MILESTONE

HELPING CHEMISTS

APPLICATION REPORT

EX00 - BASIL FRAGRANCES

Basil Solvent-Free Microwave Extraction (SFME) and Microwave Hydrodistillation (MWHD)

Introduction

Ocimum basilicum L. (Lamiaceae), respectively, named basil, is an aromatic herb that has been used traditionally as a medicinal herb in the treatment of headaches, coughs, diarrhea, constipation, warts, worms and kidney malfunctions. It has a long history as culinary herb, thanks to its foliage adding a distinctive flavor to many foods. It is also a source of aroma compounds and essential oils containing biologically active constituents that possess insecticidal, nematicidal, fungistatic and antimicrobial properties[1].

[1] O. Politeo, M. Jukic, M. Milos, Food Chemistry 2007, 101, 379-385.

rev.00/2016

Why to choose Microwave Fragrances set-up?

The standard method is the Clavenger method, which was published for the first time in 1928. According to that method, the essential oil from basil can be extracted by hydrodistillation or steam distillation. These techniques take several hours of heating which may cause degradation of thermolabile compounds present in the starting plant material and therefore odor deterioration.The patented and innovative Microwave Hydrodistillation (MWHD) and Solvent-free Microwave Extraction (SFME) techniques allow the production of essential oils with higher quality.

- High quality frangrances
- No thermal degradation
- Fast extraction
- High purity, no artifacts

Instrumentation and Principles of Operation

A very efficient extraction process can be achieved thanks to the selective heating of microwaves to materials through molecular interactions with the electromagnetic field via conversions of electromagnetic energy into thermal energy. The high quality fragrance were obtained through the SFME or MWHD techniques (see the “Microwave Extraction Techniques” section for theory and principle).

Results and experimental procedure

The SFME and the MWHD techniques are respectively suitable for fresh and dry raw materials. See the “Quick start guide” for a list of easy and sequential setting-up operations (*Table 1*).

Fresh Basil, SFME						
Reactor	Weighted fresh raw material [g]*	Power [W]	Chiller		Volatile fraction [mL]	Yield [%]
			1kW	2.1kW		
Small	500	500	•		0.4	0.07
Medium	1580	1580		•	1.3	0.08
Large	3720	1800		•	3	0.08

Dry Basil, MWHD						
Reactor	Weighted dry soaked material [g]*	Power [W]	Chiller		Volatile fraction [mL]	Yield [%]
			1 kW	2.1kW		
Small	500	500	•		0.2	0.04
Medium	1580	1580		•	0.5	0.03
Large	3720	1800		•	1.5	0.04

*Time, Power
The extractions were carried out till complete recovery of the fragrance
≤ 1800 g: Power(W) = Weight(g).
> 1800g: Power = 1800W
Chiller settings:
≤ 900g, 1 kW Chiller
> 900g, 2.1 kW Chiller

Table 1

Important remarks

The system is developed with an automatic recirculation of the distilled water. This allows to manage extraction power and time to match your own specific requirements. Please take care to seal properly the glass reactor during the installation of the fragrances set-up according to the manual, to avoid loss of vapor during extraction.

Conclusion

In this study, we propose state-of-the-art processes for extraction of essential oils from Basil through SFME and MWHD. It is the unique modern concept of the antiquated Clavenger method, highly accelerating the isolation process, without causing changes in the volatile oil composition. The efficiency of the new techniques SFME and MWHD are considerably higher than the conventional procedure, if we take into account short distillation times required, cost and energy used and cleanliness of the process. An added-value feature is the possibility to work with scalar amounts of sample due to three different reactor vessels (small, medium, large), complying with a high range of extraction-scale needs.

No.	Identified compound	Peak area (%)	RI[a] HP-20M	RI[a] HP-101
1	β-Pinene	0.1	-	949
2	Limonene	0.1	1180	1005
3	1,8-Cineole	4.0	1185	1006
4	Camphor	0.5	1477	1109
5	Linalool	28.6	1518	1092
6	Bornyl acetate	0.5	1545	1252
7	Terpinen-4-ol	0.7	1563	1154
8	α-Bergamotene	2.2	1564	1407
9	Caryophyllene	0.3	-	1385
10	Aloaromadendrene	0.1	-	1450
11	Estragole	21.7	1632	1177
12	α-Terpineol	1.0	1653	1176
13	Germacrene D	0.3	1673	1444
14	α-Humulene	0.2	-	1417
15	Carvone	0.4	1685	1207
16	β-Cubebene	0.5	1694	1059
17	β-Burbonene	t	-	1354
18	β-Elemene	0.3	-	1364
19	α-Cadinene	0.2	1716	1426
20	Calamenene	0.2	-	1483
21	α-Amorphene	1.0	1710	1479
22	β-Farnesene	0.2	-	1452
23	Δ-Cadinene	0.1	1724	1486
24	α-Bisabolene	0.1	-	1506
25	(Z)-Methyl cinnamate	1.6	1900	1281

Table 2. Chemical composition of basil essential oil

No.	Identified compound	Peak area (%)	RI[a] HP-20M	RI[a] HP-101
26	Methyl eugenol	3.1	1959	1378
27	(E)-Methyl cinnamate	14.3	2019	1364
28	Spatulenol	0.8	2066	-
29	Eugenol	5.9	2105	1368
30	Carvacrol	t	2118	1814
31	α-Cadinol	7.1	2120	1614
32	Torreyol	0.2	2173	-
33	Chavicol	0.7	-	-[b]
	Total	97.0		

–, not identified.
t, trace (<0.1%).
[a] Retention indices relative to C_8–C_{22} n-alkanes on polar HP-20M and apolar HP-101 column.
[b] Retention times is outside of retention times of homologous series of C_8–C_{22} n-alkanes (identified by MS).

Table 2 (continued).