ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-9

COMPOSITION OF ESSENTIAL OIL FROM DRIED BASIL (Ocimum Basilicum L.)

Mambetsheripova A.A.[1], Sultanova Sh.A[2]., Safarov J.E[3]

[1]*Karakalpak state university named after Berdakh*

[2]*Deputy mayor of Tashkent city*

[3]*Tashkent state technical university*

e-mail: *jasursafarov@yahoo.com, tel: +998935690288*

Abstract. The present work describes a methodological approach for the isolation and analysis of essential oils (EOs) obtained from finely ground basil plants. The extraction of basil EO was carried out by hydrodistillation using a classical Clevenger apparatus for a duration of three hours. The distillates were subsequently treated with n-hexane, followed by dehydration with anhydrous sodium sulfate in order to remove residual moisture. The yield of the essential oil under these conditions varied within the range of 0.74–0.81%. The isolated oils were characterized as pale-yellow, mobile liquids possessing a specific aromatic odor typical of basil. For the identification of chemical constituents, the qualitative and quantitative composition of the oils was studied using gas chromatography–mass spectrometry (GC–MS). The analyses were performed on an Agilent 5975C inert MSD/7890A GC instrument equipped with a quartz capillary column Agilent HP-INNOWax, under a programmed temperature regime. This integrated approach enables reliable isolation, precise characterization, and effective identification of the component profile of basil essential oils.

Keywords: essential oils, basil, hydrodistillation, gas chromato-mass spectrometry (GC-MS), component composition, yield, aromatic compounds.

QURUTILGAN RAYHONDAN (Ocimum Basilicum L.) OLINGAN EFIR MOYINING TARKIBI

Mambetsheripova A.A., Sultanova Sh.A., Safarov J.E.

Annotatsiya. Ushbu ishda maydalangan rayhon (Ocimum basilicum L.) o‘simliklaridan olingan efir moylarini (EM) ajratish va tahlil qilishga oid metodologik yondashuv bayon etilgan. Rayhon efir moyi klassik Klevenger apparati yordamida uch soat davomida gidrodistillyatsiya usulida ajratib olindi. Olingan distillyatlar n-geksan bilan ishlov berildi, so‘ngra qoldiq namlikni yo‘qotish maqsadida suvsiz natriy sulfat yordamida degidratatsiya qilindi. Ushbu sharoitda efir moyining chiqishi 0,74–0,81 % oralig‘ida bo‘ldi. Izolyatsiya qilingan moylar rang jihatdan och sariq, harakatchan suyuqliklar bo‘lib, rayhonga xos o‘ziga xos aromatik hidga ega ekanligi aniqlandi. Kimyoviy komponentlarni aniqlash uchun efir moyining sifat va miqdoriy tarkibi gaz xromatografiya-mass-spektrometriyasi (GXM-S) usulida o‘rganildi. Tahlillar Agilent 5975C inert MSD/7890A GC qurilmasida, Agilent HP-INNOWax kvarts kapillyar kolonnasi yordamida, dasturlashtirilgan harorat rejimida olib borildi. Ushbu kompleks yondashuv rayhon efir moylarini ishonchli ajratish, aniq tavsiflash va samarali identifikatsiya qilish imkonini beradi.

Kalit so‘zlar: efir moylari, rayhon, gidrodistillyatsiya, gaz xromatografiya-mass-spektrometriya (GXM-S), komponentlar tarkibi, chiqim, aromatik birikmalar.

СОСТАВ ЭФИРНОГО МАСЛА ИЗ СУШЕНОГО БАЗИЛИКА (Ocimum Basilicum L.)

Мамбетшерипова А.А., Султанова Ш.А., Сафаров Ж.Э.

