CHARACTERIZATION OF *CINNAMOMUN VERUM* OIL FROM SOXHLET EXTRACTION

Nur Fatin binti Abdul Rashid, DR. Norhuda binti Haji Ismail

Faculty of Chemical Engineering, Universiti Teknologi Mara

***Abstract*— In this research, focus will be on the determination of the component and medical properties in *Cinnamomun Verum*. Gas Chromatography-Mass Spectrometry (GC-MS) is used to characterize the components in *Cinnamomum verum* and Fourier Transform Infrared Spectroscopy (FTIR) to identify the chemical structure in *Cinnamomun verum*. Soxhlet extractor is used to extract the essential oil using ethanol, hexane and dichlomethane solvent. Based on the result obtained, ethanol extract had the highest essential oil yield (13%) and contained high percentage of E-Cinnamaldehyde (55.3%). The component determined from different types of solvent is similar however the composition is varying from each sample. Others major compound in *Cinnamomun verum* are gurjunene(15.97%), citronelly isobutyrate(3.69%), humulane-1,6-dien-3-ol (2.11%), 1-methylpiperidine(1.27%), spathulenol (1.19%) and elemene (1.11%) based on ethanol extract. These compounds were mainly reflected in the alkane, alkene, amide, aromatic and aldehyde group. There are ten compound that was determined to exhibit therapeutic activities such as E-Cinnamaldehyde, spathulenol, elemene, caryophyllene, aromadendrene, champhene, squalene, a-pinene and aristolene. Most of the compound in the Cinnamomun verum showed antimicrobial, anti-cancer, anti-tumor, anti-oxidant and anti-inflammation properties.**

***Keywords*— Cinnamon, essential oil, Cinnamomun verum, GC-MS, FTIR, E-cinnamaldehyde, Soxhlet extraction, Antioxidant**

I. INTRODUCTION

Cinnamomun is an evergreen tropical tree which belongs to *Lauraceae* families with about 21 species in Peninsular Malaysia over approximately 250 to 350 species distributed worldwide in tropical and subtropical region (Abdelwahab et al.,2014). The term 'cinnamon' is derived from *Kinnamomon*, a Greek word which bring the meaning of spice. There are hundred types of cinnamon but only four types are commercially used which are Ceylon cinnamon, Cassia cinnamon, Saigon Cinnamon and Korintje Cinnamon. The scientific names for each of the cinnamon are *Cinnamomum verum, Cinnamomum aromaticum, Cinnamomum loureiroi* and *Cinnamomum burmanni* respectively. These four types are slightly different in color, taste, shape and Coumarin content.

Cinnamomum verum sticks are soft, brittle and rolled like cigar. Wild *Cinnamomun verum's* tress usually height to 17 meters tall with 30 to 60 cm diameter with thick and grey bark (Orwa et al.,2009). This plant can grow in tropical condition which is warm and wet climate without extreme hot or cold weather. Besides, the soil quality and climate changes also influence the quality of the cinnamon. The optimum condition for cinnamon growth is at 20 °C to 30°C with average rainfall 1250–2500 mm in sandy soils enriched with humus (Nabavi et al., 2015).

It is widely used in food industries, cosmetic, pharmaceuticals and in pest control (Vinatoru, 2001). Cinnamon has become important ingredient in pharmaceutical industry because it has been identified with anti-inflammatory, anti-oxidant, anti-cancer and antibacterial properties (Yan-qun et al.,2013). Historically, cinnamon drop was used as tonic, sedative in childbirth and aid in digestion (Orwa et al., 2009). It was also used as breath sweetener due to sweet smell properties of the cinnamon. It is also used in limited amount in some perfume.

Organic content in daily product have increased in demand due to the usage of synthetic chemical in daily product produce harmful effect to health. Increasing in interest on the medicinal and herb have led to the determination of the new compound and application of herbs constituent. Since the cinnamon contains many precious components that are believed to have their own medicinal value, this research paper will focus on the determination of the component in the *Cinnamomun verum* which is used in Malaysia and determine the medical properties in it.

II. METHODOLOGY

A. Sample Materials

Cinnanumon verum in stick form was purchased from local hypermarket, Giant. This sample must be stored in cool, dry place and avoid direct sunlight. *Cinnanumon verum* stick is the product of Malaysia.

