

**Sudan University of Science & Technology
College Of Science
Chemistry Department**

Extraction & Characterizations Of Zingiber Volatile Oil

**Dissertation submitted for the partial fulfillment the
requirement of B.Sc. (Honours) in chemistry**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

بِسْـدَقْوٍ نَ فِيهَا كَأْسًا
كَأَن مِرْزَاجُهَا
زَنْجَبَرِيَّةٌ

(صدق الله العظيم سورة الإنسان الآية 17 .

Dedication

To

**My parents who faded me candles to light
my way**

To

My brothers and all best friends

To

**My teachers who present their fruitful
ideas and great skill to highlight my
future**

To

**My Supervisor
Dr. Mai Makki**

Acknowledgement

First of all thanks god for helping and supporting my research.

Thanks to all who assisted me to reach this stage in my life.

Special thanks

To

My Supervisor (Dr. Mai Makki)

My dear husband Altayeb Abdallah

My best friend Mogam Ayoub Balla

Thanks to my mother, father, family teachers friends, college and to all who helped me to complete this research

Abstract

The project aims to extract Zingiber volatile oils using steam distillation technique and studies some of the physical properties such as Saponification value, Acid value, Peroxide value and Iodine value.

And that was found to be as follow:

- 1- Saponification value (SV) = 90.1 mg/g
- 2- Acid value (AV) = 1.123 mg/g
- 3- Iodine value (IV) = 33.62 mg/g
- 4- Peroxide value (PV) = 0.00 meq/kg

مستخلص البحث

يهدف هذا البحث إلى استخلاص الزيوت الطيارة من الزنجبيل عن طريق تقنية التقطير البخاري و دراسة بعض الخواص الفيزيائية مثل رقم التصبن، رقم الحموضة، رقم البيوكسيد و رقم اليود.

90.1مج/ج	=	1- رقم التصبن
1.123مج/ج	=	2- رقم الحموضة
33.62مج/ج	=	3- رقم اليود
0.00مايكرو/كج	=	4- رقم البيروكسيد

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Chapter One

Literature Review

1. Introduction:

1.1 Ginger or ginger root:

Is the rhizome of the plant *Zingiber officinal*, consumed as a delicacy, medicine, or spice. It lends its name to its genus and family (*Zingiberaceae*). Other notable members of this plant family are turmeric, cardamom, and galangal. The distantly related decocts in the *Asarum* genus have the common name wild ginger because of their similar taste.

Ginger produces clusters of white and pink flower buds that bloom into yellow flowers. Because of its aesthetic appeal and the adaptation of the plant to warm climates, ginger is often used as landscaping around subtropical homes. It is a perennial reed-like plant with annual leafy stems, about a meter (3 to 4 feet) tall. Traditionally, the rhizome is gathered when the stalk withers; it is immediately scalded, or washed and scraped, to kill it and prevent sprouting. The fragrant perisperm of *Zingiberaceae* is used as sweetmeats by Bantu, also as a condiment and sialogogue. (*Zingiber Officinale*

Information from NPGS/GRTN 2008)

1.1.1 Classifications:

In considering the question of classifying the volatile oils, two methods of arrangement naturally suggest themselves, viz. : a classification according to the botanical natural orders to which they belong, and a chemical classification based on the most important chemical constituents of the oils themselves. While the first of these is the more readily made, it suffers from the disadvantage of being cumbrous and less readily understood except by the botanist. On the other hand, the second plan shows at a glance the sources of the valuable odoriferous and medicinally and technically important constituents for which the volatile oils are largely used. That it has not been generally adopted is no doubt due to the fact that many of the oils contain several different constituents of value, and it is therefore difficult to make an assignment of some of them to individual chemical groups. Any chemical system of classifying volatile oils must be either exceedingly complex and cumbersome or, if conciseness is attempted, there are too many inconsistencies and discrepancies. For instance, one of the favored methods of classification is to divide them into four groups, i.e. the terpenes, oxygenated oils, nitro-generated oils, and sulphurated oils. If this be critically studied it is seen that oil of lemon. the terpene class, owes its real identity and value to citral, an aldehyde present in only a very small proportion (less than 5 per cent) and that oil of bitter almond, which is given as the example of the nitrogenated class, owes its classification in this respect only to the incidental presence of hydrocyanic acid, which is frequently removed from the oil, especially when it is used for flavoring purposes.