Аннотация. В настоящей работе описывается методологический подход к выделению и анализу эфирных масел (ЭМ), полученных из мелко измельченных растений базилика. Экстракция ЭМ базилика проводилась методом гидродистилляции с использованием

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-9

классического аппарата Клевенгера в течение трех часов. Дистилляты затем обрабатывались н-гексаном, после чего проводилась дегидратация безводным сульфатом натрия для удаления остаточной влаги. Выход эфирного масла в этих условиях колебался в пределах 0,74–0,81 %. Изолированные масла были охарактеризованы как бледно-желтые, подвижные жидкости, обладающие специфическим ароматическим запахом, типичным для базилика. Для идентификации химических компонентов качественный и количественный состав масел был изучен с помощью газовой хроматографии-масс-спектрометрии (ГХ-МС). Анализы проводились на приборе Agilent 5975C inert MSD/7890A GC, оснащенном кварцевой капиллярной колонкой Agilent HP-INNOWax, в режиме программируемой температуры. Такой комплексный подход позволяет надежно выделять, точно характеризовать и эффективно идентифицировать состав компонентов эфирных масел базилика.

Ключевые слова: эфирные масла, базилик, гидродистилляция, газовая хромато-масс-спектрометрия (ГХ-МС), состав компонентов, выход, ароматические соединения.

INTRODUCTION

Essential oils are valuable natural products with a wide range of biological activity and are used in the pharmaceutical, food, and perfume and cosmetics industries. Among aromatic plants, basil (Ocimum basilicum L.) occupies a special place, whose essential oil is characterised by a high content of volatile aromatic compounds and a variety of biologically active components. Despite a fairly large number of studies devoted to essential oils, the development and improvement of methods for their extraction, as well as a detailed study of their qualitative and quantitative composition, remain a pressing task. In this regard, the study of the chemical profile of basil essential oil by gas chromatography-mass spectrometry is an important direction for establishing its potential properties and expanding its practical application possibilities [1-5].

MATERIALS AND METHODS

Essential oils (EOs) were obtained from finely ground basil plants by hydrodistillation for 3 hours using a standard method with a Clevenger apparatus. The obtained distillates were extracted with n-hexane, and the EO extracts were dried with anhydrous sodium sulfate. After removing the solvent, we obtained EOs with the following yields:

- № 1 - 0.76%;
- № 2 - 0.74%;
- № 3 - 0.76%;
- № 4 - 0.78%;
- № 5 - 0.75%;
- № 6 - 0.81%.

Prior to analysis, the oils were stored at 4°C in a refrigerator in tightly sealed vials. The obtained basil EOs are pale yellow, mobile liquids with a characteristic odor. The qualitative and quantitative composition of basil EM was determined by chromato-mass spectrometry (GX-MS) using the Agilent 5975C inert MSD/7890AGC device. To separate the components of the mixture, the Agilent HP-INNO Wax (30 m × 250 μm × 0.25 μm) quartz capillary column was used in the temperature range: 60°C (2 min) - 4°C/min to 220°C (10 min) - 10°C/min to 240°C (20 min). The volume of the administered sample was 1.0 μl, the flow rate of the mobile phase (H2) was 1.0 ml/min. Components were identified based on comparing mass spectral characteristics with electronic library data (Wiley-9th Ed. and NIST 2017) and comparing the retention indices (RI) of compounds determined in

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-9

relation to the retention time (RV) of n-alkanes (C9-C32), as well as comparing their mass spectral fragmentation with those described in the literature [6-9].

RESULTS AND DISCUSSION

The results of the laboratory experiments on the qualitative and quantitative essential oil composition of basil (Ocimum basilicum L.) are summarized in a systematic order and provided in Table 1. The table provides the total data regarding the individual chemical compounds of the oil, together with their relative percent content as determined by gas chromatography–mass spectrometry (GC–MS). These data allow complete description of the volatile profile of basil essential oil and comparison with literature data. Summarized results take into consideration both the variety of the aromatic compounds present in the oil and their contribution to the overall chemical composition, therefore highlighting the significance of basil as a rich source of bioactive molecules.