B. Solvent and chemicals

Ethanol, dichloromethane and hexane is obtained from storage of chemical chemistry laboratory to be used as solvent for Soxhlet extractor. These solvents were selected based on high yield of essential oil extracted proved by the result from previous research.

C. Sample preparation

Drying and grind process was included in the sample preparation steps. The *Cinnamomun verum* must be ensured completely dry. The cinnamon stick is cut into smaller pieces to increase the surface of the cinnamon. After the drying process, the sample is grounded using heavy duty grinder for 6 minute to reduce the sample size to one or two micron.

D. Soxhlet extraction

Approximate 30gm of the grounded *Cinnamomun verum* sample is placed inside a thimble then covered by glass wool to avoid floating. The timber is placed in distillation flask contain the solvent. The round bottom flask contained boiling chips must be weighted before 250ml of ethanol is poured into the flask. The Soxhlet extractor is heated to reflux at 100°C and 1 atm for 6 hour. This procedure is also repeated to hexane and dichloromethane but the heating temperature for both solvent is different. For hexane, it is heated to 65°C while for dichloromethane is at 40°C

E. Gas Chromatography-Mass Spectrometry(GC-MS) Analysis

The analysis was performed using GC-MS model Varian 450-GC and Varian 240-MS.At constant heating rate of 5°Cmin^{-1}, the oven temperature is raised from 40°C to 230°C. For the first 4 minute, the temperature is maintained at 40°C then gradually increases to 230°C and held for 20 minute. The volatile gas with the carrier gas flow through a column of 30 m length and 0.25 mm internal diameter with 0.1µm film thickness for separation process. Inert gas such as nitrogen and helium are usually used as carrier gas. For this research, Helium is used as the carrier gas with linear velocity of 1.2mL min^{-1}, and split ratio of 30:1.

F. Fourier Transform Infrared Spectroscopy (FTIR) Analysis

FTIR spectrometer model (Perkin elmer/ spectrum one) was used to detect the molecular structure of the compound in the Cinnamomun verum. The room was maintained at constant ambient temperature and relative humidity which is at 25°C and 30% respectively. The FTIR is operated in resolution of 4 cm^{-1} and the infrared spectra in range of 515 to 4000 cm^{-1}. The volatile oil is dropped to form a thin film on the KBr table. The software will run the spectrometry analysis and the average chart was taken as sample spectrum. All the sources of interference such carbon dioxide, water vapor and background air spectrum are subtracted from the spectra.

III. RESULTS AND DISCUSSION

A. The Percentage Yield Of Cinnamomun Verum Essential Oil Via Soxhlet Extraction

In this process, the sample of *Cinnamomun verum* contact with the solvent and the volatile component diffuse from the solid to the liquid phase. This may result in separation of the components originally in the powder *Cinnamomun verum.* The high temperature that provided from the mantel of the Soxhlet extractor, vaporise the solvent. Then, the vaporise solvent diffuse inside the *Cinnamomun verum* powder and dissolve the soluble material and diffuse out. The grinding process of the *Cinnamomun verum* increase the rate of extraction since the larger surface area was provided for the solvent diffusion. *Cinnamomun verum* stick was grounded using heavy duty grinder for seven minute. Besides, grinding also reduce the resistance by the cell wall of the sample and reduce the diffusion distance of solvent.