Kingdom Plantae

Division : Angiosperma
Class : Monocotyledoneae
Order : Scitaminaea
Family : Zingiberaceae
Genus : Zingiber
Species : Officinale

(Roscoe: 1807)

1.1.2 Vernacular names:

Sanskrit : Adrakam, Ardraka
Hindi : Adrak, Sunthi, Sonth
Kannada : Sunthi
Marathi : Nisam
Gujarati :Sunt
English : Ginger

(Roscoe Ginger Lao Jiang)

1.1.3 Botanical description:

A herbaceous rhizomatous perennial, reaching up to 90 cm in height under cultivation. Rhizomes are aromatic, thick lobed, pale yellowish, bearing simple alternatedistichous narrow oblong lanceolate leaves. The herb develops several lateral shoots in clumps, which begin to dry when the plant matures. Leaves are long and 2-3 cm broad with sheathing bases the blade gradually tapering to a point. Inflorescence solitary, lateral radical pedunculate oblongcylindricalspikes. Flowers are rare, rather small, calyx superior, gamosepalous, three toothed, open splitting on one side, corolla of three subequal oblong to lanceolate connate greenish segments

1.14 Geographical distribution:

The plant is widely cultivated all over India, Bangladesh, Taiwan, Jamaica and Nigeria. This perennial grows in warm climates. (*Zingiber Officinale* Information from NPGS/GRTN 2008).

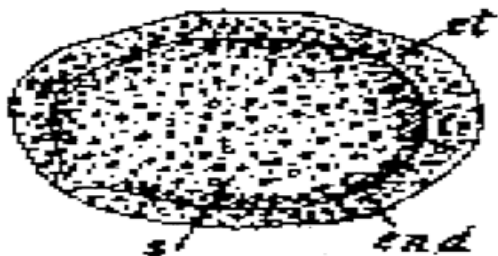
1.1.5 Traditional uses:

Ginger is carminative, pungent, stimulant, used widely for indigestion, stomachache, malaria and fevers. It is chiefly used to cure diseases due to morbidity of Kapha andVata. Ginger with lime juice and rock salt increases appetite and stimulates the secretion of gastricjuices. It is said to be used for abdominal pain, anorexia, arthritis, atonic dyspepsia, bleeding, cancer, chest congestion, chicken pox, cholera, chronic bronchitis, cold extremities, colic, colitis, common cold, cough, cystic fibrosis, diarrhea, difficulty in breathing, dropsy, fever, flatulent, indigestion. disorders of gallbladder, hyperacidity,

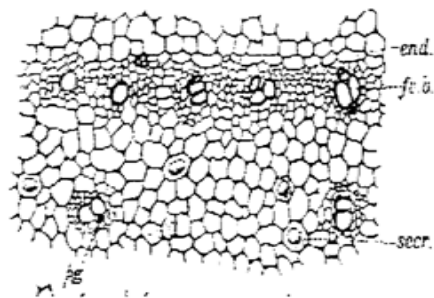
hypercholesterolemia, hyperglycemia, indigestion, morning sickness, nausea, rheumatism, sore throat, throat ache, stomach ache and vomiting. Ginger forms an important constituent of many pharmacopoeia Ayurvedic formulations' (Philips *et al*, 1993 b)