Table 1

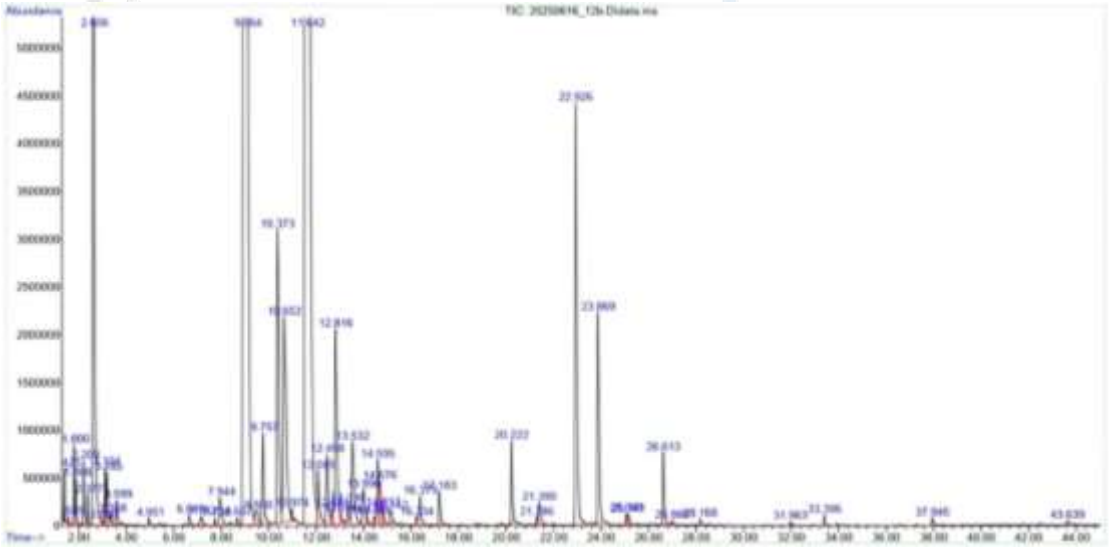
Component composition of essential oil in basil

№	Component	(RI)	Samples, %					
			1	2	3	4	5	6
1	α-Pinene	1040	0,13	0,06	0,14	0,06	0,15	
2	β-Pinene	1076	0,26	0,15	0,27	0,13	0,24	0,06
3	Sabinene	1085	0,17	0,10	0,19	0,09	0,14	-
4	β-Myrcene	1114	0,26	0,20	0,26	0,15	0,20	-
5	α-Terpinene	1128	0,16	0,10	0,12	0,11	0,13	-
6	Eucalyptol (1,8-cineole)	1148	7,07	6,86	8,14	4,25	5,05	5,11
7	β-Ocimene	1198	0,20	0,19	0,29	0,11	0,21	0,24
8	*o*-Cymene	1207	0,09	0,08	0,07	-	0,09	-
9	Terpinolene	1218	0,22	0,15	0,14	0,13	0,14	-
10	(*Z*)-4-hexen-1-ol	1282	0,02	0,03	0,05	-	0,04	0,11
11	Camphor	1418	0,39	0,37	0,44	0,30	0,31	0,33
12	α-Copaene	1446	0,27	0,07	0,05	0,09	0,11	-
13	cis-Ocimene	1461	28,82	31,01	31,49	21,65	29,13	23,38
14	β-Phellandrene	1477	-	0,22	0,21	0,24	0,28	0,26
15	(-)-Bornyl acetate	1488	0,74	0,70	0,67	0,57	0,72	0,64
16	γ-Terpinene	1510	3,27	4,20	4,33	2,58	3,14	3,76
17	α-Bergamotene	1521	5,35	4,66	8,41	2,80	6,93	4,00
18	3-Carene	1533	0,13	0,09	0,05	-	0,13	
19	Estragole	1558	39,23	37,26	47,52	41,72	34,14	38,52
20	Isobornyl acetate	1588	0,70	0,65	0,64	0,92	0,79	0,48
21	(+)-epi-Bicyclosesquiphellandrene	1596	-	-	-	0,27	0,25	-
22	α-Terpineol	1601	1,96	1,91	2,26	1,95	1,86	2,04
23	(-)-Isoledene	1629	1,53	1,28	0,92	2,54	2,19	0,34
24	Germacrene B	1646	0,54	0,44	0,34	0,98	0,67	0,11
25	β-Bisabolene	1651	0,11	0,10	0,06	0,57	0,18	-