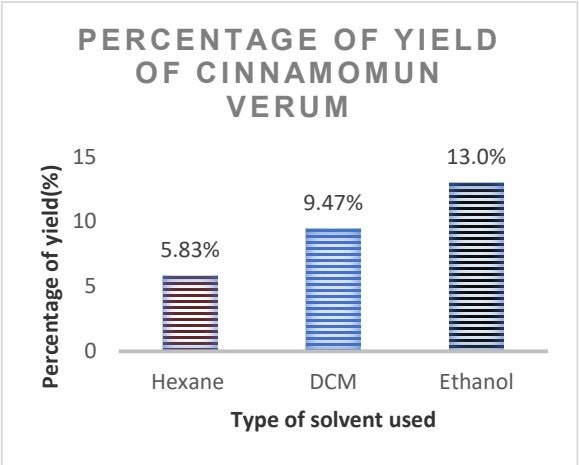

Fig. 1. Percentage yield of cinnamon essential oil using different solvent

The Soxhlet extraction was conducted for 30g of *Cinnamomun verum* powder using different type of solvent which is hexane, ethanol and dichloromethane Figure 1 shows graph of percentage yield of *Cinnamomun verum.* It was indicated that ethanol is the solvent that produce higher yield follow by DCM and hexane. The extraction of *Cinnamomun verum* using ethanol produce dark red essential oil with 13% yield. The cinnamon powder that was extract using dichloromethane produce dark brown essential oil as the second higher yield after ethanol with 9.47% yield. Extraction of *Cinnamomun verum* powder with hexane produced 5.83% of light yellow essential oil.

This result was comparable with Kasim et al., (2014) which concluded that dichloromethane produce higher percentage of essential oil compare to hexane and petroleum ether. However, Kasim et al., obtained slightly small yield of dichloromethane extract which is 5.22% compared to 9.47% in this research. The sample that extract using hexane shows higher yield from the result obtained by Kasim et al., (2014) which is 3.84%. Kasim et al.(2014) in their journal noted that, hexane shows low yield however it has high selectivity compare to dichloromethane. The sample that extract by using hexane will shows wide range of compound due to it non-polar properties of the solvent (Kasim et al.,2014). However, for ethanol sample, Wong et al.,(2014) obtained low yield which is only 6.84% and 5.79% for 10 and 5 hour extraction.

Temperature and selectivity influence the rate of extraction. Elevated temperature influenced the rate of extraction because it can increase the solubility of the solute in the solvent. Besides, the viscosity of the solvent and the extract also decrease. Selectivity of the solvent influenced the composition of the essential oil. High selectivity lowers the composition of desired compound due to other compounds that were extracted together during the extraction. The different in yield of essential oil might due to the evaporation duration in the rotary vapour. Different boiling point of the solvents influenced the evaporation rate of the essential during this process. Since the higher temperature was used for ethanol sample might contribute to higher yield of the essential oil extract by ethanol. The selectivity of the solvent also influenced the yield of essential oil. Ethanol can extract more medicinal compound such as tannis, polyphenol, flavonol, terpenoids and alkaloids. However, DCM only can extract terpenoid group noted by J.Azmir et al.(2013). Hexane which is non-polar solvent was expected to contain hydrophobic compounds with extremely high lipophilicity.

B. GC-MS Analysis

Table 1
Volatile compound from *Cinnamomun verum* essential oil using different solvent

Compounds	Percentage (%) volatile compound by different solvent		
	Ethanol	DCM	Hexane
Squalene	0.183	0.801	-
Camphene	0.538	0.389	0.657
E-Cinnamaldehyde	55.390	52.546	8.662
ç-Elemene	1.111	0.349	0.478
(Aromadendrene) 1H-Cycloprop[e] azulene	0.766	0067	0.102
Caryophyllene	0.610	0.980	0.870
Valencene	-	-	0.117
Aristolene	-	-	0.602
δ-Cadinene	0.500	2.161	1.578
γ −gurjunene	16.119	0.39	0.319
Humulane-1,6-dien-3-ol	2.110	-	0.392
Spathulenol	1.187	2.367	0.682
Aromadendrene	0.026	-	0.608
ç-Himachalene	0.121	-	0.113
2-Propyl-4,5-dihydro-1H-imidazole	0.416	-	0.358
Piperidine	1.266	-	0.397
a-Vatirenene	-	-	0.174
Citronellyl isobutyrate	3.686	0.007	0.220
1,5-diphenyl-1-penten-3-one	0.259	0.437	46.240
a-Pinene	-	-	0.152
Guaiene	-	-	0.110
1,9-dihydropyrene	-	-	1.278

