MOL2NET, 2016, 2, http://sciforum.net/conference/mol2net-02

SciForum
MOL2NET

DEVELOPMENT AND CHARACTERIZATION OF NEW FERMENTED BEVERAGES OF LOW ALCOHOLIC GRADUATION FROM STRAWBERRY

Ángeles Fernández-Recamales, Ana Sayago, Raúl González-Domínguez, Verónica López Carbón, Ikram Akhatou and Rafael Beltrán

Department of Chemistry "Prof. J.C. Vílchez Martín", Faculty of Experimental Sciences, Agrifood Campus of International Excellence, ceiA3, Avd. Tres de Marzo S/N, 21007, Huelva, Spain
* Author to whom correspondence should be addressed; E-Mail: recamale@uhu.es Tel.: +34 959219958; Fax: +34 959219942

Introduction

R.D. 1650/1991, of November 8, on the Technical-Sanitary Regulation for the elaboration and sale of fruit juices and other similar products, in its article 2 of Title One, defines the puree, pulp or cremogenate as follows: ***Puree, or fruit pulp, or fruit cremogenate****, is the fermentable but not fermented product obtained by grinding or sifting the edible part of whole fruits or peeled without removing the juice*. Also in the same article defines the **puree, or concentrated fruit pulp, or fruit cremogenate** as*: the product obtained from the puree, the pulp, or the cremogenate of fruit eliminating through physical procedures a part of the water that constitutes it*. These purees of strawberry have been the raw material chosen for the development of a new product of added value, obtained by fermentation.

Product development

Strawberry puree

Must preparation

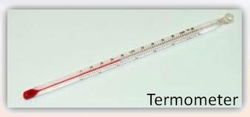
Fermentation

Addition of potassium metabisulfite (80mg $K_2S_2O_5$/L)

Filtration and transfer to bottles

Daily monitoring of fermentation

Temperature



Density

pH

Total Acidity

ºBrix

Control after fermentation

Iodolyser

Microdistiller

Alcohol measuring system and hydrometer

Free and Total SO_2

Volatile acidity

Alcoholic Grade

Characterization of the finished product

Physical-Chemical Parameters

Physico-chemical parameters	λ(nm)	Standar	Equation	Values
Colour intensity (IC)	420,520,620	-	$IC = A_{420} + A_{520} + A_{620}$	1,04225
Tonality (T)	420,520	-	$T = \frac{A_{420}\ (amarillo)}{A_{520}\ (rojo)}$	1,42525
Wine colour (WC)	520	-	$WC = A_{520}$	0,3875
Color fade-resistant ($CDSO_2$)	520	-	$CD_{SO2} = A_{520}^{SO2}$	0,28775
Free anttocyan color (AC)	520	-	-	0,1
Chemical age of wine (CAW)	520	-	$CAW\,(\%) = \frac{CD_{SO2}}{WC} \cdot 100$	73,79875
Total polyphenols	725	Galic acid	-	536,18175 mg/L
Total polyphenols Index (IPT)	280	-	-	14,0425
Flavonoid content	510	Catechin	-	85,5375 mg/L
Total anthocyans	520,700	-	$AT\left(\frac{mg}{L}\right) = \frac{A \cdot FD \cdot PM \cdot 1000}{\varepsilon}$	4,711 mg/L
Condensed tannins	640	Catechin	-	10,42075 mg/L
Antioxidant activity	515	Trolox	-	1,0305 mM TE
Alcoholic grade	-	-	-	6.2 º
Free SO_2	-	-	-	23.8 mg/L
Total SO_2	-	-	-	88.2 mg/L
Total acidity	-	-	-	5.5 g/L Tartaric acid
pH	-	-	-	3.5
Volatile acidity	-	-	-	0.70

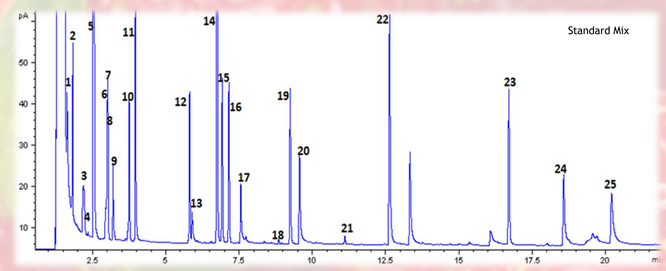
Volatile compounds profile

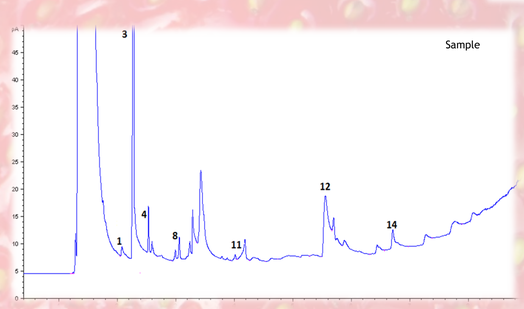
Chromatographic conditions

Carrier Gas	He
Fllow	1mL/minute
Detector	FID, 320ºC
Inyector	Split flow relation(5.4:1)
Inyector T	280ºC

Temperature gradient

Gradient (ºC/min)	Tª (ºC)	Time (min)
	50	1
5	250	5
10	300	1
Total time analysis 52 minutes		