1.1.6 Anatomy of the Rhizome:

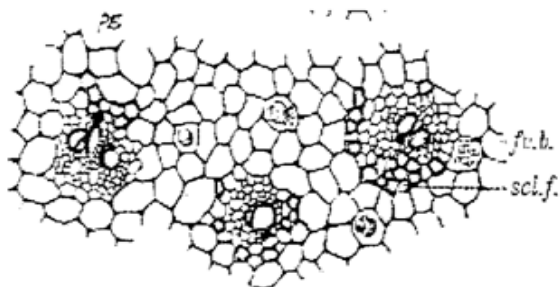
Scraped rhizome with buff external surface showing longitudinal striations and occasional loose fibers, outer surface dark brown and more or less covered with cork which shows conspicuous, narrow, longitudinal and transverse ridges; the cork readily exfoliates from lateral surfaces but persists between branches. Smoothed transversely cut surface exhibiting a narrow cortex separated by an endodermis from a much wider stele, numerous widely scattered fibro vascular bundles, abundant scattered oleoresin cells with yellow contents. Starch abundant in the thin-walled ground tissue, as flattened, ovate to sub-rectangular, transversely striated, simple granules, each with the hilum in a projection towards one end. Pigments cells with dark reddish brown contents occurring either singly in the ground tissue or in axial rows accompanying the vascular bundles. Vessels with spiral or reticulate thickening in the scattered vascular bundles are found irregularly shaped thin-walled fibers with delicate, transverse septa, yielding only slightly the reaction characteristic of lignin. Sclereids and calcium oxalate crystals absent.



Fig(1:1)



Fig(1:2)



Fig(1:3)

Fig.: Transversely cut surface of the rhizome, vascular bundles represented by circles, secretion cells by dots(x3).

Fig.2: Transverse section in the region of the endodermis (x100)

Fig.3: Transverse section of the central part (x100) Ct- cortex, endodermis. ft.b.vascular bundles. pg-pigment cell, S-stele, sd. f- sclerenchymatous fibres. secr. - secretion cell.

1.1.7 Pharmacology and Clinical Studies:

1.1.7.1 Anti-emetic Activity:

Early animal studies had demonstrated the anti-emetic property of fresh ginger but it was the clinical work of Mowrey and Clayson

which generated a wider interest in this use of ginger⁸, They compared the effects of 1.88g of dried powdered ginger, 100mg dimenhydrinate (Dramamine) and placebo on the symptoms of motion sickness in 36 healthy subjects who reported very high susceptibility to motion sickness. Motion sickness was induced by placing the blind folded subject in a tilted rotating chair. Ginger was found to be superior to dimenhydrinate and placebo in preventing the gastrointestinal symptoms of motion sickness and the authors postulated a local effect in the gastrointestinal tract for ginger. This was particularly likely since it was given as a powder only 25 minutes before the test. The gingerols and shogaols were subsequently identified as the main anti-emetic compounds in ginger. (Stewart *et al*, 1997), (Planta Medica, 1994).

1.1.7.2 Improvement of digestive function:

Early Chinese and Japanese research found that oral and intragastric application of fresh ginger decoction produced a stimulant action on gastric secretion. German scientists found that chewing 9g of crystallized ginger had a profound effect on saliva production. Amylase activity was also increased and the saliva was not more watery, although it contained slightly less mucoprotein. Intraduodenal doses of ginger extract increased bile secretion in rats. Total secretion of bile solids was also increased, but not to the same extent as bile flow. 6-gingerol and 10-gingerol were identified as the active components⁵. Fresh ginger also contains a proteolytic enzyme.

Ginger, in conjunction with other pungent Ayurvedic herbs, increased the bioavailability of a number of drugs by promoting their

absorption and/or protecting them from being metabolized in their first passage through the liver• Oral doses of 6-shogaol accelerated intestinal transit in rats. Also an extract of ginger, and isolated 6-shogaol and gingerols, enhanced gastrointestinal motility in mice after oral doses. (Blumberger, W, *et al*, 1965)

1.1.7.3 Anti-ulcer Activity:

Ginger and 6-gingerol inhibited experimental gastric ulcers in rats Fresh ginger decocted in water resulted in symptomatic improvement in 10 patients with peptic ulcers (Yamahara, J, *et al*, 1988)

1.1.7.4 Antiplatelet Activity:

Srivastava and co-workers found that aqueous extract of ginger inhibited platelet aggregation induced by ADP, epinephrine, collagen and arachidonic acid in vitro Ginger acted by inhibiting thromboxane synthesis It also inhibited prostacyclin synthesis in rat aorta. The antiplatelet action of 6-gingerol was also mainly due to the inhibition of thromboxane. (Thonmson *et al*, 2002).