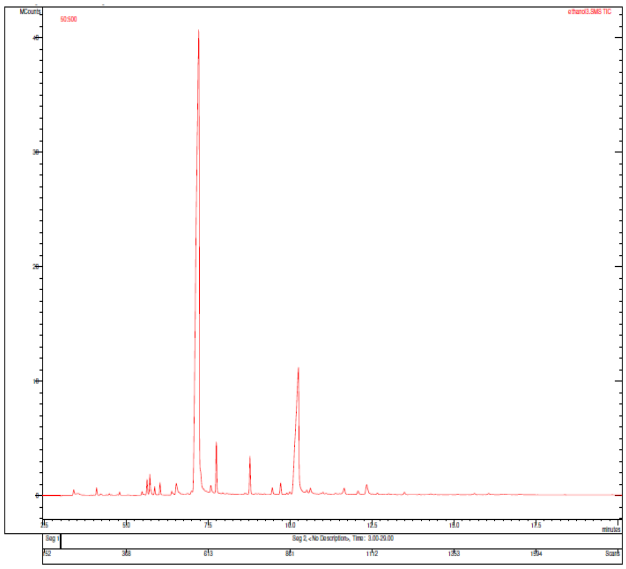

Fig. 2. Example of chromatogram using ethanol as solvent

As shown in the table 1, it was recorded 16 compounds accounting for 84.3% of total *Cinnamomun verum* essential oil for ethanol extract. The major component are E-cinnamaldehyde (53.9%) along with gurjunene (15.97%), citronelly isobutyrate (3.69%), humulane-1,6-dien-3-ol (2.11%), 1-methylpiperidine (1.27%), spathulenol (1.19%) and ç-elemene (1.11%). Others compound that below 1% was consider as minor compound. For DCM extract, there are 11 compounds accounting for 60.5% of the total essential oil. E-cinnamaldehyde (52.55%) recorded as the major compound follow by spathulenol (2.36%) and cadiene (2.16%).

21 compounds of *Cinnamomun verum* extract by hexane representing about 64.4 % of the total essential oil. 1,5-diphenyl-1-pentan-2-one and E-cinnamaldehyde was determined as the major compound in the *Cinnamomun verum* with 46.24% and 8.66% respectively. There also other major constituent that was characterized such as cadinene (1.58%),1,9-dihydropyrene(1.28%), Caryophyllene (1.16%), 1,9-dihydropyrene(1.28%), spathulenol (0.68%) and camphene(0.66%).

The obtained result was comparable as Kasim et al., (2014) where the major compound is cinnamaldehyde and no linalool and eugenol was detected. In a researched by Y.-q. Li et al. (2003), extraction of *Cinnamomun verum* shows significant quantity of eugenol which is 7.29% from the hydrodistillation extraction. Therefore, it can be proved that the method of extraction also may influence the composition of the *Cinnamomun verum*. Besides, Eugenol also may be loss in the soxhlet extraction process due to high temperature exhibit by this type of extraction or due to the insufficient length of column. Y.-q. Li et al.,(2003) also observed the present of 1.51% of a-guaiene and no constituent of linalool and caryophyllene in *Cinnamomun verum*. However, in this research, caryophyllene and guaiene was detected in all samples.

Wong et al., (2014) have compared the percentage of cinnamaldehyde in the sample extract by ethanol for five hour and ten hour. They observe that the cinnamaldehyde produce from five four extraction is higher which is 73.16% compared to 62.737% for ten hour extraction. Therefore, the duration of extraction can be related the composition of E-cinnamaldehyde determined in the *Cinnamomun verum.* Low percentage in this sample may due to six hour of extraction time. Besides, E-cinnamaldehyde may loss in the extraction process when they were exposed to high temperature and longer heat exposure.

Most of the sample recorded E-cinnamaldehyde as the major compound, however the composition of this major compound was differing. Ethanol extract recorded the larger constituent compared to other solvent which was 55.4% follow by dichloromethane and hexane. By referring the chromatogram, the retention time for the E-cinnamaldehyde present in the essential oil shows inconsistency

between different types of solvent. This result also shows compatibility with Y.-q Li et al.(2013) when a-calacorene was not detected in *Cinnamomun verum*. However, other species record the present of a-calacorene in their constituent. The result obtained also proved this statement.

