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Characterization of Essential Oil from Offered Temple Flower *Rosa damascena* Mill

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ABSTRACT

In the present study rose oil was extracted (0.14% v/w) from offered temple flower Rosa damascena by steam distillation. The availability of offered flowers in five temples in and around Chennai region of TamilNadu was evaluated through a survey . There were about 2350 kg offered flowers generated per day. Four types of offered flowers such as rose, marigold, chrysanthemum and jasmine were recorded as commonly available offered flowers. Rose flowers were collected and the petals were separated, shade dried and extracted essential oil. The chemical components present in the rose oil were characterized by GC-MS analysis and 54 compounds were recorded of which phenyl ethyl alcohol (23.19%) was recorded as the major component followed by octadecane (10.49%), hexadecane (7.76%), phenyl ethyl tetra decyl ester (5.77%) and tetra methyl trisilocendecanol (3.45%). This study suggests that the offered temple flower R. damascena can be used for the preparation of essential oil.

Key Words: *Offered temple flower, Rosa damascena, essential oil, GC-MS, phenyl ethyl alcohol.*

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INTRODUCTION

Rosa genus, belonging to the *Rosaceae* family, includes 200 species and more than 18,000 cultivars [1]. One of the most important *Rosa* species is *Rosa damascena* Mill. This extremely popular species of rose in India is a cultivated hybrid, native to Asia, introduced to Europe. In India, it is commonly known as the Damask rose or simply as "Damask", it is a rose hybrid, derived from *R. gallica* and *R. moschata.* Damask roses have been long time recognised for their strong fragrance [2]. *R. damascena* var. "Trigintipetala" also known as the oil-bearing rose, is one of the most important Damask roses industrially cultivated for production of rose oil and rose water after steam distillation or rose concrete and rose absolute after solvent extraction [3]. Of these, the production of rose oil has largest economic impact [4]. In South India, it is used in garlands and in making “panneer” means rose-water. Rose oil consists of over 300 compounds [5- 6] and its quality is evaluated by implementation of an International standard [7]. Rose oil is primarily used in perfumes, creams, soaps, lotions and other cosmetic products. *R. damascena* is also cultivated for its medicinal properties and *R. damascena* essential oil has been demonstrated to possess anti-HIV, antibacterial and antioxidant activities [8]. Beside this, the rose water and other products derived from *R. damascena* flowers are widely used as flavour ingredients in various food products like cakes, cookies, sweets, ice creams, beverages etc. The main producers of rose oil and rose water are Bulgaria, Turkey and Iran. Smaller amounts of mainly rose water are also produced in the countries of Northern Africa, India and China [4]. Because of the low oil content in *Rosa* genus and lack of natural and synthetic substitutes, rose oil is one of the most expensive essential oil in the world markets. Extraction of rose oil, characterization and determination of its components is essential. Gas chromatography–mass spectrometry (GC–MS) is one of the most promising technique for determination of the components of essential oil [9].

In India, 300,000 metric tonnes of flowers are being cultivated and utilized for various purposes like decorations, making garlands and ingredients in perfumes, fragrances and pigments. The flowers which were offered to deities in temples were available around 1450 tonnes as temple waste among this rose was recorded as 50%. The present study is focused on extraction of rose oil from offered temple flowers by steam distillation and to identify the chemical

components by GC-MS analysis.

MATERIALS AND METHODS

Survey and status of offered Flowers

The status on the availability of offered flowers were evaluated based on various field visits undertaken during January 2011 to May 2011. Questioner containing information such as the quantity, type, utility and the seasonal availability of these offered flowers were recorded from five different temples which includes Ashtalakshmi temple (Besant Nagar **),** Marudeeshwar temple (Thiruvanmiyur), Kabaleeshwar temple (Mylapore), Murugan temple (Vadapalani), Sri Parthasarathy temple (Light house) in and around Chennai of TamilNadu, India. The information on the availability of offered flowers are listed in results and discussion.

