Indirect Skin Homeostasis Modulation by an Essential Oil Blend in Mice with Insomnia Comorbid Anxiety: Sensitivity of Dermal Fibroblasts to Exogenously Applied Circulating Molecules

Supplementary Materials

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Quality Test Report of Lavender Essential Oil
Quality Test Report of Orange Essential Oil
Quality Test Report of Clary sage Essential Oil
Quality Test Report of Roman chamomile Essential Oil
Quality Test Report of Kushui rose Essential Oil
Quality Test Report of Sandalwood Essential Oil

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Supplementary Table S1. Composition of the essential oil blend (EOB) as determined by GC-MS

No.	Compound	Retention times(min)	Retention index (RI)	Relative content (%)	Library (RI)
1	alpha-Pinene	3.86	1014	0.77	1028±8
2	3-Thujene	3.94	1018	0.05	1028±7
3	Camphene	4.67	1054	0.15	1071±8
4	Isobutyl isobutyrate	5.24	1082	0.14	1090±2
5	beta-Pinene	5.56	1098	0.11	1112±7
6	Sabinene	5.90	1111	0.13	1124±8
7	3-Carene	6.61	1137	0.09	1147±7
8	Myrcene	7.04	1152	0.69	1161±7
9	Isobutyl methacrylate	7.13	1155	0.12	1168±6
10	Isobutyl 2-methylbutyrate	7.43	1166	0.09	1179±6
11	2-Methylallyl isobutyrate	7.50	1169	0.04	/
12	Limonene	7.98	1186	13.67	1200±7
13	beta-Phellandrene	8.23	1195	0.14	1211±7
14	Eucalyptol	8.30	1198	0.52	1213±9
15	Butyl butyrate	8.63	1208	0.08	1220±8
16	trans-beta-Ocimene	9.13	1224	2.30	1250±6
17	gamma-Terpinene	9.40	1233	0.07	1246±9
18	beta-Ocimene	9.63	1240	0.65	1250±4
19	2-Methylallyl methacrylate	9.74	1244	0.10	/
20	p-Cymene	10.07	1254	0.11	1272±8
21	Hexyl acetate	10.27	1261	0.43	1272±7
22	Terpinolene	10.51	1268	0.17	1283±7
23	Isobutyl angelate	10.78	1277	0.74	1290±3
24	(E)-2-Methylbut-2-en-1-yl isobutyrate	11.61	1303	0.08	/
25	Butyl angelate	12.52	1331	0.07	1417±N/A
26	Neoalloocimene	13.38	1358	0.11	/
27	2-Butenoic acid, 2-methyl-, 2-methyl-2-propenyl ester, (Z)-	13.43	1360	0.72	/
28	1-Octen-3-yl-acetate	13.65	1366	1.40	1380±6
29	3-Methylpentyl methacrylate	13.85	1372	0.18	/
30	Pentan-2-yl 2-methylbut-2-enoate	13.98	1377	0.42	/
31	2-Methylbutyl angelate	14.12	1381	0.70	1395±N/A
32	(E)-2-Methylbut-2-en-1-yl methacrylate	14.24	1385	0.08	/
33	Hexyl butyrate	14.84	1403	0.18	1414±8
34	Linalool oxide A	15.59	1427	0.16	1444±19
35	1-Octen-3-ol	15.93	1438	0.25	1450±7