C. FTIR Analysis

Table 2

Compound class of the *Cinnamomun verum* essential oil

Wavenumber(cm^{-1})			Compound class
DCM	**Hexane**	**Ethanol**	
None	None	3313.94-3337.22	O-H Alcohol
None	None	2973.17-2974.48	O-H Carboxylic acid
2926.95-3056.31	2852.07-2925.63	2893.73-2974.48	C-H Alkyl, aliphatic group, alkane
1576.89-1626.70	1606.05-1606.67	1607.68-1667.94	C=C Alkene
1674.39-1676.03	1624.87-1672.19	1664.34-1667.94	C=O Amide
1122.96-1264.63	1120.12-1120.28	1043.26-1275.84	C-O-C Ester
702.14-731.65	687.44-745.74	878.26-878.85	C-H Aromatic bending

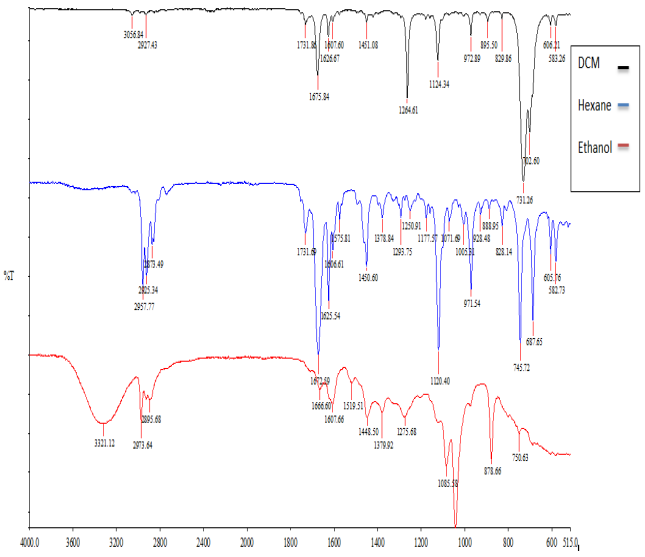

Fig. 3.Comparison of FTIR spectra between different type of solvent

All the samples showed high frequencies of absorption around 1731.31-1449.97 cm^{-1} which indicated the present of alkene and amide group. For the ethanol extract, the spectrum has a broad absorption peak between 3313.94 cm^{-1} to 3337.22 cm^{-1} which is likely due to the present of O-H stretching in alcohol or phenol. However, hexane and dichloromethane extract shows weak absorption in this range which cannot be categorized as alcohol and phenol group. Ethanol extract also shows different when it detect strong intensity peak at 2973.17 cm^{-1} to 2974.48 cm^{-1} which likely related to carboxylic acid functional group. Alkane functional group can be detect in all sample indicated by the medium peak in the range 2852.07 cm^{-1} to 2974.48 cm^{-1}.Besides, all the samples shows stretching vibration of C=C which generally assigned to alkene. On the other hand, the present of C=O amide group is detected for dichloromethane, ethanol and hexane extract in range of 1624.87 to 1676.03 cm^{-1}. Strong peak of spectra can be identified between the ranges of 1043.26 to 1275.84 cm^{-1} which assigned to C-O-C stretch of ester group. Aromatic bending of C-H stretching was detected in all samples in the range of 687.44 to 878.85 cm^{-1}

By comparing FTIR spectra of the samples, it was found that their spectra have similar basic shape with each other. For example their peak intensity and position was almost the same for all samples. The different between all the spectra is the present of alcohol and carboxylic acid in the ethanol extract. Present of these compounds is due to the properties of the ethanol which is categorized as alcohol solvent. However, the ethanol shows less peak detected compared to hexane and dichloromethane. In the sample extract by hexane, there are more peak of compounds that can be observed compared to ethanol and dichloromethane due to its non-polar properties and high selectivity. The complexity and wide range of compound in the *Cinnamomun verum* produce overlaps fingerprint. Therefore, it is difficult to confirm the group that present in this essential oil.

FTIR analysis has validated the group of compound present in the *Cinnammun verum.* There are 6 group in *Cinnamomun verum* that was identified by FTIR including alcohol, aromatic C=C, carboxylic acid, aldehyde, amide and aster group. There are many compound under alkene group which was characterized in the *Cinnamomun verum* essential oil such as; Squalene, á-Pinene, Camphene, ç-Elemene,(gurjunene) Azulene, 1,2,3,3a,4,5,6,7-octahydro-1,4-dimethyl-7-(1-, Caryophyllene, Aromadendrene, Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methyle, á-Vatirenene, Caryophyllene, Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7, ç-Himachalene, 1H-Cycloprop[e] azulene, decahydro-1,1,7-trimethyl-, and 1,9-Dihydropyrene. Cinnamalehyde in the *Cinnamomun verum* is classified under aldehyde group. Spathulenol and Humulane-1,6-dien-3-ol was identified under alcohol group where else piperidine was classified under amide group. Each type of compound determined in *Cinnamomun verum* was found to have various valuable therapeutic effects. The combination of the compounds produced beneficial *Cinnamomun verum* with complex function as remedy for many diseases.

