JCEIB

Open Access; Volume 1 pp. 57-63; March2017
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DOI: https://doi.org/10.15282/JCEIB-V1-11.31/3/2017/1.1.1

UMP PUBLISHER Innovative Engineering

COMPARISON STUDY OF ESSENTIAL OIL EXTRACTED FROM *ETLINGERA ELATIOR* (TORCH GINGER) BY USING SOXLET EXTRACTION

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ABSTRACT

Significance of essential oils from *Etlingera elatior* (*E. elatior*) are growing these days and have prospective to embrace great export in future, yet the quantity of the essential oil extracted does not extant in decent rate. Therefore the purpose of this research is to determine the optimum yield of the *E. elatior* essential oil. The *E. elatior* were prepared in two conditions which are normal (fresh) and dry grinded sample. The extraction of normal and dry grinded *E. elatior* was conducted using Soxhlet extraction with methanol as a solvent. The extraction process was conducted at different extraction time (2, 4, 6 hours). The study indicated that the dry grinded *E. elatior* produced a higher yield of essential oil as compared to normal grinded E. elatior. The yield of essential oil obtained from dry grinded *E. elatior* was 71.44% while with normal grinded E. elatior, the yield was 56.42%. The effect of extraction time towards yield of essential oil shown that prolong extraction up to 6 hours gave a higher yield of *E. elatior* essential oil. The constituents in the *E. elatior* essential oil were determined and quantified using GC-MS analysis. The analysis indicated that the *E. elatior* essential consist of 2-Furaldehyde, 5-methyl, 3-Methyl-1,2-cyclopentanedione, Maple lactone, Furan-2,5-dial, Pyranone and 5-Hydroxymethyl furaldehyde.

Keywords: Torch Ginger, Etlingera elatior, Essential Oil, Soxhlet Extraction, GC-MS.

1.0 INTRODUCTION

Etlingera elatior (*Zingiberaceae*) or its mutual name torch ginger and widespread acknowledged in Malaysian as "bunga kantan" is symbolize as a natural to Asia and one of the most attractive of all tropical blossoming plants. There are broad traditional used of *E. elatior* plant in Malaysia. For example, the new shoots, flower sprouts or fruits can be consumed directly by ethnic communities or as a condiment or cooked. Jeevani (2010) stated that the flower also has been used as a lawn ornamel because the inflorescences or blossom of *E. elatior* are very common as a seasoning of nutrition additive and crucial elements in some traditional foods of Malaysia like asam laksa and nasi kerabu. *E. elatior* essential oil is extensively used as natural essences in food, scents in fragrance, and in traditional medicines (Maui, 2013). Chan (2011) reported that among 5 *Etlingera* species investigated, *E. elatior* has the highest antioxidant properties. Hazrin (2008) stated that the worldwide demands of *E. elatior* have opened up the worldwide opportunities due to its increasing application in pharmaceutical, aromatheraphy and also cosmetics.

Extraction of essential oil from *E. elatior* can be obtained using hydro distillation or solvent extraction. However this process results in low yield, losses of its volatile compounds, residue of toxic solvent, very long extraction times and also degradation of unsaturated compound (Mostafa *et al.*, 2013). Moreover, steam distillation always involved with a higher operating cost (Silva *et al.*, 2013). Another recent technology in essential oil extraction is supercritical extraction. Unfortunately, supercritical CO_2 method is very expensive and required a higher operating of time (Barve *et al.*, 2010). Thus in order to overcome these limitations, optimization of the extraction process is needed to achieve higher extraction yield with minimum operation cost. It is reported by L.F Hu (2005), extraction is influenced by several factors including extraction time, pressure, temperature, and sample mass. Therefore, the present was focused on the optimization of the extraction process using Soxhlet extraction by varying extraction time and morphology of the raw material used in the extraction.

2.0 METHODOLOGY

Preparation of raw material (E. elatior infloresence)

Two different samples (normal (fresh) and dry grinded) of *E. elatior* were investigated. In the present study, *E. elatior* inflorescences were brought from the market in Shah Alam, Selangor. The inflorescences were taken from *E. elatior*, washed with tap water to remove dirt and stain. The broken and gloomy inflorescences were detached physically and were dried for 9 hours at 40°C as according to the method describe by Hazrin (2008).