No.	Compound	Retention times(min)	Retention index (RI)	Relative content (%)	Library (RI)
36	alpha-Copaene	17.17	1477	0.11	1492±7
37	3-Methylpentyl angelate	17.46	1486	0.77	/
38	Camphor	17.55	1489	0.13	1527±4
39	(E)-2-Methyl-2-butenyl angelate	17.75	1496	0.22	/
40	Linalool	18.88	1532	19.15	1547±7
41	Linalyl acetate	19.09	1539	27.14	1555±10
42	Pinocarvone	19.13	1541	0.18	/
43	alpha-Santalene	19.58	1555	0.24	1575±9
44	trans-alpha-Bergamotene	19.99	1569	0.08	1580±6
45	beta-Caryophyllene	20.18	1575	1.60	1595±16
46	Terpinen-4-ol	20.36	1581	1.58	1602±9
47	Lavandulyl acetate	20.58	1588	2.83	/
48	Alloaromadendrene	21.66	1619	0.46	1650±11
49	(-)-trans-Pinocarveol	21.94	1627	0.23	1664±7
50	(E)-beta-Famesene	22.60	1644	0.48	1664±6
51	Lavandulol	22.90	1652	0.29	1677±9 (
52	alpha-Terpineol	23.62	1671	0.93	1697±10
53	Borneol	23.71	1673	0.86	1702±15
54	Isodaucene	24.73	1700	0.14	/
55	Neryl acetate	24.92	1703	0.53	1724±9
56	(+)-delta-Cadinene	26.23	1726	0.13	1758±13
57	Geranyl acetate	26.41	1729	0.61	1752±11
58	Citronellol	27.17	1742	6.16	1765±9
59	Nerol	28.96	1774	0.65	1797±11
60	2-Tridecanone	29.26	1779	0.25	1809±6
61	Geraniol	32.28	1827	3.37	1847±10
62	Caryophyllene oxide	38.93	1930	0.13	1989±19
63	Methyleugenol	41.77	1977	0.13	2013±16
64	Heneicosane	48.15	2094	0.10	2100
65	Eugenol	49.29	2117	0.14	2169±16
66	tau-Cadinol	49.70	2125	0.13	2169±16
67	Ylangenal	55.06	2235	0.48	/
68	Tricosane	57.61	2290	0.18	2300
69	alpha-Santalol	58.08	2300	1.30	2350
70	Bergamotol, Z-alpha-trans-	58.61	2313	0.12	2328±N/A
71	Farnesol	58.99	2321	0.44	2350±8
72	beta-Santalol	61.55	2380	0.57	2413±22

- **Supplementary Report S1. Quality Test Report of Lavender Essential Oil**

CERTIFICATE OF ANALYSIS AND QUALITY

Product name: Lavender oil organic lot# LA-02-2024-B
INCI name: Lavandula Angustifolia
Product code: CAS 8000-28-0
Manufacturing date: 22JUL/2024
Expiry date: 22/JUL/2028

APPEARANCE	COLOURLESS TRANSPARENT LIQUID
RELATIVE DENSITY AT 20C	0.881
REFRACTIVE INDEX AT 20C	1.461
OPTICAL ROTATION	- 8.50
COLOUR	PALE YELLOW
ODOUR	CHARACTERISTIC

CONTENT OF TIPICAL INGREDIENT, %
(By Gas-Chromatography)

		MIN %	MAX %
LINALOOL	31.03	25.0	34.0
LINALYLACETATE	27.82	25.0	42.0
LAVANDULILACETATE	3.22	2.0	5.0
CAMPHOR	0.26	-	0.6
LAVANDULOL	1.02	0.3	
1.8 CINEOL	0.88	-	2.0
TERPINEN 4-OL	4.80	2.0	5.0
TRANS-BETA-OCIMENE	2.95	2.0	5.0
ALFA TERPINEOL	1.29	0.8	2.0
CIS-BETA-OCIMENE	5.94	3.0	9.0
3 OKTANONE	1.41	0.2	1.6
LIMONENE	0.38	-	0.6
BETA-PHELLANDRENE	0.13		

Note: 1.8-cineole and beta-phellandrene are often coeluted.

