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A Chemometric Approach for the Development of a New Fermented Dairy Product with Buckwheat

Tatiana MOSCU [1], Daniela PARASCHIV [2], Aida VASILE[1], Gabriela BAHRIM[1], Iulia BLEOANCA [1], Daniela BORDA[1]

1. Faculty of Food Science and Engineering , Dunarea de Jos University- Galati, Romania; Daniela.Borda@ugal.ro ; 2.Christian Hansen- Brasov, Romania

INTRODUCTION

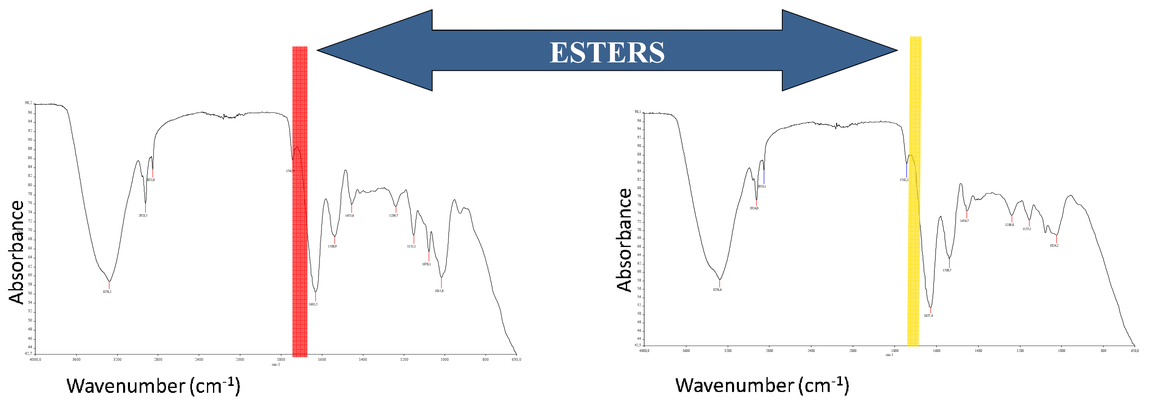
Sensorial properties of fermented dairy products are the main drivers of consumers` acceptability. They are influenced by the balance between flavor compounds produced via biochemical transformations occurring during glycolytic fermentation, but also during proteolytic and lypolytic pre- and post fermentative processes.

OBJECTIVES

- to develop a new probiotic product using milk as a raw material, functionalized with buckwheat as a prebiotic ingredient
- to characterize the functional and sensorial properties of the new product

FTIR

FTIR analysis showed a clear spectral difference through the frequency bands of **1742,2** and **1742,9** cm^{-1} respectively, specific for the aroma compounds in the samples with **L.casei-431®** and **La-5®**.



The IR spectrum of the product fermented with mesophilic culture Flora Danica and La-5® *with the addition of buck-wheat flour (FD+LA).*

The IR spectrum of the product fermented with mesophilic culture Flora Danica and L.casei-431® *with the addition of buckwheat flour (FD+LC).*

Spectral bands associated with specific bioactive groups indentified inthe analyzed products

Frequency areas, cm^{-1}	Characteristic frequencies (cm^{-1}) found in the analyzed samples	Bioactive compounds
A area < 1000	928,8	phosphates (P = O), polyunsaturated fatty acids, carotenoids
B area 1000-1100	1015,8 1077,5	glucose, oligosaccharides and polysaccharides, organic acids, alcohols
C area 1100-1300	1150,50 1239,8	phosphorylated carbohydrates, secondary amines
D area 1500-1700	1538,7 1634,9	lactic acid, proteins, peptides, amides
E area 1700-1750	1742,2 1742,9	esters (C = O), flavors
F area 2272-2403	-	CO2
G area >2800	2852,8 3281,8	fatty acids

METHOD

Three formulations were tested, all of them based on cow milk, Flora Danica (FD) starter culture (Chr. Hansen, Denmark) and buckwheat flour.

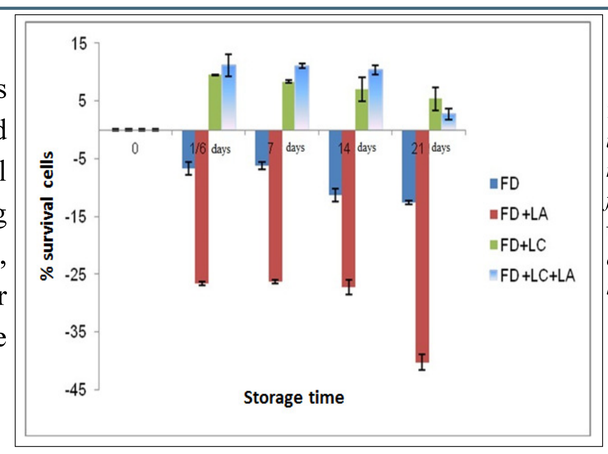
⇒ milk, 5% buckwheat, FD and La-5® (*Lactobacillus acidophilus*); milk, 5% buckwheat, FD and L.casei-431® (*Lactobacillus casei*); milk, 5% buckwheat, FD, La-5® and L.casei-431®

⇒ the control sample - milk with 5% buckwheat- was inoculated with FD mesophilic starter culture comprising the following strains: *Lactococcus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *diacetylactis* and *Leuconostoc mesenteroides* subsp. *cremoris*

FTIR spectra were obtained using a Magna-IR Spectrometer 350 equipped with an HATR accessory attenuated total reflectance. Spectra were scanned in the absorbance mode from 4000 to 900 cm^{-1}.