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

26	γ-Cadinene	1669	1,35	1,17	0,81	2,67	2,35	1,64
27	β-Sesquiphellandrene	1690	0,21	0,23	0,12	0,42	0,35	-
28	Cosmen	1696	-	0,04	-	-		-
29	Calamenene	1733	0,08	0,11	0,07	0,17	0,10	-
30	Phenylethyl alcohol	1770	0,10	0,20	0,25	0,14	0,14	0,55
31	Methyleugenol	1894	0,26	0,26	0,49	1,17	0,38	0,19
32	β-Selinene	1940	0,05	0,04	0,04	0,08	0,07	-
33	(+)-Cubenene	1944	0,31	0,28	0,24	0,50	0,38	0,63
34	Eugenol	2011	1,17	2,18	3,20	1,53	1,97	-
35	γ-Muurolene	2055	1,79	1,84	4,24	3,28	2,54	1,62
36	Eremophilene	2109	-	-	0,06	-	-	-
37	(+)-Aromadendrene	2110	0,05	0,07	-	0,09	0,09	-
38	10-Epizonarene	2113	0,10	0,11	0,10	0,19	0,12	0,41
39	Chavicol	2134	0,17	0,27	0,44	0,26	0,31	0,76
40	Docosane	2200	-	0,04	-	-	-	0,18
41	Indole	2256	-	0,03	0,04	-	0,03	-
42	Tetracosane	2400	-	0,04	-	-	-	0,16
43	Pentacosane	2500	-	0,04	-	-	-	0,19
44	Palmitic acid	2774	-	-	-	-	0,87	-
45	1-Tetradecene	2777	0,02	0,03	0,05	0,09	-	0,65
46	Stearic acid	2987	-	-	-	-	0,97	0,07
	Σ		**97,28**	**97,86**	**117,21**	**92,8**	**97,89**	**86,43**

The results of chromatographic analysis of basil essential oil obtained using various drying methods are presented in the chromatograms shown in Figures 1–6. These graphical materials allow for a clear comparison of the qualitative and quantitative composition of the volatile components of the oil depending on the drying method used, as well as to identify differences in the content of the main aromatic compounds.



ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

VOLUME-5, ISSUE-9

Figure 1. Chromatogram of determination of essential oil in the composition of dried basil during solar drying