- **Supplementary Report S2. Quality Test Report of Orange Essential Oil**

ANALYSIS CERTIFICATE

Product: Orange Oil	
Sample: W3341	
Shelf Life (at 4°C under Nitrogen) : 24 months	
Shelf Life (at 25°C under Nitrogen): 12 months	
Analysis	***Value***
Appearance:	Yellow Reddish / Giallo con tono Rosso
Flavour:	Fresh, typical of fruit
Optical Rotation at 25°C :	97,49
Refractive Index at 20°C :	1,473
Specific Gravity at 20°C :	0,850
Peroxide Value meq / kg / N° di Perossidi:	8,430
Alpha Pinene Content % GC:	0,572
Myrcene Content % GC:	1,994
Octanal Content% GC:	0,326
D-Limonene Content% GC:	95,036
Linalool Content% GC:	0,318
Decanal Content% GC:	0,289
Aldehydes Content% GC:	0,828

Catania 29/01/2026

- **Supplementary Report S3. Quality Test Report of Clary sage Essential Oil**

Certificat d'analyse / Analysis certificate	
Huile essentielle / Essential oil :	Sauge sclarée / Clary sage
Lot / Batch :	250503
Date début essai / Analysis start date :	*30/10/2025*
Date fin essai / Analysis end date :	*03/11/2025*
Date fabrication / Manufacture date :	*30/07/2025*
DLUO / Expiry date :	*30/07/2028*

Essai / Test	Résultat / Result
INDICE DE REFRACTION	1,461
POUVOIR ROTATOIRE°	-19,00
LINALOOL	18,22%
Alpha-TERPINEOL	0,72%
LINALYL ACETATE	64,09%
GERMACENE D	5,11%
SCLAREOL	0,20%

Simiane la Rotonde, **04/11/2025**

- **Supplementary Report S4. Quality Test Report of Roman chamomile Essential Oil**

Confidential to recipient *Date: 01/10/2024*

CERTIFICATE OF ANALYSIS

Product Description: **ENGLISH CHAMOMILE OIL (ANTHEMIS NOBILIS)**
Lot / Batch: **FF/24**

Cropping date: **1 August 2024**

Date of expiry: **1 August 2027 (if stored correctly)**

TEST	RESULTS
COLOUR	PALE BLUE / GREEN
ODOUR	FRESH FRUITY HERBACEOUS
APPEARANCE	MOBILE LIQUID
REFRACTIVE INDEX@ 20˚C	1.4421
SPECIFIC GRAVITY @ 20˚C	0.9022
OPTICAL ROTATION @ 20˚C	+ 3.7˚C
FLASH POINT (closed cup method)	>64ºC
ESTER VALUE	75%
ACID VALUE	5 mg /g

- **Supplementary Report S5. Quality Test Report of Kushui rose Essential Oil**

Certificate Of Analysis（COA）

Product Name: Shuiku Rose Essential Oil
INCI Name: Rosa Rugosa Flower Oi
Material Code: 1.1.086.48.012
Batch No.: ECO-24/06E

Production Process: Distillation
Extracted Part: Flower
Production Date: June 2024
Shelf-life: 5 years

Items	Specification	Result
Appearance	Pale yellow to light-yellow clear free-flowing liqui	Complies
Odor	Strong floral aroma of Kushui rose	Complies
Relative Density (25 °C)	0.8560 ~ 0.900	Complies
Refractive Index (25 °C)	1.4600 ~ 1.4730	Complies

Main Components and Contents (%) [GC-MS]

Citronellol	40.0 ~ 54.0	43.08
Geraniol	7.0 ~ 18.0	11.44
Linalool	1.0 ~ 4.0	2.25
Nerol	2.0 ~ 6.0	3.08
Citronellyl acetate	2.0 ~ 4.5	4.30

- **Supplementary Report S6. Quality Test Report of Sandalwood Essential Oil**

CERTIFICATE OF ANALYSIS

PRINTED ON : 22.04.2026

Item Code : **SLFA03S001** **Batch No. : SLFA/SWO/CO2/13/04/2026-27**

Item Name : **SANDALWOOD OIL CO2**

CAS #	8006-87-9
EINECS #	284-111-1
Botanical Name	Santalum album
Product Description	Clear, pale yellow to Golden color Liquid having pleasant , sweet, woody and Balsamic odor
Origin	Obtained by Supercritical Fluid Extraction sourced from South Indian plantations
Plant Part Used	Logs
Manufacturing Date	April , 2026
Expiry Date	March,2029
Blend	100 % Pure natural and no additives are added