Nº	Compuestos	Tr
1	Furaneol	1.629
2	2-Methyl-1-propanol	1.758
3	Methyl butanoate	2.182
4	Isoamyl alcohol	2.342
5	Hexanal	2.549
6	Ethyl butanoate	2.989
7	Ethyll hexanoate	3.032
8	Ethyl lactate	3.185
9	Octanoic acid	3.235
10	Ethyl 2-methylbutanoate	3.686
11	1-hexanol	3.928
12	Benzaldehyde	5.792
13	5-Methylfurfural	5.889
14	2-Octanol (IS)	6.704
15	cis-3-Hexenyl Acetate	6.909
16	trans-2-Hexenyl Acetate	7.140
17	Diethyl succinate	7.561
18	Mesifurane	8.241
19	Linalool	9.263
20	Benzyl alcohol	9.561
21	2-Phenylethyl alcohol	11.128
22	Nerol	12.718
23	Hexyl hexanoate	16.760
24	5-Hydroxymethylfurfural	18.594
25	cis-Nerolidol	20.290

Volatile Compounds	Calibration curve	R^2	LOD	LOQ	mg/L in samples
Furaneol	$y = 0.0224x + 0.178$	0.9847	2.976	9.921	5.78
2-Methyl-1-propanol	$y = 0.0089x + 0.0044$	0.9987	1.082	3.607	1.24
Methyl butanoate	$y = 0.0078x - 0.0072$	0.9950	2.092	7.973	6.20
Isoamyl alcohol	$y = 0.0095x + 0.0079$	0.9962	1.519	5.164	5.15
Ethyl Butanoate	$y = 0.0157x - 0.0106$	0.9910	4.306	14.353	nd
Ethyl lactate	$y = 0.0129x - 0.0062$	0.9965	1.627	5.425	5.33
1-hexanol	$y = 0.0127x - 0.0142$	0.9971	1.125	3.751	1.50
Benzaldehyde	$y = 0.0114x - 0.0317$	0.9809	3.950	13.179	9.16
5-Methylfurfural	$y = 0.0173x - 0.0123$	0.9951	1.914	7.380	nd
Mesifurane	$y = 0.0047x - 0.003$	0.9941	1.843	6.146	nd
Linalool	$y = 0.0138x - 0.0177$	0.9977	1.372	4.574	nd
Nerol	$y = 0.0296x - 0.1272$	0.9956	1.824	8.081	nd
trans-2-hexenyl acetate	$y = 0.0123x - 0.0106$	0.9971	1.588	5.295	nd
Octanoic Acid	$y = 0.0204x - 0.0168$	0.9839	3.817	12.723	6.01

The profile of major volatile compounds was determined by GC-FID and direct injection of the wine, identifying and analyzing 8 compounds including furaneol (compound responsible for strawberry odor) and isoamyl alcohol, benzaldehyde, methyl butyrate, 1-hexanol , Ethyl lactate, octanoic acid, isobutanol, ethyl butyrate, which are metabolites originated during the fermentation process

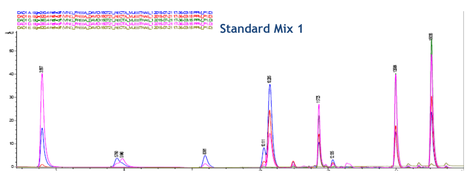
Profile of phenolic compounds

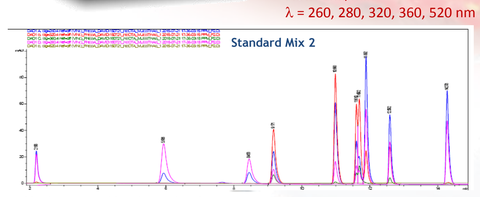
Samples

13400 rpm
5 min

Time	Formic Acid 1%	Acetonitrile
0	95	5
5	95	5
8	85	15
13	60	40
17	60	40
19	0	100
22	0	100
24	5	95

Inyection volume: 5 µL
Flow: 1ml/min
λ = 260, 280, 320, 360, 520 nm





λ= 260 nm ⇨ Protocatechic Acid (3.58); p-Hidroxibenzoic acid (6); Vanillic acid (8.5); Sinapic acid (11.7); Rutin (11.8)

λ= 280 nm ⇨ Galic acid (2.2); Tirosol (5.8); Catechin (8.4); Protocatechyl aldehyde (10.1); Vanillin (10,3); m-Coumaric acid (11.9); p-Hydroxyphenylacetic acid (12); Epicatechin (12.1); o-Coumaric acid (12.6); Cinamic acid (14.3)

λ= 320 nm ⇨ Caffeic acid (9,2); p-Coumaric acid (11), Ferulic acid (11.6); Elagic acid (11.7)

λ= 360 nm ⇨ Quercetin (14); Kaempferol (15)

λ= 520 nm ⇨ Cianidin chloride (11.6); Pelargonidin Chloride (12.2)

From the twenty-three phenols analyzed, only eight compounds (shown in the table) were identified and quantified in the elaborated wines.

Compuesto	Retention time	mg/L	SD
1. Galic acid	2,2	4,49	0,64
2. Tirosol	5,8	10,08	0,53
3. p-hidroxibenzoic acid	6	7,43	1,90
4. Catechin	8,4	15,74	0,73
5. Caffeic acid	9,2	22,60	1,26
6. Cianidin chloride	11,6	27,15	1,52
7. m-coumaric acid	11,9	8,24	0,65
8. Pelargonidin Chloride	12,2	11,19	0,92