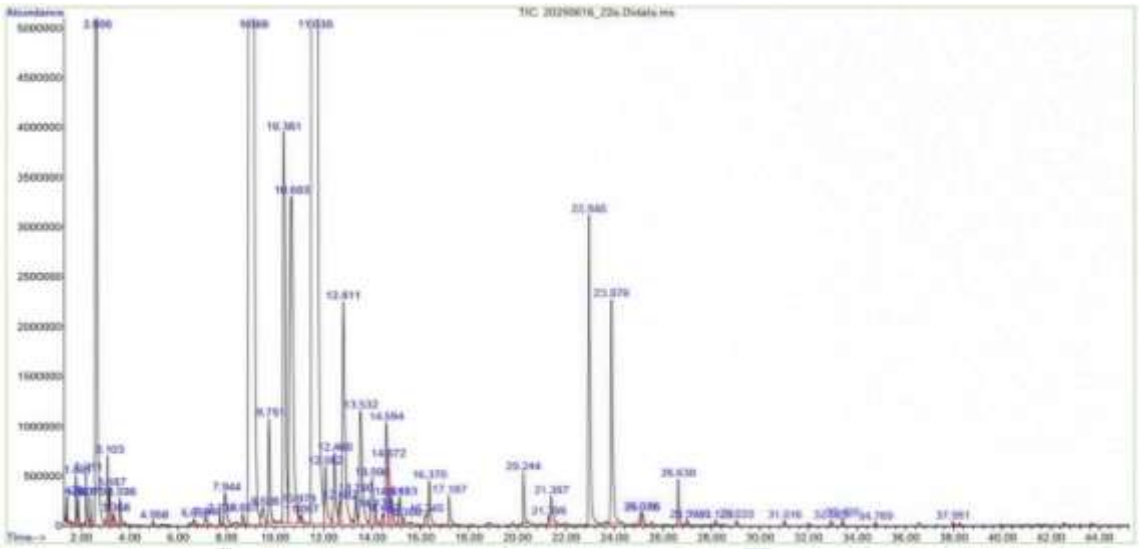


Figure 2. Chromatogram of determination of essential oil in the composition of dried basil during solar drying

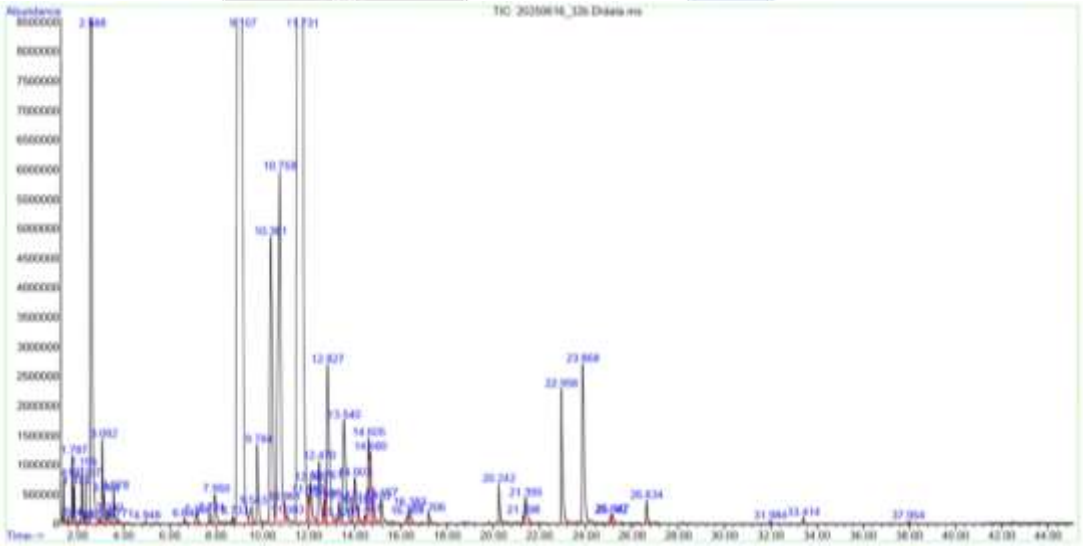


Figure 3. Chromatogram of determination of essential oil in the composition of dried basil during solar drying