1.1.7.5 Anti-Inflammatory Activity:

Ginger extract inhibited carrageenan-induced paw swelling and was as active as aspirin. Essential oil of ginger inhibited chronic adjuvant arthritis in rats. Ginger and its pungent components are dual inhibitors of arachidonic acid metabolism. That is, they inhibit both cyclooxygenase (prostaglandin synthetase and lipoxygenase enzymes

of the prostaglandin and leukotriene biosynthetic pathways. (Kiuchi *et al.*, 1992).

1.1.7.6 Antipyretic Activity:

Ginger extract given orally reduced fever in rats by 38%, while the same dose of aspirin was effective by 44%¹⁵. The antipyretic activity of 6-shogaol and 6- gingerol has also been observed (Suekawa, M, *et al.*, 1984).

1.1.7.7 Cardiovascular Effects:

Ginger exerted a powerful positive inotropic effect on isolated guinea pigs left atria. Gingerols were identified as the active components.

1.1.7.8 Antioxidant Activity:

Extracts of ginger have pronounced antioxidant activity comparable to that of synthetic antioxidant preservatives. (Jagetia *et al.*, 2003).

1.1.7.9 Other Effects:

Ginger extract exhibited a prolonged hypoglycemic activity in rabbits. Antihepatotoxic activities of gingerols and shogaols were observed using carbon tetrachloride and galactosamine induced cytotoxicity in cultured rat hepatocytes. Injection of 6-shogaol showed an intense antitussive action in comparison with dihydrocodeine phosphate. (Suekawa, M, *et al.*, 1984).

1.1.7.10 Pharmacokinetics:

After injection, 90% of 6-gingerol was bound to serum protein and elimination was mainly via the liver. Oral or intraperitoneal dosage of zingerone resulted in the urinary excretion of metabolites within 24 hours. mainly as glucuronide and/or sulphate conjugates, Appreciable biliary excretion (40% in 12 hours) also occurred⁴). (Naora, K, *et al*, 1992).

1.1.8 Toxicity and Adverse Reactions:

The mutagenic activity of ginger extracts has been observed in several strains. As a result of component fractionation of ginger juice, it was found that 6- gingerol was a potent mutagen. When mutagenicity of gingerol or shogaol was tested in the presence of zingerone. it was observed that zingerone suppressed the mutagenic activity of both compounds. Ginger extract caused no mortality at doses of up to 2.5g./kg in mice (equivalent to about 75g/kg of fresh rhizome). This low acute toxicity was confirmed in a separate study. which also found that ginger extract at 100mg/kg per day for three months caused no signs of chronic toxicity⁸. Topical application of ginger may cause contact dermatitis in sensitive patients⁹.

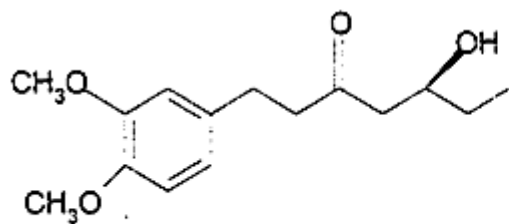
1.1.9 Phytochemistry:

Ginger has been reported to contain usually 1-3% of volatile oil, pungent principles viz., gingerols and shogaols and about 6-8 lipids and others. Ginger oil contains Zingiberene and bisabolone as major constituents along with other sesqui and monoterpenes. Ginger oleoresin contains mainly

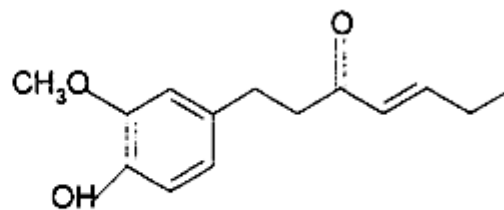
the pungent principles gingerols and shogaols as well as zingiberone. Shogaols have recently been found to be twice as pungent as gingerols¹⁻⁴.

