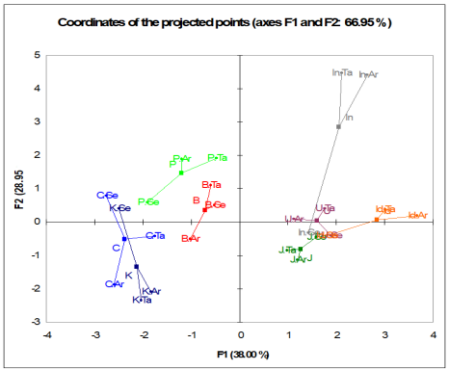

Figure 1 Coordinates of the projected points in the space resulting from the MFA

Partial Least Squares Regression was used to correlate chemical data related to bitter note and show that model relative to taste provide good results in determining the sensory scores (Q^2 0.50, R^2 in prediction is 0.77 with an error of 0.77). Bitter scores prediction obtained with targeted aroma fingerprint show a Q^2 of 0.62 and values of R^2 0.82 with a prediction error of 0.72. A possible approach to describe the multimodal perception could be to fuse aroma and taste data. Its application resulted in a lower prediction ability ($Q^2 = 0.60$) for bitter compared to the aroma fingerprint.

3. – Conclusion

Bitter and acid are stimuli perceived through the taste but its feeling could be due to the odor&taste integration signals elaborated by the brain. In addition during the roasting process similar reaction pathways form both volatiles and non-volatiles, therefore the correlations between taste (non-volatiles) and aroma attributes are not surprising. For routine controls, the analysis of the aroma through a total analysis system (TAS) can be useful to describe these attributes in defining the sensory properties of a cup of coffee.

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