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-9

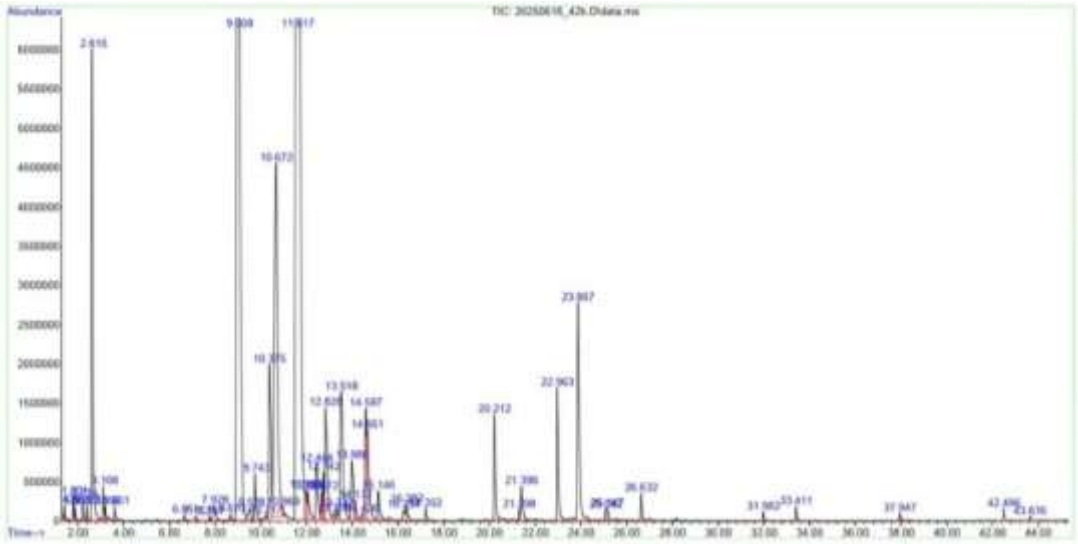


Figure 4. Chromatogram of determination of essential oil in the composition of dried basil during solar drying

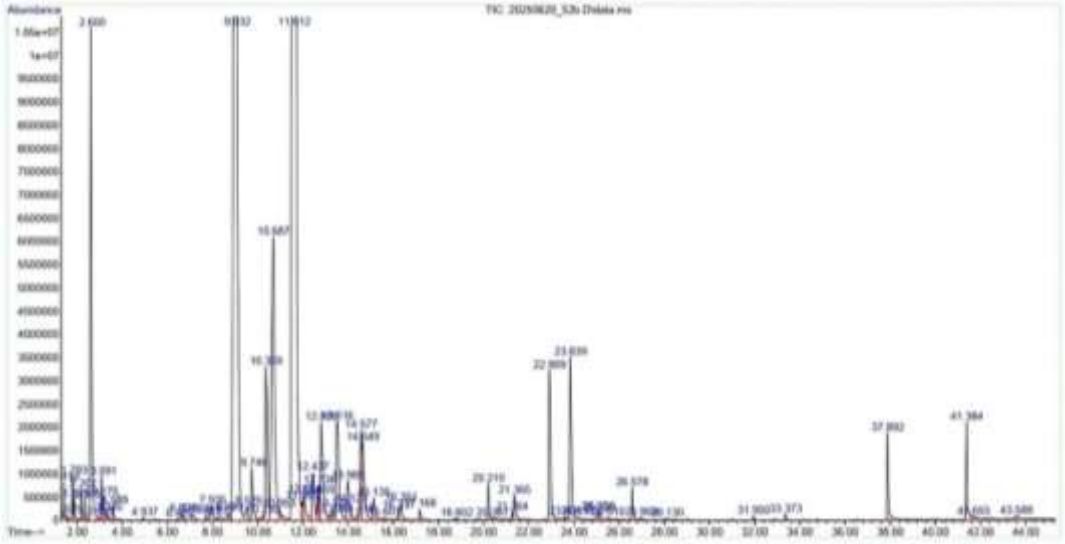


Figure 5. Chromatogram of determination of essential oil in the composition of dried basil by natural method