1.1.10 Active principles:

Gingerols. Shogaols.



Fig(1:4)



fig(1:5)

[6] Gingerol 4 C₁₇H₂₆O₄ 294.3

[8] Gingerol 6 C₁₉H₃₀O₄ 322.7
C₁₇H₂₄O 276.3

[6] Shogaol 4

[8] Shogaol 6 C₁₉H₂₈O

304

[10]

Shogaol 8 C₂₁H₃₂O₃ 332.1

[10] Gingerol 8 C₂₁H₃₄O₄ 350.2

Jan – Mar 2011

1.2 Essential oils:

1.2.1 Distillation of essential oil:

Distillation accounts for the major share of essential oils being produced today. The choice of a particular process for the extraction of essential oil is generally dictated by the following considerations:

- a) Sensitivity of the essential oils to the action of heat and water.
- b) Volatility of the essential oil.
- c) Water solubility of the essential oil.

As most of the essential oils of commerce are steam volatile, reasonably stable to action of heat and practically insoluble in water hence are suitable for processing by distillation.

1. Water or hydro distillation.
2. Steam vacuum water distillation.
3. Steam distillation.

Steam Distillation:

The main components of steam distillation unit are:

1. Distillation tank with steam coil
2. Condenser (usually multi-tube tubular)
3. Oil separator or receiver
4. Boiler

Steam distillation exploits the twin action of heat and moisture from steam to break down the cell walls of the plant tissues to liberate the essential oil.

Steam is generated separately in a steam boiler and is passed through the distillation tank through a steam coil. The plant material is tightly packed above the perforated grid (false net). Steam along with oil vapours is condensed in the condenser and is separated in the oil receiver. Capital cost of putting up steam distillation unit is higher and also a trained person is required for operation of the boiler. Steam distillation is preferred where a lot of area is under cultivation and more than one unit is installed. Also for distillation of high boiling oils such of roots / woods for example agarwood chips), patchouli, etc.

Chapter Two

1.2.2 Method of analysis of oils:

1.2.2.1 Saponification value:

Or “saponification number”, also referred to as “sap” in short) represents the number of milligrams of potassium hydroxide or sodium hydroxide required to saponify 1g of fat under the conditions specified. It is a measure of the average molecular weight (or chain length) of all the fatty acids present. As most of the mass of a fat/triester is in the 3 fatty acids, it allows for comparison of the average fatty acid chain length. The long chain fatty acids found in fats have low saponification value because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat as compared to short chain fatty acids. If more moles of base are required to saponify N grams of fat then there are more moles of the fat the chain lengths are relatively small, given the following relation:

Number of moles = mass of oil / relative atomic mass
The calculated molar mass is not applicable to fats and oils containing high amounts of unsaponifiable material, free fatty acids (>0.1%), or mono- and diacylglycerols (>0.1%). Handmade soap makers who aim for bar soap use NaOH sap values which are derived from the saponification value calculated by laboratories (KOH sap value). To convert KOH values to NaOH values, divide the KOH values by the ratio of the molecular weights of KOH and NaOH (1.403).

1.2.2.2 Iodine value:

The iodine value (or “iodine adsorption value” or “iodine number” or “iodine index”) in chemistry is the mass of iodine in grams that is consumed by 100 grams of a chemical substance. An iodine solution is yellow/brown in color and any chemical group in the substance that reacts with iodine will make the color disappear at a precise concentration, The amount of iodine solution thus required to keep the solution yellow/brown is a measure of the amount of iodine sensitive react ye groups.

One application of the iodine number is the determination of the amount of’ unsaturation contained in *fatty* acids. This unsaturation is in the form of double bonds which react with iodine compounds. The higher the iodine number, the more unsaturated fatty acid bonds are present in a fat.[1] In a typical procedure the acid is treated with an excess of the Hanus solution which is a solution of iodobromine (BrI) (or Wij’s iodine solution which a solution of iodine monochloride (ICI) inacial acetic acid). Unreacted iodobromine (or iodine monochloride) is reacted with potassium iodide which converts it to iodine. The iodine concentration is then determined by titration with sodium thiosulfate

1.2.2.3 Peroxide value:

The Peroxide value of an oil or fat is used as a measurement of the extent to which rancidity reactions have occurred during storage.

