Supplementary Materials

Sustainable Development of Dairy-Based Functional Beverages Enriched with Bee Pollen: A Circular Economy Approach

Table S1. Volatile compounds (relative content, %) in fermented dairy beverages samples.

No	Compounds	Flavor description [2]	CAS	RI_{cal} [3]	RI_{ref} [4]	MB37.5	MW37.5	MW75	MBW	M100	MB75
	Esters										
1	Ethyl acetate	Pineapple	141-78-6	-	878	1.56	4.25	1.79	3.55	1.68	4.76
2	Vinyl acetate		108-05-4	988	-	0.43	0.59	0.40	0.75	0.59	1.23
3	Methyl butanoate	Ether Fruity Sweet	623-42-7	993	989	0.14	0.20	0.09	0.30	0.10	0.29
4	Isobutyl acetate	Fruity Apple Banana	110-19-0	1019	1018	1.34	3.37	1.92	2.96	1.36	3.81
5	Ethyl butyrate	Apple	105-54-4	1041	1042	0.43	0.34	0.31	0.19	-	0.23
6	2-Pentyl acetate	Herbaceous	626-38-0	1078	1075	3.76	8.73	5.72	8.53	9.11	10.32
7	Isobutyl isobutyrate	Pineapple	97-85-8	1094	1092	0.61	0.09	0.23	0.11	0.07	0.07
8	Isoamyl acetate	Banana	123-92-2	1126	1125	4.51	14.41	9.55	10.66	6.21	13.68

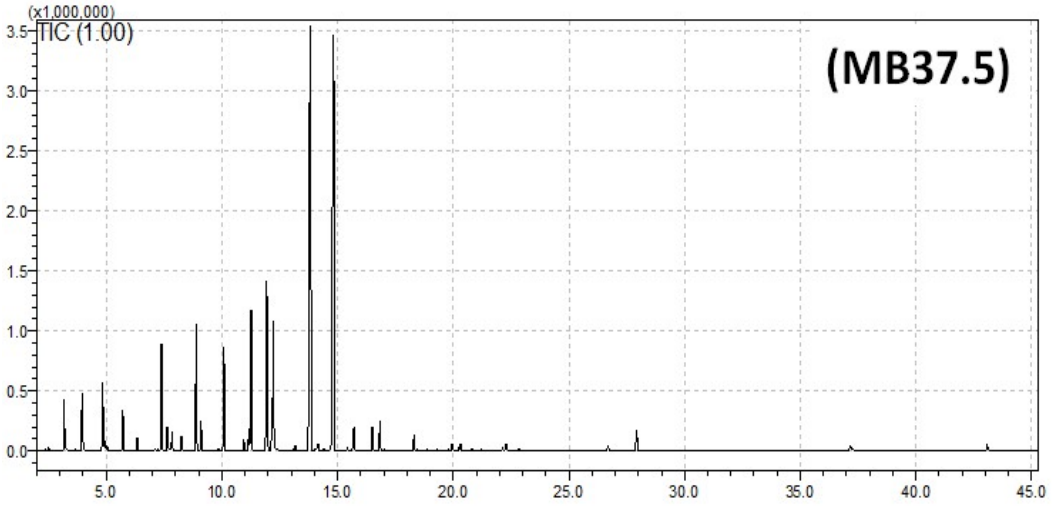
9	Isobutyl butyrate	Sweet Fruity Apple Pineapple	539-90-2	1162	1160	3.65	2.68	3.66	3.07	4.21	1.88
10	Isobutyl isovalerate		589-59-3	1194	1191	0.92	0.12	0.66	0.14	0.14	-
11	Isoamyl isobutyrate	Fruity	2050-01-3	1197	1195	5.20	0.99	2.21	1.04	0.77	0.57
12	Propanoic acid, 2-methyl-, 1-methylbutyl ester		54340-93-1	1219	-	0.47	2.55	3.86	3.71	9.23	2.42
13	Ethyl hexanoate	Apple Fruity	123-66-0	1240	1236	-	0.15	0.10	-	-	-
14	Butyl isovalerate	Fruity	109-19-3	1253	1250	0.23	-	0.19	-	-	-
15	Isoamyl butyrate	Fruity banana	106-27-4	1272	1267	25.70	24.11	25.35	23.82	27.36	16.97
16	Hexyl acetate	Fruity Herb	142-92-7	1278	1275	0.12	0.37	0.29	0.31	-	-
17	Isoamyl 2-methylbutyrate	Fruity	27625-35-0	1281	1274	0.26	-	0.25	0.06	-	-