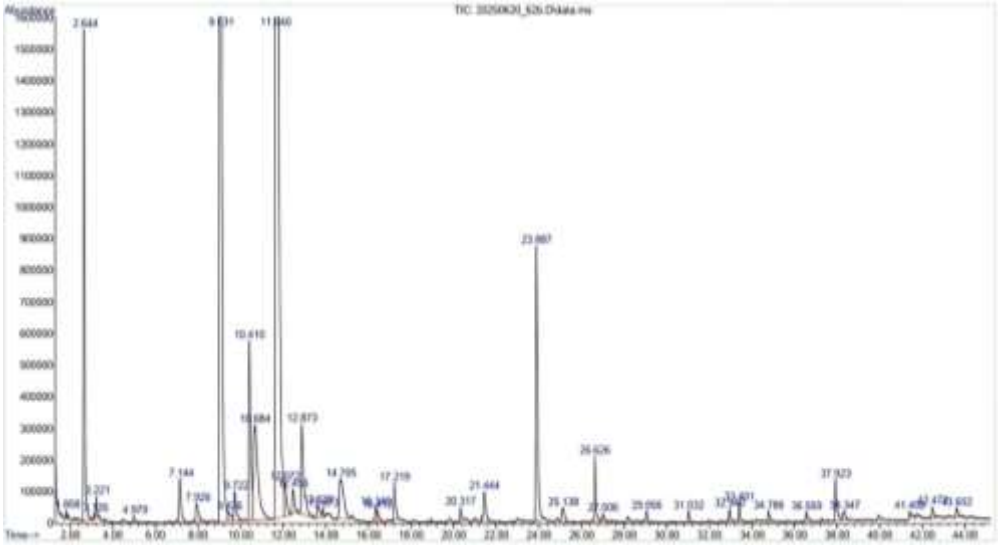


Figure 6. Chromatogram for determining the essential oil content in untreated (control) basil

A study of the chemical composition of six samples of dried basil showed that in sample No. 3, which is basil dried in a solar convective drying unit (a drying method proposed by the author), the concentration of essential oil is characterised by the following component content (%): β-Pinene – 0.27; Sabinene – 0.19; Eucalyptol – 8.14; β-Ocimene – 0.29; cis-Ocimene – 31.49; Camphor – 0.44; γ-Terpinene – 4.33; α-Bergamotene – 8.41; Estragole – 47.52; α-Terpineol – 2.26; γ-Myrcene – 4.24; Eugenol – 3.20. The data obtained indicate a high content of estragole and cis-ocimene, which determines the aromatic profile of the oil and can significantly affect its biological activity and practical application.

REFERENCES

1. Ткачев А. В. Исследование летучих веществ растений / А. В. Ткачев. - Новосибирск: «Офсет», 2008. — 969 с

2. Ionut Avrămia, Mircea-Adrian Oroian, Radu-Cristian Oiţă. A review of current trends of vitamin identification and quantification by chromatography from food samples. J Food Compos Anal. 2024;131:106244.

3. Amithabh G.S., Kumar T., Gireesh Kumar M.P., Kaviya S., Baskar B. Development and validation of a novel HPLC-UV method for quantifying vitamin D forms and precursors in vegetable oils after exposure to sunlight and UV radiation. Acta Chromatographica – 2024. https://doi.org/10.1556/1326.2024.01275

4. Sultanova Sh.A., Safarov J.E., Usenov A.B., Mambetsheripova A.A. Analysis of technology extraction of essential oil from basil plant. XIII International scientific and practical conference “Scientific achievements in solving current problems of production and processing of raw materials, standardization and food safety”. -Kiev, 2025. P.28-30.

5. Мамбетшерипова А.А., Султанова Ш.А., Сафаров Ж.Э. Изменение свойств пищевых материалов растительного происхождения во время сушки на клеточном уровне. V Международный нучно-технической конференции «Инновационные решения: устойчивое развитие в сельском хозяйстве и пищевой промышленности». -Ташкент, 2025. С.278-279.

6. Mambetsheripova A.A, Makhmudov K.A. Safarov J.E, Sultanova Sh.A. Study of bazilik (ocimum basilicum l.) as an object for drying. International scientific and practical conference “Scientific achievements in solving current problems of production and processing of raw materials, standardization and food safety”. -Kiev, 2024. p.147-150.

7. Mambetsheripova A.A, Safarov J.E, Sultanova Sh.A. Changes in the properties of food materials of plant origin during drying at the cellular level. International scientific and practical conference “Scientific achievements in solving current problems of production and processing of raw materials, standardization and food safety”. -Kiev, 2024. p.131-133.

8. Султанова Ш.А., Мамбетшерипова А.А., Сафаров Ж.Э. Энергоэффективный метод сушки. III Международной научно-технической конференции «Актуальные проблемы системы электроснабжения». Ташкент, 2023. -С.54-55.

9. Sultonova S.A., Saparov Dj.E., Mambetsheripova A.A., Usenov A.B., Alimova D.Q. Control of modes of energy-saving vibro-drying devices. // RSES 2023. E3S Web of Conferences 461, 01059 (2023). P.1-4.