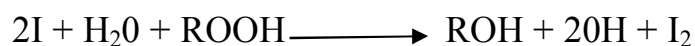
Other methods are available but peroxide value is the most widely used.

The double bonds found in fats and oils play a role in autoxidation. Oils with a high degree of unsaturation are most susceptible to autoxidation. The best test for autoxidation (oxidative rancidity) is determination of the peroxide value. Peroxides are intermediates in the autoxidation reaction.

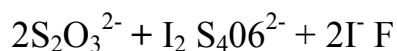
Autoxidation is a free radical reaction involving oxygen that leads to deterioration of fats and oils which form off-flavours and off-odours. Peroxide value, concentration of peroxide in an oil or fat, is useful for assessing the extent to which spoilage has advanced.

The peroxide value is defined as the amount of peroxide oxygen per 1 kilogram of fat or oil. Traditionally this was expressed in units of milliequivalents, although if we are using SI units then the appropriate option would be in millimoles per kilogram (N.B. 1 millimole = 2 milliequivalents). Note also that the unit of milliequivalent has been commonly abbreviated as mequiv or even as meq.

The peroxide value is determined by measuring the amount of iodine which is formed by the reaction of peroxides (formed in fat or oil) with iodide ion.



Note that the base produced in this reaction is taken up by the excess of acetic acid present. The iodine liberated is titrated with sodium thiosulphate.



The acidic conditions (excess acetic acid) prevents formation of hypoiodite analogous to hypochlorite), which would interfere with the reaction,

The indicator used in this reaction is a starch solution where amylose forms a blue to black solution with iodine and is colourless where iodine is titrated.

A precaution that should be observed is to add the starch indicator solution only near the end point (the end point is near when fading of the yellowish iodine colour occurs) because at high iodine concentration starch is decomposed to products whose indicator properties are not entirely reversible.

1.2.2.4 Acid value:

In chemistry, acid value (or “neutralization number” or “acid number” or “acidity”) is the mass of potassium hydroxide (KOH) in milligrams that is required to neutralize one gram of chemical substance. The acid number is a measure of the amount of carboxylic acid groups in a chemical compound, such as a fatty acid, or in a mixture of compounds. In a typical procedure, a known amount of sample dissolved in organic solvent is titrated with a solution of

potassium hydroxide with known concentration and with phenolphthalein as a color indicator.

The acid number is used to quantify the amount of acid present, for example in a sample of biodiesel. It is the quantity of base, expressed in milligrams of potassium hydroxide, that is required to neutralize the acidic constituents in 1 g of sample.

$$AN = (V_{eq} - V_{spike})N \cdot 56.1 / W_{oil}$$

V_{eq} is the amount of titrant (ml) consumed by the crude oil sample and 1ml spiking solution at the equivalent point, V_{spike} is the amount of titrant (ml) consumed by 1 ml spiking solution at the equivalent point, and 56.1 is the molecular weight of KOH. The molarity concentration of titrant (N) is calculated as such:

$$N = 1000W_{kHP} / 204.23V_{eq}$$

1.2.2.5 GC-MS Analysis:

The essential oil of *Zingiber officinal* (Ginger) of two varieties were analyzed by Electron Impact Ionization (EI) method on GC-17A gas chromatograph, coupled to a GCMs 2010 plus mass spectrometer; fused silica capillary column temperature of 40° C (was held 2 min) was maintained with carrier gas helium at a constant pressure of 90kPa. Samples were injected by spilliting with the split ratio 10. Essential oil sample was dissolved in chloroform. The operating condition were as follows: name of

Column- RTS- 5MS, diameter 30 cm, length 0.25mm, temperature of the column- initial temperature 40°C (was held 2 min) , injector

