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Making of Perfumes from Essential Oils Extracted from Lavender Plant Collected from Egerton University, Main Campus Njoro, Kenya

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Abstract

A study was undertaken to extract essential oils from flowers and leaves of the Lavender plant (*Lavanda officinalis*) using water distillation method. The extracted oils were further mixed with different proportions of methanol, ethanol and formaldehyde to make perfumes. Although there was no significant difference in the amount of essential oils extracted from flowers and leaves of the lavender plant (P=0.08), flowers gave higher yields of essential oils than leaves. In addition, there was no significant difference in the percentage composition of the different compounds in the essential oils extracts from flowers and leaves (P=0.46). Moreover, a mixture of methanol and formaldehyde gave the highest quality of perfumes in the final products compared to when methanol, ethanol or a mixture of ethanol and formaldehyde is used. Lavender plant is a potential source of essential oils for making perfumes. There is a need for testing the essential oils of lavender plant from Egerton University for other uses such as their antimicrobial properties.

Keywords: Egerton University, essential oils, Extraction, Kenya, Lavender plant, Perfumes.

INTRODUCTION

Lavender plant's flowers and leaves produce essential oils that can be put to many uses such as making of perfumes, flavoring of foods, and treating of diseases (Bachhav and Shankar, 2013). Analgesics, antimicrobial and anti-inflammatory effects of lavender essential oils have been reported from many parts of the world (Fornari *et al*., 2012). Previous studies have shown that essential oils from lavender are composed of cotronellal (57%), citronellol (15.89%), citronellyl acetate (15.33%) coupled with other organic compounds (Kaskoniene *et al*., 2013). The fore mentioned compounds have indicated a high potential for wide usage, both domestic and industrial which include but is not limited to antimicrobial, antifungal and anti-candida properties (Sekoussounon, 2012).

In addition the essential oils have shown expectorant and cough stimulating activity. The disinfecting properties of essential oils from lavender plant has made them gain allot of popularity in treating wounds, cleaning hospital apparatus and scrubbing floors in hospitals (Vignesh *et al*., 2016). Besides, the essential oils possess herbicidal, insecticidal, antihelmintic, anti-tumor and anti-leech properties not to mention their inclusion in integrated pest management (Sambath *et al*., 2012). Beauty therapy is one of the fastest growing industries in the 21st century. This has created high demand for perfumes (Mann *et al*., 2013). As a result, millions of people have fallen prey of unscrupulous business people who have taken advantage of the high demand to sell below standard

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beauty materials (Jakhetia *et al*., 2011). The materials have proven to have dire consequences for many of their users, creating a need for coming up with quality, safe to use substances such as perfumes (Velavan *et al.,* 2013).

The use of lavender essential oils in making of perfumes saw the wake of the day back in ancient Chinese civilization where people would simply rub flowers and leaves of the plant on their bodies. Since then, the use of essential oils from lavender plant has gained popularity (Enzo, 2011).

There are various methods of extracting of essential oils from plant samples. Expression is the oldest and the least complex. Plant materials are manually pressed until all the oils are squeezed out (Coelho *et al*., 2012). Following at a close range is another method, popularly known as effleurage which involves spreading of plant materials on glass sheets coated with grease. The glass sheets are placed between wooden frames in tiers. The plant materials are removed by hand and changed until the grease has absorbed their fragrance (Herrero *et al*., 2013).

A similar method to effleurage is maceration in which warmed fats are used to soak up flower smell (Patinha *et al*., 2013). The grease and fats are in turn dissolved in alcohol to obtain the essential oils. In an additional method called solvent method, plant materials are placed in rotating tanks and drums. Benzene or petroleum ether is poured over the plant materials so as to extract the essential oils (Madziga *et al.,* 2010). The method that is currently witnessing allot of usage is steam distillation (Kabiru *et al.,* 2016).

In this method, steam is passed through plant materials to convert the essential oils to gas. The gas is passed through tubes followed by cooling and liquefaction. The oils can also be extracted by boiling the plant materials in water instead of steaming them (Sovilj *et al*., 2011). The main aim of carrying out this study was to make perfumes from essential oils of lavender plant.

MATERIALS AND METHODS

Study area

Egerton University Main Campus is located 180 kilometers North West of Nairobi and about 30 Kilometers from Nakuru on a 144 – hectare piece of land donated by Lord Maurice Egerton of Tatton (1874 – 1958). The coordinates of the university are: 0°22'11.0"S, 35°55'58.0"E (Latitude: -0.369734; Longitude: 35.932779). The University lies at an altitude of approximately 2,250 meters above sea level (GoK, 2014).