18	Prenyl isobutyrate	Fruity Buttery	76649-23-5	1289	-	0.09	0.13	0.14	0.15	0.28	-
19	Isoamyl isovalerate	Fruity Apple	659-70-1	1301	1294	22.96	2.96	17.67	3.04	2.68	2.19
20	Methyl octanoate	Orange	111-11-5	1397	1390	-	0.29	0.12	0.13	-	-
21	Butanoic acid, 1-methylhexyl ester		39026-94-3	1405	1401	0.56	0.31	0.63	0.40	0.86	0.50
	Alcohols										
22	Ethanol	Sweet	64-17-5	938	937	2.13	0.84	1.31	0.91	0.59	1.04
23	Isobutanol	Wine Solvent Bitter	78-83-1	1107	1108	0.59	0.18	0.46	0.29	0.13	0.35
24	2-pentanol	Green	6032-29-7	1132	1127	0.95	-	-	-	-	-
25	Butanol	Medicine Fruity	71-36-3	1155	1157	0.08	0.10	0.09	0.13	0.08	0.13
26	3-Methyl-1-butanol	Whiskey Malt Burnt	123-51-3	1217	1217	8.41	1.64	2.36	2.59	1.11	3.19
27	2-heptanol	Mushroom	543-49-7	1327	1326	0.92	0.67	0.61	1.12	1.10	1.59

28	Hexanol	Resin Flower Green	111-27-3	1361	1362	1.01	1.05	0.54	1.19	0.67	1.56
	Ketones										
29	2-pentanone	Ether Wine Fruity	107-87-9	983	982	2.30	2.73	1.66	4.64	3.68	5.55
30	2-heptanone	Soap	110-43-0	1188	1188	0.43	0.67	0.37	0.95	0.93	0.96
	Aldehydes										
31	Hexanal	Grass Tallow Fat	66-25-1	1087	1087	0.78	1.64	1.35	2.74	3.56	2.49
32	2-hexenal, (E)-	Apple Green Vegetable	6728-26-3	1225	1220	4.77	9.68	9.55	12.08	15.79	12.31
	Ether										
33	Butane, 1-methoxy-3-methyl-		626-91-5	1351	-	0.84	0.96	0.67	1.37	1.35	2.01
	Acids										

34	Hexanoic acid	Sweat	142-62-1	-	1849	0.40	5.10	0.76	2.94	0.64	2.80
35	Octanoic acid	Sweat, Cheese	124-07-2	-	2038	0.32	3.08	0.52	1.75	0.41	1.82

