

Sensory and chemical characterization of mould off-flavour in dark chocolate

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Introduction

A lot of organic dark chocolate were characterized by a well perceived mould flavour. The aim of the study was to characterize aroma components to improve a control plane on supplier chain to prevent the production of bad flavoured chocolate.

The study started from edible dark chocolate to continue, in the future, to cocoa bean.

Sampling

Some different lots of organic dark chocolate were sampled from warehouse. There are three type of samples: defected samples (D), blank samples without defects (B) and not known samples.

Sensory profile (ISO 13299:03)

The samples were analyzed three time by a well trained panel of twelve experts judge (Afnor V09A), without randomization plan.

The training were done by the use of specific standards developed by the way.

The standards were: cocoa mass, well-nibs, mould-nibs, 70% chocolate (crunch), cocoa powder without KOH treatments, 90% chocolate (bitter).

Objectives

The aim of the work is to estimate a chemometric model to prevent the production of off-flavoured chocolate bar.

Methods

The sample of chocolate (50g) were stored at 25°C for 30 min. SPME fiber Carboxen/PDMS Stable Flex 85µm (Supelco: 57334-U) previously conditioned at 300°C with carrier helio for 1 hour, was exposed at headspace of the chocolate samples for about 30 min. at 25°C.

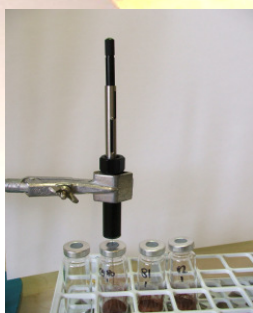
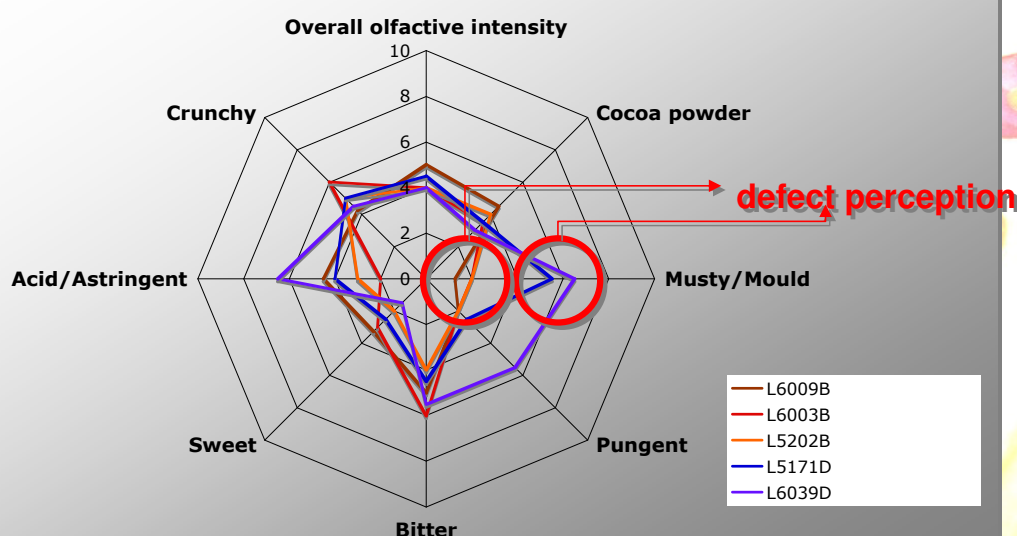
Injection with split/splitless GLC (6890N) MS (5973N) Agilent

Condition GLC:

- column: Varian Factor Four VF-1ms 60m, 0,32mm ID, 1,0µm (CP8930)
- gas pressure carrier: 10 p.s.i.
- type of injection: splitless for 0,5 min.
- injector temperature: 250°C
- oven temperature: initial temperature: 45°C for 1 min scale 5°C/min to 250°C for 1 min

Condition Mass Spectrometer

- (wiley libraries):
- transfer line temperature: 280°C
 - quadrupole temperature: 150°C
 - source temperature: 230°C
 - autotune optimization
 - EM offset: 200 volts
 - SCAN: 35-350, threshold 150, sampling rate 2²

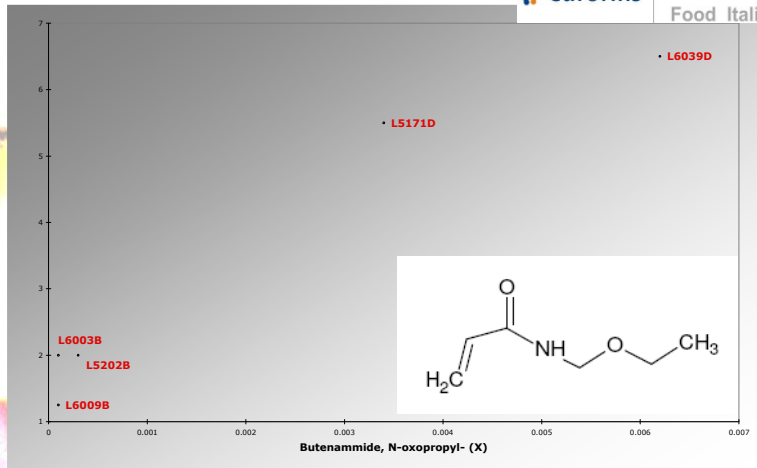


Results

Sensory profile put in evidence that only one good sample was very good, the other two are affected by very low intensity musty/mould defect. In presence of off-flavour in the sample is not possible to apply the randomization plans to avoid the carry-over effect, because the samples must be divided into two groups: the defect one and the no defect one.