D. Medicinal properties of Cinnamomun verum

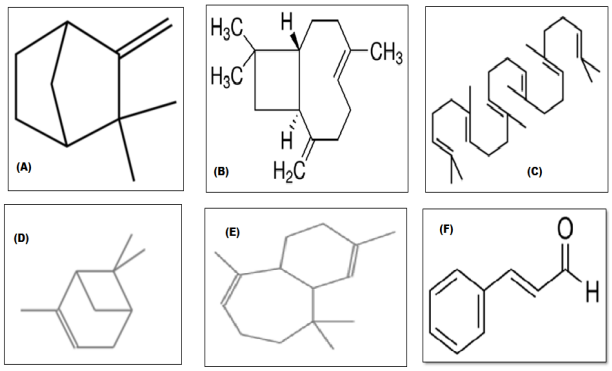

Fig. 4.Example of medicinal compound; (A)Champene, (B) Caryophyllene, (C) Squalene, (D) á-Pinene (E) Gamma himchalene and (F)E-cinnamaldehyde

Cinnamaldehyde has been proven effective in fighting human hepatoma cells and Alzheimer's. Development of the filamentous “tangles” that characterized Alzheimer’s can be prevented by the cinnamon due to the present of E-cinnamaldehyde. Study at University of Tel Aviv provided evidence that cinnamon can delay the effects of five aggressive strains of Alzheimer's inducing genes. Animal models were also used in the research for correcting

cognitive impairment in Alzheimer's problem and positive result was obtained. Besides, E-cinnamaldehyde showed antiviral, antimicrobial, vasodilators, hypotensive, produce calming effect, antipyretic, sedative, spasmolytic activities according to Djilani, A. and Dicko, A. (2012). Cardiovascular system also can be protected by the activity of cinnamaldehyde. Besides, it was found to have hypothermic and antipyretic action (Abdelwahab,2014).

Cinnamon also can be used in anti-aging treatment cream due to the content of E-cinnamaldehyde that promote the expression of collagen (Ranasinghe et al.,2013). Cinnamaldehyde derived 2'-hydroxycinnaldehyde in which can synthesize CB403 which is a chemical that can inhibit tumour growth. The effectiveness of cinnamaldehyde as antibiotic properties of cinnamon was proved by Wong et al. (2014). This result is also similar to G. Sigh et al.(2007), that E-cinnamaldehyde possessed antimicrobial activity. Rao and Gan (2014), mentioned that E-cinnamaldehyde in cinnamon has an anti-tyrosinase properties which is widely used in medicine to prevent hyperpigmentation. E-cinnamaldehyde can control the tumor cell growth besides boosting the tumor cell death. Besides, E-cinnamaldehyde was proved by Kasim et al. (2014), to have insecticidal and repellence activity of ant. E-cinnamaldehyde has antimicrobial properties against pathogen, bacteria and fungi that may cause food spoilage and poisoning (Wong et al. 2014). Besides, cinnamaldehyde also exhibit peripheral vasodilatory, antimutagenic, antifungal, and cytotoxic activities (Mathew and Abraham, 2006).

Camphene is included as the major compound in the *Cinnamomun verum* since it was detected in most of the *Cinnamomun verum* sample. It is a bicyclic, monoterpene compound which contributed to pungent smell of the *Cinnamomun verum.* It is commercially used as ingredient in fragrances, insecticides, and food additives. The extract that contained camphene was used especially to keep away mosquitoes (Ayurvedic, 2016). Camphene exhibit precious medicinal properties such as antifungal, anti-nociceptive, antioxidant, anti-biotic and cytotoxic properties (Ayurvedic,2016). Rajeshwari and Andallu also reported that this compound exhibit anti-oxidant properties that help to repair the damage in skin (Ayurvedic, 2016).Camphene also can be effectively used as treatment to dysentery, dermatitis, athlete's foot and fungal skin infection due to anti-fungal properties. Besides, camphene also exhibit anti-biotic properties that cure fungal, viral and bacterial infections. Essential oil with camphene constituent shows anti-congestive, anti-inflammation, analgesic, anti-nociceptive, sedative and disinfectant properties. Study also proved that camphene can reduce hyperlipidemia which is related to cardiovascular disease (Ayurvedic, 2016). However, camphene should be taken by pregnant women since it was toxic in nature (OrganicFacts, 2015).