SR. NO.	PARAMETERS	SPECIFICATION	RESULT	PROTOCOL / METHOD
	ORGANOLEPTIC CHARACTERISTICS			
1	Appearance	Clear, pale yellow to Golden Color Liquid	CONFORMS	Visual
2	Odor	pleasant , sweet, woody and Balsamic	CONFORMS	Organoleptic
3	Taste	Characteristic	CONFORMS	Organoleptic
	PHYSICO-CHEMICAL SPECIFICATIIONS			
4	Refractive Index @ 25°C	1.5000 - 1.5100	1.5073	In House Method
5	Specific Gravity @ 25°C	0.9650 - 0.9850	0.9833	In House Method
6	Optical Rotation	-20° to -15°	-20 to – 15 %	In House Method
7	Solubility	Insoluble in water, Soluble in Alcohol	CONFORMS	<USP 561>
8	Esters, calculated as santalyl acetate	NMT 7 %	< 7 %	GCMS
9	Main Components	Alpha-Santalol: 41.0-55.0% Beta-Santalol: 16.0-24.0% Total Santalol: > 90 %	53.33 % 23.31 % 90.73 %	GCMS
	HEAVY METALS			
10	Lead	NMT 0.5 PPM	CONFORMS	AOAC 16TH Edition
11	Arsenic	NMT 0.1 PPM	CONFORMS	AOAC 16TH Edition
12	Cadmium	NMT 0.5 PPM	CONFORMS	AOAC 16TH Edition
13	Mercury	NMT 0.1 PPM	CONFORMS	AOAC 16TH Edition
14	PESTISIDES	As per EU 396	COMPLIES	

	MICROBIOLOGICAL PROFILE			
15	Total Plate Count	*< 1000 cfu/g*	*CONFORMS*	*BAM Online*
16	Yeast / Moulds /Fungi	*< 100 cfu/g*	*CONFORMS*	*BAM Online*
17	E-Coli	*ABSENT/g*	*CONFORMS*	*BAM Online*
18	Salmonella	*ABSENT in 25 gms*	*CONFORMS*	*BAM Online*
19	Coliforms	*< 10 cfu/g*	*CONFORMS*	*BAM Online*
20	P. Aeruglinosa	*ABSENT*	*CONFORMS*	*BAM Online*
21	S. Aureus	*ABSENT*	*CONFORMS*	*BAM Online*
22	Staphylococcus sp	*ABSENT in 10 g*	*ABSENT*	*BAM Online*
	MYCOTOXINS			
23	Aflatoxin B1	*<5 ppb*	*CONFORMS*	*ASTA 24.2. 1997 Edition*
24	Aflatoxin (B1+B2+G1+G2)	*<10ppb*	*CONFORMS*	*ASTA 24.2. 1997 Edition*

Legislation	Natural
Stability	Avoid strong acids strong bases and all oxidizing agents.
Uses	Flavors & Fragrance
Handling Precaution	Handle in adequate ventilation, avoid skin and eye contact, use goggles or face shield and wear protective clothing
Packing & Storage	Store at ambient temperature, dry and well-ventilated area, away from heat source and protected from light. Store in tightly sealed original containers, packed in HDPE Food grade cans.
Labeling	The Label displays Product Name, Batch No., Net Weight, Gross Weight and other information / marks specified by the customer
Allergens	Complies with Regulation (EU No.1169/2011)
Suitability Data	Kosher, FDA Certified
GMO Statement	The product and the raw material used to produce said product are free from GMO
BSE / TSE Status	BSE / TSE Free
Irradiation Status	Non-irradiated
Remarks	We hereby declare that our facility conforms to ISO/HACCP and that all necessary measures are in place to avoid cross contamination.