Extraction of rose oil from *R. damascena*

The extraction of rose oil was performed in Gandhigram trust, Dindugal. 35 kg of rose petals which are less than 24 h old collected from temples of Chennai were stored in a cold percolation chamber filled with n-hexane (1:3) for 1h. The solvent along with water was stored in a column were the water was drained out. The enriched solvent was then distilled at 78-79°C. The distilled solvent was stored in a separate chamber. The residue which was the rose component settled at the base of the distillation column. The residue was then collected and incubated at room temperature till it gets solidified. The solidified flower component obtained was the concrete. The concrete was weighed and it was extracted twice with ethanol at the ratio of 1:1.5 with continuous stirring till it became slurry. The slurry was freezed, till the wax was solidified and ethanol which was enriched with rose oil was separated. The enriched ethanol was then distilled using steam distillation under 5 mm Hg vacuum. The alcohol was solubilized leaving the crude rose oil. The crude oil was collected and stored in small vial. It was then analysed by GC-MS for identification of essential compounds [10].

GC/MS analysis

The extracted rose oil was analysed using GC/MS system equipped with DB-5MS column with helium as a carrier gas at a septum purge flow of 1 ml min^{-1}, splitless injection of 1 µl of the sample and the following acquisition parameters: injector temperature 250°C; Oven Program: 30°C for 0.15 min then 150°C min^{-1} to 250°C for 5 min; Run Time 60 min. The compounds were identified by MSD Chem workstation [11].

RESULTS AND DISCUSSION

Table 1 : Status of offered flowers in selected temples of Chennai

Temple Name	Types Of Flowers	Quantity of Flowers kg day^{-1}	Quantity of Wasted Flowers Kg day^{-1}	Utility of Offered Flowers
Ashtalakshmi temple, Besant Nagar	Jasmine, Marigold, Rose	1000	200	Given to people as blessed flowers.
Marudeeshwar temple, Thiruvanmiyur	Jasmine, Rose, Chrysanthemum	950	125	Given to people as blessed flowers.
Kabaleeshwar temple, Mylapore	Rose, Marigold, Chrysanthemum	2500	800	Given to people as blessed flowers.
Murugan temple, Vadapalani	Jasmine, Marigold, Rose	1500	400	Given to people as blessed flowers.
Sri Parthasarathy temple, Light House	Rose, Marigold, Chrysanthemum	1200	400	Given to people as blessed flowers.

In the present study offered flowers from temples of Chennai were collected. There were about 2350 kg offered flowers were generated from these five temples per day. Four types of offered flowers such as rose, marigold, chrysanthemum and jasmine were recorded as commonly available offered flowers. Among them *R. damascena* was recorded for its availability throughout the year. These offered flowers were available in temples mostly on Fridays and also during festive seasons like Pongal, Karthigai, Diwali, etc. About 70% of these offered flowers from temples were returned to the devotees after worship and 30% of the offered flowers were disposed and dumped near the temple (Table 1). 40% of the total productions of flowers are unsold and wasted everyday which are thrown in river Ganga or dumped which also creates water pollution and environmental pollution [12].

Five mL of rose oil was obtained from 35 kg of rose processed through steam distillation and the oil obtained was observed to be yellowish brown in color. The yield of essential oil was 0.14% (v/w) which is in accordance with Moeina *et al.* [13] who has obtained 0.16% (v/w). Depending on the conditions of the steam distillation 0.4-1% (v/w)