Collection of plant samples

Lavender (*Lavandula angustifolia*) flowers and leaves were collected from Egerton University main campus, Njoro, Kenya. The flowers and leaves were separately washed with running tap water and finally with distilled water to sterilize them.

Extraction of essential oils

A sample of 400g of fresh lavender flowers and leaves was separately loaded into 2-Litre round bottom flask containing 1.5 liters of water and placed on a heating mantle having a power rating of 450 watt and timed. The samples were boiled with water which helps to release the oil held within the matrix of the flowers and leaves. The volatile oils evaporated along with the water into the condenser connected to the flask at 100^{o}C and atmospheric pressure (Figure 1). The condensed steam and oils were collected in a separating funnel where the essential oil and water were separated. The water was drained off gently and the oils were separately collected in a 10ml measuring cylinder and measured. The measurement was taken at an interval of 20minutes for 180minutes. The cumulative volume of the oil was measured and recorded. The traces of water in the essential oils were removed by adding 1 gram of magnesium sulfate in the oil as a drying agent after which the yield obtained was calculated using the formula given below (Seid *et al*., 2014);

$$\boldsymbol{Yield\ of\ essential\ oil}\ (\%)\ \frac{\boldsymbol{amount\ of\ essential\ oil\ obtained}\ (\boldsymbol{g})}{\boldsymbol{Amount\ of\ raw\ materials\ used}\ (\boldsymbol{g})}\boldsymbol{x100}$$

Determination of essential oil constituents

In order to identify the chemical constituents of the essential oils and therefore determine their quality, the extracted essential oil samples were analyzed using Gas Chromatography Mass Spectrometry (GC-MS) Agilent 6890 gas chromatography instrument coupled to an Agilent 5973 mass spectrometer and an Agilent Chem. The following operating parameters were used for the essential oil sample: capillary GC column HP-5MS 5% phenylmethyl siloxane\(30 x 0.25mm i.d. x 0.25 mm film thickness), a carrier gas Helium (flow rate 1.2mL min-1) and a split-less injection mode. Injector temperature was 250°C; Oven temperature was set initially at 50°C and then raised to 250°C at 10°C min-1 rate till the end of the analysis. The eluted analyses detected using (5973 network) mass selective detector and Electron Impact ionization (EID) was carried out at 70 eV.

Making of perfumes

The essential oils from flowers and leaves were separately blended together according to a formula given by Andrea *et al*. (2013). The oils were mixed with varying proportions of methanol, ethanol and formaldehyde to develop the scent. The perfume was aged for 4 months, after which the quality was determined as high or low

Figure 1. Essential oil distiller

based on standards described by Chouitah *et al*. (2011).

Data analysis

Data was presented using frequency tables. The relationship between time and yield of essential oils was determined using Pearson correlation. The differences in yield of essential oils and the percentage of compounds in the flowers and leaves were calculated using t-test. All the data analysis procedures were carried out using Statistical Package for Social Sciences (SPSS) version 17.0 software.

RESULTS

Extraction of Essential Oils

The percentage yield of essential oils varied from 4.5 after the sampled were heated for 180 minutes to 0.5 after heating for 20 minutes in flowers (Table 1). On the other hand, the percentage yield in leaves ranged from 3.5 after the samples were heated for 180 minutes to 0.1 after heating for 20 minutes. The weights of the plant samples, volume of distilled water and the heating temperature were maintained constant at 400g, 1.5 L, 100^{o}C respectively. There was a relationship between heating time and yield of essential oils from flowers (r=1) and leaves (r=0.99). Conversely, there was no significant difference in the amount of essential oils produced by flowers and leaves (P=0.08).

Constituents of essential oils

The percentage composition of myrcene in flowers was 4.02 and in leaves 4.30, β-lin1oo1 (0.69, 0.70), nerol (20.00, 24.99), citral (16.09, 15.06), limonene oxide (0.20, 0.91), cineole (10.29, 11.02), berbenol (2.10, 1.56) and oleic acid (25.76, 24.86) (Table 2). There was no significant difference in the percentage composition of the different compounds in the essential oil extract from flowers and leaves (P=0.46).