Squalene was classified under triterpenoid compound and a fat-soluble compound. This compound can act similar to the haemoglobin because it can carry up oxygen to the body cells that have low concentration of oxygen. Squalene was used in emulsions and vaccines as a carrier into the body due to its therapeutics activity besides can improve immune response (Fatma Esra Güneş,2013). This compound was reported to exhibit anti-cancer, anti-carcinogenic, free radical scavenger and anti-aging activity. Researcher has focus on squalene as anti-cancer since it is proven effective in research on animal and epidemiological. Based on research, squalene exhibit strong anti-tumor activity besides can prevent the growth of various cancer cells. It widely used cancer therapy and it also believed can improve the effect of anti-cancer drug. Besides, carcinogenic effect from drug treatment can be reduced when the squalene shows free radical scavenger activities.

According to Bullon et al.,(2009) squalene can contributes to correct hepatic steatosis and atherosclerosis in males based on research at male rabbit. Study clearly indicates that squalene provides anti-oxidant, emollient, hydration and anti-tumor properties (Huang, Lin and Fang, 2009). Besides, this compound also has the potential to reduce the side-effect of chemotherapy for cancer patient. Skin also can be protected from oxidation, radioactive and ultraviolet radiation by the squalene activity (P. Bullon et al.,2009). Study in rodents proved that squalene can prevent the tumorigenesis of colon, skin and lung (Huang et al., 2009). Besides, squalene can be seen as anti-aging agent and improve the mitochondria activity

In the *Cinnamomun verum*, spathulenol which classified under oxygenated sesquiterpene class was also detected. Spathulenol was reported can enchance antibacteria activities, exhibit anti-microbial activity (Ivanescu,B. et al., 2014), produce immunomodulatory and anti-inflammatory effect (Maimulyanti and Prihadi,2016). This compound is also used as insect repellent properties especially for mosquito. Caryophyllene is a bicyclic sesquiterpene compound which present in the *Cinnamomun verum* extract. Caryophyllene was determined to show anti-proliferative effect to certain cells (Sun et al., 2014). Moreover, caryophyllene at certain concentration can help to induce human hepatocellular carcinoma cell (Wu et al.,2010). Rajeshwari and Andallu (2011) mention that caryophyllene exhibit anti-tumor, anti-inflammation, anti-ulser and anti-microbial properties.

Among the component identified, alpha pinene was known to treat short term memory loss. This compound was classified under terpene class that also possessed anti-inflammatory, increase alertness and improve the respiratory system (Rahn, 2016). Rajeshwari and Andallu (2011) also noted that a-pinene exhibit anti-inflammatory and anti-cancer properties. Asthma patient can use á-Pinene product to reduce the symptom (Rahn, 2016). Alpha-pinene was reported to shows antibiotic, antimicrobial properties and act as acetyl cholinesterase inhibitor (Ayurvedic, 2016). Besides, Wu et al.,(2010) also mention that essential oil that contained terpenoid component including a-pinene , contributes to anti-oxidant activity. This compound also was used as ingredient in analgesic balm, cough lozenges, cold and chest ointments due to its therapeutic properties (Ayurvedic, 2016). Besides, it also used as formulations in mouthwashes due to its antibacterial properties. Study also shows anti-osteoarthritic and anti-catabolic activity of á-Pinene (Ayurvedic, 2016).