yield and eighteen major components of the essential oil extracts were identified by GC-MS [14]. The essential oil extracted from rose through steam distillation was recorded to be yellowish brown [15] and pale yellow [16] in color. GC-MS analysis reported that 54 compounds (Table 2) were present in the rose essential oil of which phenyl ethyl alcohol (23.19%) was recorded as the major component in rose oil followed by octadecane (10.49%), hexadecane (7.76%), phenyl ethyl tetra decyl ester (5.77%) and tetra methyl trisilocendecanol (3.45%). Liquid Gas Chromatographic analysis has revealed that phenyl ethyl alcohol (56.68%) was the major component in rose oil [15]. The sample studied by us is different from the other Iranian and Burgarian samples. Citronellol (59.5%), geraniol (13.2%) and phenyl ethyl alcohol (5.6%) were among the main components of *R. damascena* [16]. In this report nonadecane and heptadecane were identified (2.2%) & (1.4%). Whereas, among 25 components, eight components, represents 99.98% of the oil, were characterized as Nonadecane (39.73%), heneicosane (32.38%), docosane (7.34%), citronellol (6.14%) and 9- nonadecene (5.69%) [13]. Iranian sample was characterized by high amounts of eicosane (29.88%), citronellol (25.59%), docosane (14.07%) [17-18]. Bulgarian rose oil was reported, to have citronellol (30.31%), geraniol (16.96%), phenyl ethyl alcohol (12.60%), nerol (8.46%), hexa-cosane (3.70%), nonadecane (2.7%), linalool (2.15%), Ionone (1.00%), ecosane (1.65%), docacosane (1.27%), farnesol (1.36%), neryal acetate (1.41%), citronellyl propionate (1.38%), geranial (1.35%), pinene (0.60%), myrceen (0.46%), cis rose oxide (0.55%), decanal (0.51%), terpine-4-ol (0.55%), caryophyllene+citronellyl act (0.81%), iso borneol (0.57%), heptadecane (0.92%) [19]. Phenyl ethyl alcohol has been reported as the major compound in most of the previous works which has also been reported in our study. The percentage of heneicosane, nonadecane and eicosane varies this may be due to the differences due to ecological factors or genetic variations. The study shows that offered temple rose flowers can be collected and used for the preparation of essential oils.

Table 2 : Composition of essential oil of *Rosa damascena* Mill.

Peak No	Components	Retention time	Peak area %
1	Benzaldehyde	3.189	0.07
2	Phenyl ethyl alcohol	4.775	27.19
3	Tetradecanol	5.394	0.15
4	Propanamide	5.452	1.44
5	Phenyl ethyl ester	5.703	0.01
6	Thiophene carboxylic ester	6.457	3.12
7	methyl 4-pentanyl acetyl ester	7.733	0.23
8	Hexadecanol	8.11	0.19
9	Ethyl amino 1- butyl cyclohexa benzene	9.091	0.29
10	Bromo propionate	9.097	0.08
11	2-2-dimethyl phenyl ethyl ester	10.595	0.55
12	Tricosene	11.243	0.19
13	Heptyle 2-phenyl ethyl ester	12.316	0.36
14	Isohexyl ester	12.452	0.27
15	8-methyl heptacosane	13.099	0.10
16	Eicosane	14.801	0.21
17	Pentatriacontene	16.068	0.14
18	Nonadecene	16.209	3.17
19	Hexadecane	16.744	7.76
20	Benzene propaonic ester	17.402	0.72
21	Eicosene	18.098	0.09
22	Phenyl Dodecanoic ester	18.562	1.11
23	Di phenyl ethyl ester	19.703	0.17

24	Octadecyl tri chloro ethyl ester	19.887	0.20
25	Heneicosanol	20.167	0.35
26	Chloropropronic ester	20.235	0.21
27	Heneicosane	20.316	10.49
28	Hexadecylester	21.995	0.11
29	2Propyl tridecyl ester	22.682	0.27
30	Dodecanoic ester	23.29	0.54
31	Tricosane	23.629	1.15
32	Tetratetracontene	23.764	1.89
33	Cyclobutyl pentadecyl ester	25.379	0.48
34	Pentadecyl 2-phenyle ethyle tridecyle ester	26.655	0.21
35	Pentatriacontene	26.752	3.03
36	Chloropropionic ester	26.848	2.73
37	Benzene dicarboxylic ester	26.955	0.15
38	Tetra methyl trisilocendecanol	27.602	3.45
39	Dimethyle benzaldehyde thiocarbamoyl hydrazone	27.718	0.23
40	Pthalic diphenyl ester	28.037	0.70
41	Hexacosane	28.124	0.31
42	Dibromoecosane	28.18	0.19
43	Octadecyle ester	28.88	0.48
44	Cyclotrisiloxane	29.495	0.39
45	Benzamine	29.536	0.22
46	Methoxyethyl ester	29.594	0.39
47	Hexadecane-l-ol acetate	29.72	0.84
48	Cyclobutane	30.068	0.61
49	Nonacosane	30.909	0.44
50	Cyclohexadiene	30.977	0.70
51	Trimethyl silyl ester	31.073	0.32
52	Phenyl ethyl tetradecyl ester	31.275	5.77
53	Thiophene	31.85	0.52
54	Hexadecyl 2-phenylethyl ester	32.6	0.32

CONCLUSION

The present study suggests that the offered temple waste flowers *R. damascena* can be effectively used for the preparation of essential oil.