Extraction of essential oil

25g of *E. elatior* infloresence was extracted with 200 mL of methanol by using Soxhlet extraction apparatus (Model: Mtop / Korea, Series Number of 2706) at 2, 4 and 6 hours of extraction time. The mixture was then evaporated in the rotary evaporator (Buchi V-700 Laboratory Rotary Evaporator with Vacuum Pump) for 45 minutes. The moisture content and oil yield were calculated by using the formula in Equation 1 and 2, respectively.

$$\% \, Humidity = \frac{Mass\ before\ dry - Mass\ after\ dry}{Mass\ after\ dry} \times 100 \quad (1)$$

$$Percent\ yield, \% = \frac{Mass\ of\ sample\ after\ extraction\ (g)}{Mass\ of\ sample\ before\ extraction\ (g)} \times 100 \quad (2)$$

Gas Chromatography Mass Spectrometry (GC-MS)

The determination the concentration of chemical constituents in essential oil of *E. elatior* was detected using the GC-MS analyses which were performed via Varian 450 gas chromatograph with attached Varian 240 mass spectrometer. This apparatus was equipped 70 eV with capillary column (30 m × 0.25 mm × film thickness 0.25 µm) at intermediate polarity. Injector temperature was set at 250 ºC and oven temperature was programmed initially 60 °C with 2 min hold then 60 to 120 °C (2 min hold) with 3ºC min^{-1} temperature programming and 120 to 270 °C at a rate of 2 °C min^{-1}. Injection volume was 1 µL with average velocity of 37 cm s^{-1}. Helium was used as carrier gas and the flow rate was set at 1 mL min^{-1} (Faridahanim *et al.,* 2007).

3.0 RESULTS AND DISCUSSION

Extraction Yield at different E. elatior morphology

Table 1 show the moisture content of the prepared *E. elatior before extraction was conducted*. The purposed of the drying is to maximum the essential oil extracted from the material. The average of the moisture content for the dried sample was 7.13%. The dried *E. elatior* used in the extraction was controlled its moisture content to the value below than 10%. The yield of the essential oil at different morphology of *E. elatior* is shown in Figure 1.

Table 1: Moisture Content of dried *E. elatior*.

Sample	Sample Mass (g)	Final Mass (g)	Moisture Content, x (%)
A	38.5748	35.5375	8.55
B	33.8377	31.4399	7.63
C	33.4802	31.3310	6.86

The results indicated that normalgrinded *E. elatior* gave lower yield of the *E. elatior* essential oil as compared to the dried grinded *E. elatior.* It shows that the dried grinded *E. elatior* gave 21 – 30% higher of extraction yield.

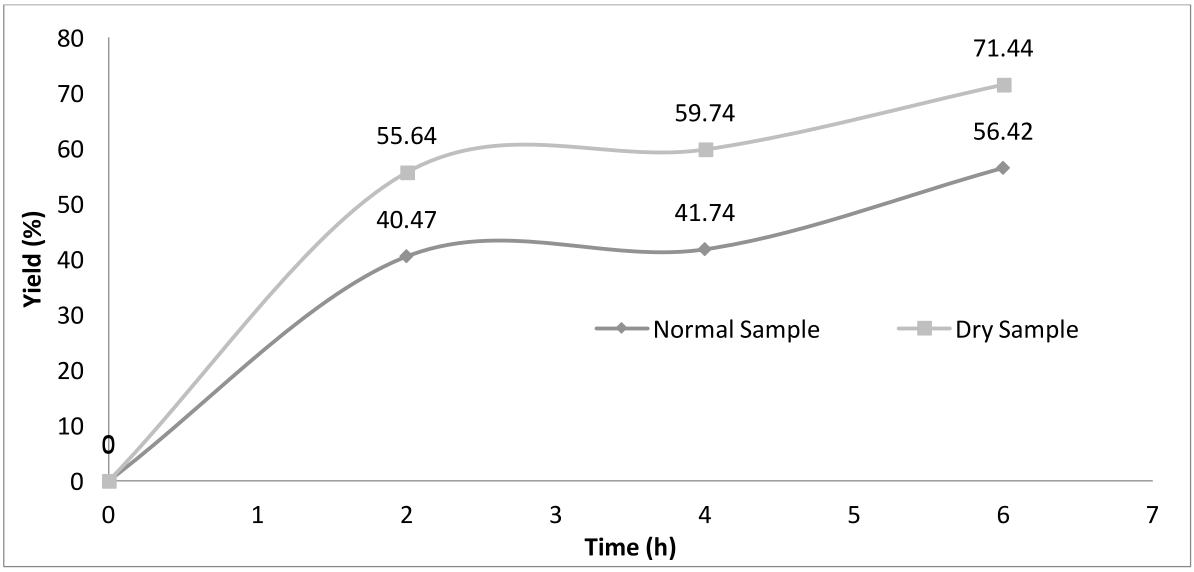

Figure 1: Percent Yield of *E. elatior* Essential Oil

While for the effect of extraction time on the yield of the essential oil indicated that prolong of the extraction period capable to increase the yield of the essential oil for normaland dry grinded of *E. elatior.* The results show that6 hours extraction time produced the highest essential oil up to 56.42 % and 71.44 % oil yield for normal and dried grinded *E. elatior* respectively. Both samples showed an increment of essential oil yield as the extraction time increased and dry *E. elatior* is preferable to enhance yield of extraction. The result is in agreement with the finding by Jeevani *et. al., (*2011) which determine that drying might reduce the amount of oil in each plant, but can greatly increase the yield per batch. According to Bence (2008) moisture contents between 7 and 18% had little effect on extractability of oil. However, the water had a negative entrainer effect by extraction of samples containing more than 18% water. When the moisture content was increased, a decrease in efficiency was found. In the case of high moisture content (~85%) the extraction was almost inhibited.