[1] Flavor description were checking from the Specifications for Flavourings presented by JECFA (Joint FAO/WHO Expert Committee on Food Additives) (https://www.fao.org/food-safety/scientific-advice/jecfa/en/), and Flavor Substances website (https://www.flavornet.org/); [2] RI_{cal} is the retention index value calculated according to eqn (4); [3] RI_{ref} is the reference retention index value consulted on the website (https://webbook.nist.gov/chemistry/); and "-" Information not available. The chromatograms are presented in Fig. S1 in the Supplementary Material.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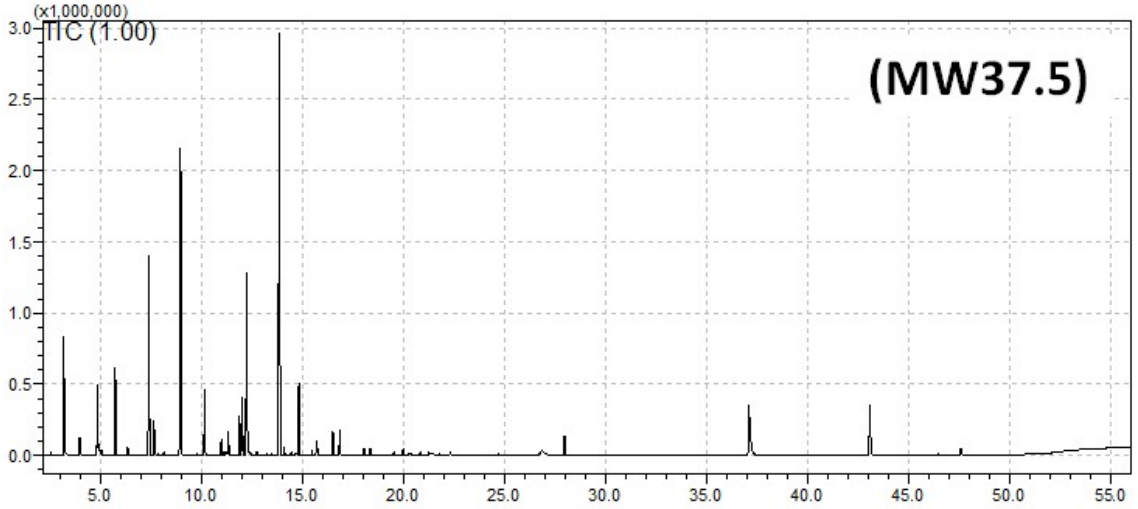