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REFERENCES

[1]. Gudin, S (2000) *Rose*: Genetics and breeding. *Plant Breed Rev.*, 17: 159-89.
[2]. Beales, P., Duncan, W., Fagan, G., Grant, W., Grapes, K and Harkness, P (1998) Botanica's roses. The encyclopedia of roses. Australia: Random House.

[3]. Widrlechner, M. P (1981) History and utilization of Rosa damascena. *Economic Botany,* 35, 42–58.
[4]. Kovacheva, N., Rusanov, K and Atanassov, I (2010) Industrial cultivation of oil bearing rose and rose oil production in Bulgaria during 21st century, directions and challenges. *Biotechnology and Biotechnological Equipment,* 24(2), 1793–1798.
[5]. Kovats, E (1987) Composition of essential oils Bulgarian oil of rose (*Rosa damascena* Mill.). *Chromatogr J.,* 406: 185-222.
[6]. Ohloff, G (1994) Scent and fragrances. The fascination of odors and their chemical perspectives, translated by Pickenhagen W, Lawrence B. Berlin, Germany: Springer-Verlag. 253.
[7]. ISO 9842:2003 International Standards for Business, Government and Society, available online: www.iso.org
[8]. Ozkan, G., Sagdic, O., Baydar, N.G and Baydar, H (2004) Antioxidant and antibacterial activities of *Rosa damascena* flower extracts. *Food Sci. Technol Int .,* 10: 277-81.
[9]. Tabanca, N., Demirici, B., Kirimer, N., Can Baser,H. , Bedir, E., Khan,I .A and Wedge, D.E (2005) *J. Chromatogr.* A 1097 :192.
[10].Stashenko, E. E., Jaramillo, B. E and Martinez, J. R (2004) Comparison of different extraction methods for the analysis of volatile secondary metabolites of Lippia Alba (Mill.) N.E. Brown, grown in Colombia, and evaluation of its in vitro antioxidant activity, *J. Chromatogr.*, A 1025, 93.
[11]. David, F., Carine, D. C and Pat, S (2010) GC/MS/MS Analysis of β-damascenone in rose oil. GC/ MS Agilent technology, 52;1-2
[12]. Papita, S and Datta,S (2006) Production Of Floral Dye From Different Flowers Available In West Bengal For Textile & Dye Industry.
[13]. Moeina,M., Karamib, F., Tavallalib, H and Ghasemia, Y (2010) Composition of the Essential Oil of *Rosa damascena* Mill. From South of Iran. *Iranian Journal of Pharmaceutical Sciences* Winter 6(1): 59-62
[14]. Loghmani-Khouzani, H., Sabzi Fini, O and Safari, J (2007) Essential oil composition of *Rosa damascena*Mill. cultivated in central Iran. *Sci Iranica ,* 14: 316-9.
[15]. Aslam,K and Rehman, S (2005) Extraction and Analysis of Essential Oil of *Rosa species. J. Agri.Biol., 7: 6.*
[16]. Iqbal, A.N (1987) Gas–chromatographic analysis of essential oil and rose water of rose cultivar gruss–an–teplitz (Surkha). *M.Sc. Thesis*, Department of Horticulture, University of Agriculture, Faisalabad–Pakistan
[17]. Mirza, M and Najafpour Navaei, M (2007) The effect of distillation method on extracted compounds from Rose water. *Iran J Med Arom Plants* 2007; 3: 375-81.
[18]. Jalali-Heravi, M., Parastar, H and Sereshtib, H (2008) Development of a method for analysis of Iranian *damask rose* oil: Combination of gas chromatography-mass spectrometry with chemometric techniques. *Anal Chim Acta,* 623: 11-21.
[19].Babu, K.G.D and Kaul, K.V (2005) Variation in essential oil composition of rose-scented geranium (Pelargonium sp.) ", Flavour and Fragrance J., 20, 222-231.

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