DATA ANALYSIS

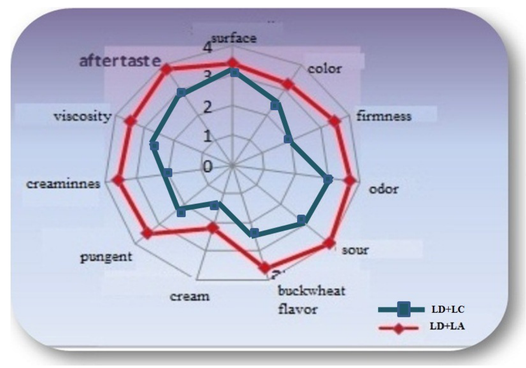
The viability of the probiotic cultures was analyzed during 21 days and while La-5® exhibited a survival rate of 8.4 log cfu/ml out of 9 log cfu/ml initially inoculated, L.casei-431® demonstrated a better survival rate of 9.5 log cfu/ml in the 21st day of storage.



The survival rate of the Flora Danica mesophilic culture in fermented products with mixed probiotic cultures and buckwheat flour..

SENSORY ANALYSIS

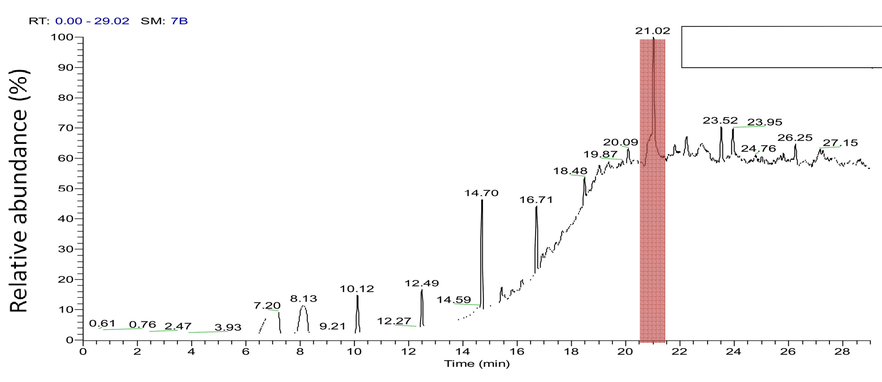
For the sensory analysis two trained groups of 7 panelists (under and over 35 years old) applied a hedonic evaluation using a Likert scale with 9 points. PCA analysis was performed to associate the preferred sensorial attributes with the probiotic starter cultures.



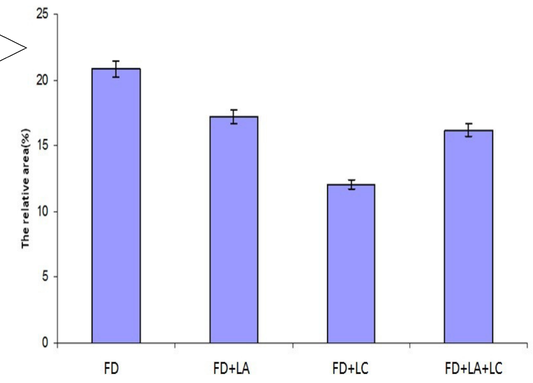
Sensory attributes of the samples with Flora Danica and La-5® *for group of tasters under 35 years .*

GC-MS

The extraction of volatile compounds was carried out by headspace SPME using a 65 m CAR PDMS fibre (Supelco, Bellefonte, PA, USA). Before extraction, the fibre was preconditioned in the GC injection port. A Thermo GC/MS Trace Ultra with ionic trap was used to identify the volatile fingerprint of the samples. Analytes were separated on a Carboxen wax column (0.25 mm x 60 m x 1µm) by applying the following temperature programme: 40 °C for 5 min, 40–200 °C at 10°C/min and at 200°C for 10 minutes .



Chromatogram of the volatile compounds from the sample with La-5® in the first day of storage .



Distribution of ethyl ketone in the samples.

Presence of sulphur compounds was identified in the samples with La-5® and high concentrations of ethyl-ketones were found in the samples with L.casei-431® .

The chemometric analysis of the GC/MS flavor fingerprints was correlated with the sensorial testing results.

Principal components (PC) analysis (PCA) biplot (PC 1 and 2) of flavor attributes of fermented milk with probiotics and buckwheat .

CONCLUSION

The methodology applied in this study facilitated the selection of the best candidate for industrial trials, designated as Flora Danica, La-5® and 5% buckwheat.

REFERENCES

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