Chemical Constituent of E. elatior Essential Oil

The extracted oil was analyzed for its chemical constituent via a GC-MS. Each component in the extracted oil was identified through matching with data of various components in the mass spectrometer library. The GCMS spectrum of *E. elatior* is shown in Figure 2 and Table 2 listed the outcome of the matching process, indicating the quality of the matching in terms of percentage, following the international standard compounds of *E. elatior* essential oil.

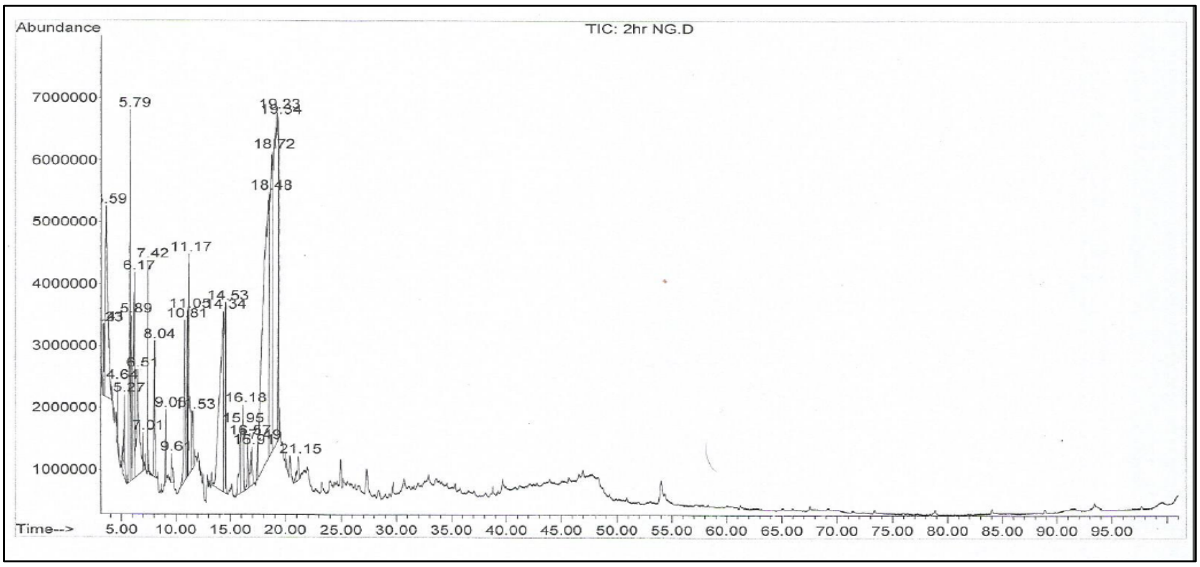

Figure 2: The Chemical constituent of the E. elatior Essential Oil for 2 Hours Extraction of Normal Sample

Table 2: Constituent of *E. elatior* Essential Oil Natural Samples (2 Hours Extraction)

RT (min)	Component	CAS #	Qual (%)
3.23	*(S)-[(S)-2-Phenyl-1,3,2-dioxaborolan-4-yl]-1,2-ethanediol*	074807-80-0	36
3.41	*2-furaldehyde*	000098-01-1	35
3.59	*2-furaldehyde*	000098-01-1	72
4.64	*Levoglucosenone*	037112-31-5	64
5.26	*Butanoic acid, 2-ethyl-3-oxo-, methyl ester*	051756-08-2	50
5.79	*Oxime-, methoxy-phenyl*	1000222-86-6	90
5.89	*2(5H)-Furanone*	000497-23-4	59
6.17	*1,2-Cyclopentanedione*	003008-40-0	72
6.51	*2-Furancarboxaldehyde, 5-methyl*	000620-02-0	53
7.01	*2-Furancarboxaldehyde, 5-methyl*	000620-02-0	72
7.42	*3,4-Diflouronisole*	115144-40-6	50
8.04	*2H-Pyran-2,6(3H)-dione*	005926-95-4	72