Making of perfumes

The addition of a mixture of methanol and formaldehyde to the scented products gave perfume of the highest quality (Table 3). In addition, addition of methanol yielded a product of high quality. However, a mixture of ethanol and formaldehyde gave low quality product just like the addition of ethanol alone.

DISCUSSION

The induction period for extraction of essential oils was between 0-20 minutes. Induction period, is the time required to rupture the cells of the plant material in order to release the oil and transport it to the condenser (Girotra *et al*., 2013). In the present study, the induction period was higher in the leaf as compared to the flower samples. This may be attributed to differences in particle strengths, suggesting that flower samples have higher particle strength than leaf samples (Solomon *et al.,* 2013). This necessitated the longer induction time in flower samples. The induction period observed in this study agrees with results obtained by other researchers (Beena and Humaira, 2015). In both the flower and leaf samples, the yield of essential oils increased with time from 20 minutes reaching a maximum after 180 minutes. This confirms Ficks's second law of diffusion about the final equilibrium achieved by the solute concentrations in plant matrix and in the solvents after a certain time (Pereira and Meireles, 2010). Fick indicates that extraction beyond final equilibrium solute concentration leads to no significant improvement in oil yield when prolonging the extraction time. These results concur with a study carried out elsewhere by Verma *et al*., (2010).

Table 1. Yield of Essential Oil extracted from flowers and leaves of the lavender plant

Plant part	Weight (g)	Distilled H_2O (L)	Heating time (Min)	Temperature (^oC)	Yield (%)
Flowers	400	1.5	20	100	0.5
	400	1.5	40	100	1.0
	400	1.5	60	100	1.5
	400	1.5	80	100	2.0
	400	1.5	100	100	2.5
	400	1.5	120	100	3.0
	400	1.5	140	100	3.5
	400	1.5	160	100	4.0
	400	1.5	180	100	4.5
Leaves	400	1.5	20	100	0.1
	400	1.5	40	100	0.3
	400	1.5	60	100	0.5
	400	1.5	80	100	1.0
	400	1.5	100	100	1.5
	400	1.5	120	100	2.0
	400	1.5	140	100	2.5
	400	1.5	160	100	3.0
	400	1.5	180	100	3.5

Table 2. GC-MS analysis of eucalyptus leave oil extracted using different methods

Compound	Composition (%)	
	Flowers	Leaves
Myrcene	4.02	4.30
β-lin1oo1	0.69	0.70
Nerol	20.00	24.99
Citral	16.09	15.06
Limonene oxide	0.20	0.91
Cineole	10.29	11.02
Berbenol	2.10	1.56
Oleic acid	25.76	24.86

Table 3. Quality of perfume from flowers and leaves of lavender plant after addition of other ingredients

Ingredient	Quality
Methanol	High
Ethanol	Low
Methanol + formaldehyde	Highest
Ethanol + formaldehyde	low

The percentage composition analysis of the essential oils carried out in the present study was meant to determine the quality of the products (Table 2). The results concurred with a previous study carried out in Nigeria by Kabiru *et al*., (2016). This could be attributed to the sources of the materials under study being similar ecologically (Bencheqroun *et al*., 2012). However, Gracelin *et al*., (2013) obtained different results from the ones obtained in this study. The previous study targeted plant materials collected from a semi-arid area while us the current study was carried out in an area that receives an adequate amount of rainfall. It is also evident that the values obtained for the various components were almost the same in both flower and leaves extracts. This disagrees with the result obtained by Baba-Moussa *et al*., (2012) in Benin. The variations could have emanated from differences in time of harvesting and methods of processing the samples (Gupta *et al*., 2015).

A study carried out elsewhere obtained similar results on quality of perfumes, after addition of other ingredients

as the current study (Bonou *et al*., 2016) (Table 3). This could be attributed to the standard polarity of methanol, ethanol and formaldehyde (Mariott, 2010). However, when carrying a similar study, Kabiru *et al*., (2016) obtained contrasting results with the ones obtained in this study. The possible reason could be that the earlier study compared flower and leaves from different plants.

CONCLUSION

This study shows that lavender plants from Egerton University are a potential sources of essential oils. The oils can be exploited economically for making of perfumes which are sources of income. In addition, the perfumes can alleviate the problem of side effects that comes after use of poorly made perfumes that have penetrated our market. There is need for moving this study a notch higher by producing the perfumes in large scale.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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