Elemene is a monocyclic sesquiterpene compound that was also found in the composition of *Cinnamomun verum*. Elemene compound was determined as anti-cancer compound. Wang et al., (2011) mention that this compound can treat various type of cancer such as nasopharyngeal carcinoma, leukemia, multiple myeloma hepatocellular, bone, gastric, brain, lung, and esophageal cancer. Gamma-elemene have many uses in medicinal especially as anti-tumor agent by enhance the cytotoxic effect in body. (Sun et al., 2014) . Besides, this molecule also has anti-proliferative properties. This compound was reported to act as antifungal, biotical agent and antioxidant by Otitolaiye, A, and C,(2016) Some insect used this compound as pheromones (Grover and Patni, 2013).Besides, Grover and Patni (2013) also reported the possibility of this compound in chemotherapy to fight some type of cancer cell since gamma-elemene may produce anti-proliferative effect

James A. Duke,(2009) mention in his book that gamma-cadinene and beta-himachalene exhibit anti-inflammatory properties. Gamma-cadinene was classified under sesquiterpenes class was also exhibit good anti-bacterial and antimicrobial properties. Aromadendrene is a tricyclic sesquiterpene compound may exhibit antimicrobials properties (Deckard, 2015).This properties enable the essential oil that contained high concentration of aromadendrene to cure infections related to viruses or other microbes (Deckard, 2015). Result also recorded piperidine and piperine is yield of ethanol extract. These compounds are alkaloid group which commonly used in the ingredient of pharmaceutical compound. Piperidine can act as monoamine oxidase inhibitor that makes this compound widely used in pharmaceutical. Aristolene also was considered as the medicinal compound when it can act as antibiotic and anti-inflammation (Solliman et al.2016). This compound shows antibiotic activity against Bacillus bacteria besides can be used as congestion. Besides it can also be used as pain reliever (Solliman et al.2016).

Table 2

Summary of medicinal properties of compounds in *Cinnamomun verum*

Component	Medicinal properties
E-cinnamaldehyde	Anti-viral, Anti-biotic, Antimicrobial, Antipyretic, Anti-tyrosinase, Anti-tumor, Anti-mutgenic, Anti-fungal, Provide spasmolytic activities, Cytotoxic activities , Provide collagen, Hypothermic, Produce calming effect, Sedative, and Anti-pyretic effect
a-pinene	Anti-inflammatory, Increase alertness, Improve respiratory system, Anti-inflammatory, Anti-cancer, Reduce the symptom of asthma,Antibiotic, Antimicrobial ,Anti-oxidant, Antibacterial, Anti-osteoarthritic and Anti-catabolic
Spathulenol	Enhance anti-bacteria activities , Exhibit anti-microbial activity, Produce immunomodulatory and Anti-inflammatory
Campene	Antifungal, Anti-nociceptive, Antioxidant, Anti-biotic, Cytotoxic and Anti-oxidant.
Carophyllene	Antioxidant, Antimicrobial, Anesthetic activity, Anti-proliferative , Induce human hepatocellular carcinoma cell, Anti-tumor, Anti-inflammation, Anti-ulser and Anti-microbial
Gamma-cadinene	Anti-inflammatory properties, Anti-bacterial and Antimicrobial properties
Squalene	Anti-oxidant, Emollient, Hydration, Anti-tumor and Anticancer
Aristolene	Antibiotic and Anti-inflammation
Aromadendrene	Antimicrobials

IV. Conclusion

Soxhlet extraction with different types of solvents which are ethanol, dichlomethane and hexane were successfully carried out to obtain essential oil of *Cinnamomun verum*. The higher essential oil yield was observed from ethanol (13%) solvent follow by dichloromethane(9.47%) and hexane (5.83%). GC-MS analysis revealed the apparent difference in the volatile compound composition in *Cinnamomun verum* from different type of solvent due to affinity of the compound to the solvent. The major compounds that were determined in *Cinnamomun verum* were E-Cinnamaldehyde, Camphene, Caryophyllene, ç-Elemene and Spathulenol. FTIR analysis validate the present of compound with alkane, alkene, amide, aromatic and ester group in *Cinnamomun verum*. E-Cinnamldehyde was found in the *Cinnamomun verum* oil extracted as the major compound exhibit many medicinal properties. Others medicinal compounds have been detected in the oil samples were spathulenol, elemene caryophyllene, aromadendrene,champhene, squalene, a-pinene and aristolene. These compounds have demonstrated effectiveness as anti-microbial, anti-tumor, analgesic, anti-bacteria, anti-fungal, anti-cancer, anti-inflammation and anti-oxidant. All of these properties are very useful for human and animal health. Availability, non-toxic properties, inexpensive price and benefits of the *Cinnamomun verum* makes these spices worse to be noticeable as a potential herb to replace the synthetic chemical medicine.

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