The CV% are low and the panel work good in the three session, ANOVA give a not significant response through the session and repeatability is good ($IR < 3$). The mean of the three session was used to next computations.

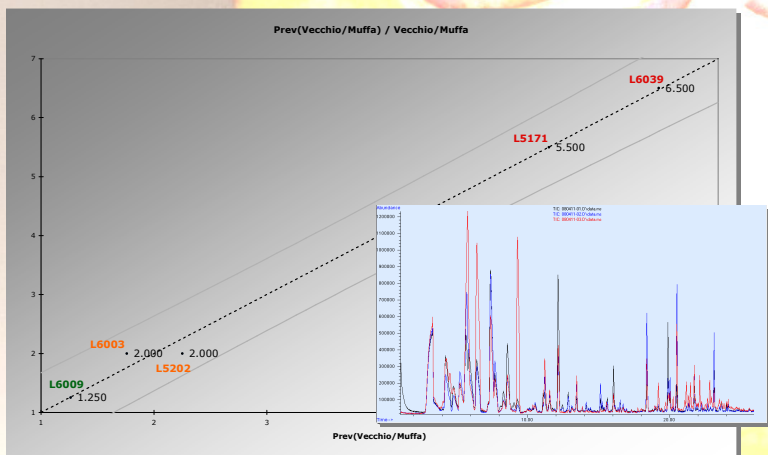
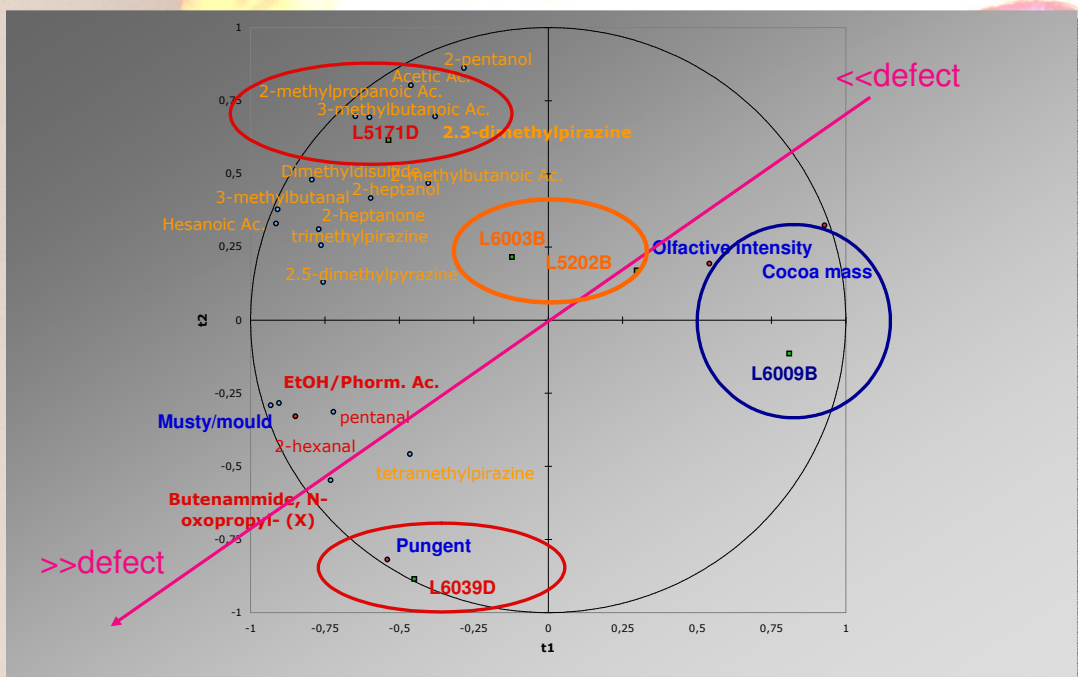
The radar profile show the five sensory profile of the analyzed samples.



On the other way, the SPME/GC-MS analysis gives the probable marker molecules of the defect. It is interesting to denote that one of these is very linked to the presence/absence of the defect (butenamamide, N-oxopropyl) and others are present in the particular defect samples (ethanol/phormic ac.; pentanal, 2-hexanal).

The only practical way to assemble chemical and sensory data with low cases (samples) is to use the PLS regression model.

PLS is a method based on recursive computation very useful for rectangular data matrix with a serious problem to compute the inverse matrix. It derive from Yoreskog-H. Wold study of the seventh's, today it has an incredible evolution in sensory analysis and chemometrics with studies of S. Wold, Tenhenaus and Esposito Vinzi.



Conclusions

The results of the implementation of a PLS regression model is the figures above. It is clear that the marker of musty/mould is the cyclic amide in association with ethanol/phormic ac., pentanal and 2-hexanal.

The prediction of the model is very good, in fact the two confidence bound on the straight line are close one to another, this shows a good fit of the model.

The model must be applied to nibs to predict the future of the chocolate bar.