(MB37.5)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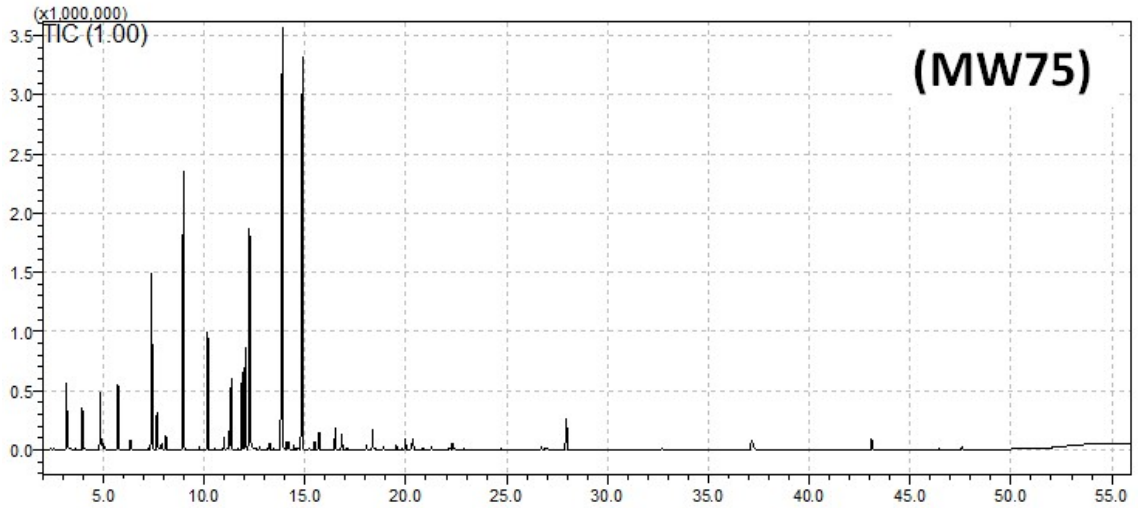
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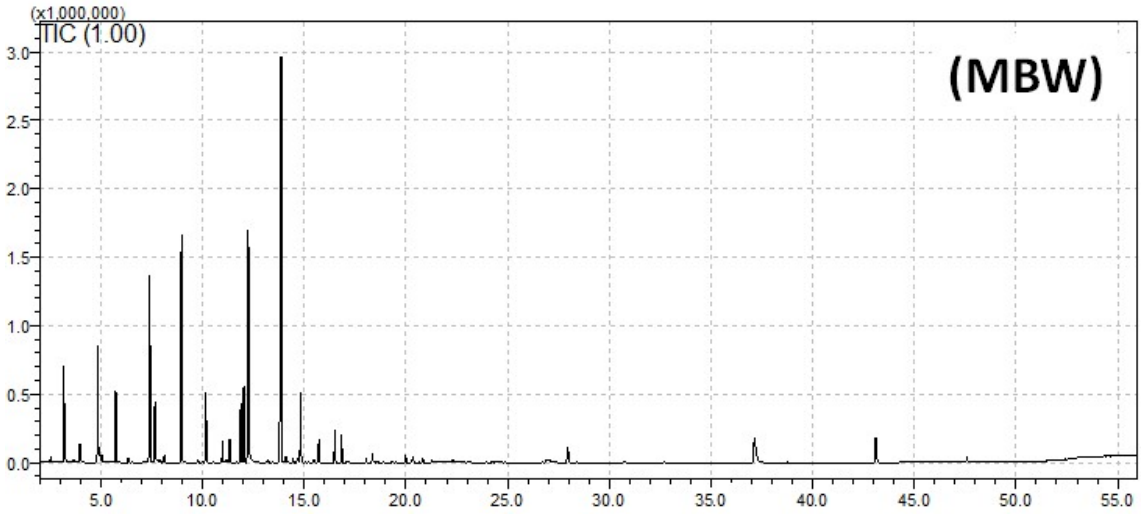
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2.0
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1.0
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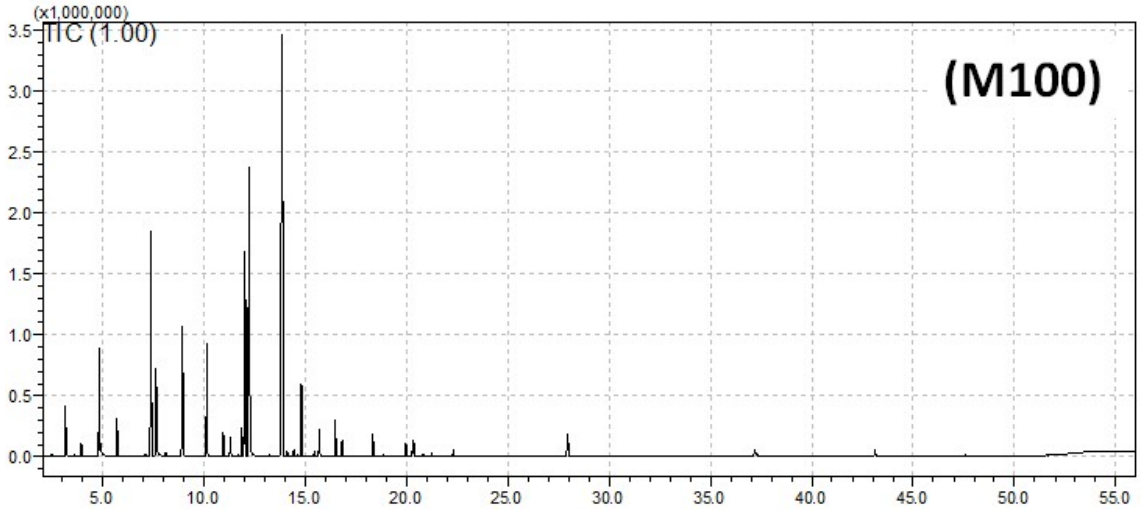
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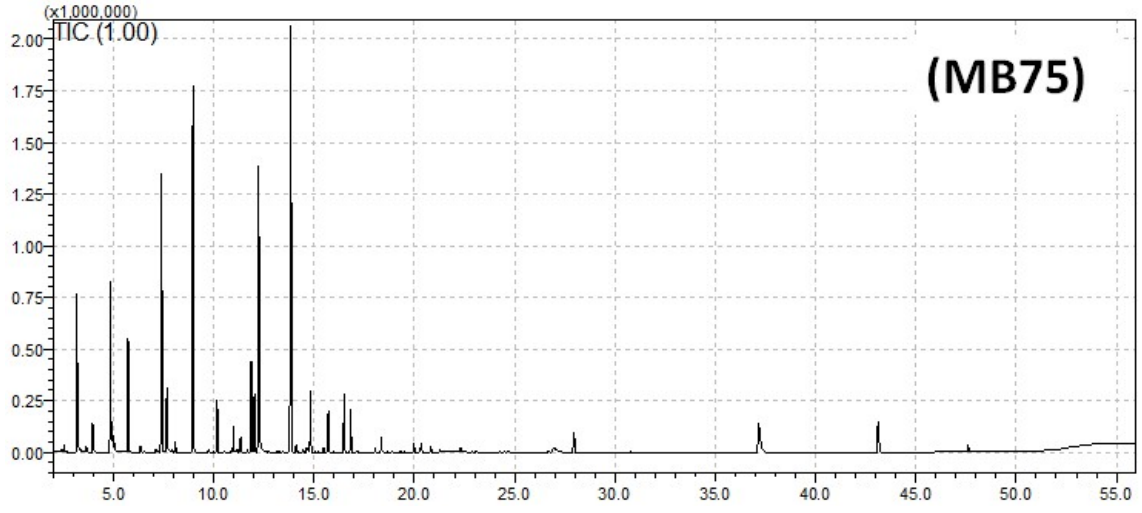
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Fig. S1 Chromatograms obtained from the analysis of samples of fermented dairy beverages by gas chromatography coupled to mass spectrometry (GC-MS).