9.08	*Maple lactone*	000080-71-7	87
9.61	*1H-Indole, 1-methyl-2-phenye*	003558-24-5	25
10.81	*Furan-2,5-dial*	000823-82-5	59
11.05	*2-Furancarboxylic acid, hydrazide*	003326-71-4	46
11.17	*2,4,5-Trihydroxypyrimidine*	000496-76-4	53
11.53	*1,3-Bis(trimethylsilyl)benzene*	002060-89-1	72
14.34	*Pyranone*	028564-83-2	38
14.53	*Pyranone*	028564-83-2	72
15.95	*4H-Pyran-4-one, 3,5-dihydroxy-2-methyl*	001073-96-7	55
16.18	*N-Benzyloxylcarbonyl-1-alanyl-1-alanine ethylamide*	066382-92-1	43
16.57	*1,2-Benzenediol*	000120-80-9	87
16.91	*5-Acetoxymethyl-2-furaldehyde*	010551-53-3	53
17.49	*5-(p-Aminopenyl)-4-(p-tolyl)-2-thiazolamine*	094460-46-5	59
18.48	*2-Furancarboxaldehyde, 5-(hydroxymethyl)*	000067-47-0	91
18.72	*2-Furancarboxaldehyde, 5-(hydroxymethyl)*	000067-47-0	91
19.23	*2-Furancarboxaldehyde, 5-(hydroxymethyl)*	000067-47-0	91

Considering a minimum of 60% matches with the standard components in the library, only 7 chemicals constituent were identified from the list of chemicals constituents distinguished in all samples presents in Table 3. These components were *2-Furaldehyde, 2-Furaldehyde, 5-methyl, 3-Methyl-1,2-cyclopentanedione, Maple lactone, Furan-2,5-dial, Pyranone* and *5-Hydroxymethyl furaldehyde*. These chemicals represent the quality of the extracted *E. elatior* oil, which gave essential oil characteristics.

Table 3: Major Components of All *E. elatior* Essential Oil Samples

Component	CAS no.	Formula	Yield (%)					
			Normal			Dry		
			2hr	4hr	6hr	2hr	4hr	6hr
2-Furaldehyde	000098-01-1	$C_5H_4O_2$	6.19	4.22	3.86	6.86	9.43	10.42
2-Furaldehyde, 5-methyl	000620-02-0	$C_6H_6O_2$	4.72	3.92	2.22	4.64	5.53	5.56
3-Methyl-1,2-cyclopentanedione	000765-70-8	$C_6H_8O_2$	0.52	0.63	0.97	0.42	0.46	0.56
Maple lactone	000080-71-7	$C_6H_{10}O_3$	0.52	0.63	0.97	0.42	0.46	0.56
Furan-2,5-dial	000823-82-5	$C_6H_4O_3$	2.78	3.21	3.36	2.78	2.74	2.3
Pyranone	028564-83-2	$C_6H_8O_4$	11.87	11.94	12.47	10.82	10.78	10.55
5-Hydroxymethyl furaldehyde	000067-47-0	$C_6H_6O_3$	50.41	49.59	45.67	52.36	44.65	39.61
Others			22.99	25.86	30.48	21.7	25.95	30.44
Total			100	100	100	100	100	100

All of the constituent present in the *E. elatior* has various industrial applications. For example, *5-Hydroxymethyl furaldehyde* is important as flavoring representatives in foods (Li *et. al.,* 1988) and showed the biggest peak range tailed by *Pyranone,* a natural ingredients and extractives. *2-Furaldehyde* gave the scent of almond while *2-Furaldehyde, 5-methyl* are skillful of foraging peroxynitrite. *3-Methyl-1,2-cyclopentanedione* isused as cockroach attractant as reported by Blanco *et. al,*(1991). Moreover, *Maple lacton* isfunction as a regular constituents and extractives and *2 Furan-2,5-dial* is one of the flavoring agent in numerous food elements (Meidell and Filipello,1969). Besides*, 5-Hydroxymethyl furaldehyde* is used in the production of dialdehydes, glycols, ethers, aminoalcohols, acetals and in aqueous acid to catalyses ring opening.

4.0 CONCLUSIONS

The extraction of *E. elatior* essential oil using dissimilar conditions (dry and normal) gave significant impact on the percentage of essential oil yield. Dry grinded *E. elatior* produced 21-30 % higher yield as compared to normal E. *elatior.* While, prolong of the extraction time up to 6 hours result up to 71.4% of the essential oil yield. The chemical composition of essential oil after extracted in Soxhlet extraction method determined by GC-MS quantified 7 chemical components that exist the essential oil which are *2-Furaldehyde, 5-methyl, 3-Methyl-1,2-cyclopentanedione, Maple lactone, Furan-2,5-dial, Pyranone and 5-Hydroxymethyl furaldehyde.* These chemical constituents have a great potential in various industrial application.

ACKNOWLEDGEMENTS

Deepest gratitude to Malaysia Ministry of Education and Universiti Teknologi MARA(UiTM) for the financial support for this project.

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