Temperature- 220 °C, holding time 5 min, column packing column, packing was done with 10% diethylene glycol succinate on 100-120 mesh diatomic CAW, splitting samples were injected by splitting with the split ratio 10, carrier gas- helium gas at constant pressure 90 kPa, sample dissolved in chloroform, range of linear temperature

Preparation of Essential Oil Samples for GC-MS

Analysis:

Essential oil was diluted to 7% by chloroform. An inert gas (i.e. nitrogen) was introduced, from a large gas cylinder through the injection part, the column and the detector. The flow rate of the carrier gas was adjusted to ensure reproducible retention time and to minimize detector dirt. The sample was then injected by a micro syringe through a heated injection part when it was vaporized and carried into the column. The long tube of the column was tightly packed with solid particles. The solid support was uniformly covered with a thin film of a high boiling liquid (the stationary phase). The mobile and stationary phases were then partitioned by the samples and it was separated into the individual components. Then the carrier gas and sample component were emerging from the column and passed through a detector. The amount of each component at a particular concentration is recorded by the device and generates a signal which was registered electrically. The signal passed to a detector.

GC-MS analyzed results which include the active principles with their retention time, molecular formula, molecular weight and composition of the essential oil of *Zingiber officinale* (Ginger) of two varieties are presented in Table-2. From essential oil of Bangladeshi variety, *Zingiber officinale* (Ginger), 11 chemical constituents were found and the oil rich in zingiberene, (38.10%), beta phellandrene (12.00%), β -sesquiphellandrene(9.546%), α - curcumene(9.224%), Camphene (5.94%), α -Farnesene (4.573%), β -bisabolene (4.39%), citral (3.91%), α - pinene(2.33%),eucalyptol (1.27%), germacene D (1.14%) respectively i.e. total monoterpene (25.45%) and sesquiterpene (66.97%). On the other hand total 10 chemical constituents were found from the China zinger essential oil. The oil contains α -curcumene (26.54%), camphene (20.60%), citral (17.90%), α pinene (6.63%), borneol (5.40%), $\beta\beta$ isabolene (4.57%), eucalyptol (2.44%), 1, 2disisopropenylcyclobutane (2.84%), hexadecanoic acid (1.55%), Lalloaromadendren (0.86%) i.e. total monoterpene (56.24%) and sesquiterpene (33.97%). Results show that essential oil from both of the two countries is a complex mixture of numerous compounds, many of which are found in trace amounts. It is worth monitoring that there is a great variation in the chemical composition of these two regions oil of *Zingiber officinale*

(Ginger). This confirms that the reported variation in oil is due to geographic divergence and ecological conditions.

Experimental and Results

Instrumental used:

- 1- Balance.
- 2- Distillation
- 3- Heating
- 4- Desciater

Chemical used:

Chloroform, wij reagent, acetic acid, potassium iodide, potassium hydroxide, sodium, thiosulphate, starch, phenolnaphthalein.

Analysis of Zingier official's oil:

1.2.2.1 Determination of Saponification value (sv):

2 gm of oil was transferred into conical flask and 25 m. of alcoholic potassium hydroxide (0.5M) is added to flask, the flask content heated in a water path using soxhlet for an hour, then titrated hydrochloric acid (0.5M) using ph.ph indicator.

Basic titration V1 = 22 ml

Blank titration V2 = 28 ml

$$SV = \frac{(V_2 - V_1) \times 28.05}{W_s}$$

$$SV = \frac{(28 - 22) \times 28.05}{2} = 90.15 \text{mg/g}$$

1.2.2.2 Determination of Acid Value (AV):

10 gm of oil mixed with 20 ml (ethonal and ether) this mixture titrated against potassium hydroxide (0.1M) using ph.ph indicator.

$$AV = \frac{(V_2 - V_1) \times 5.615}{W_s}$$

$$AV = \frac{(4 - 2) \times 5.615}{2} = 1.123 \text{mg/g}$$

1.2.2.3 Determination of Peroxide Value:

5gm of oil mixed with 30 ml of (chloroform and acetic acid) mixture, then 10 ml of potassium iodide was added to the mixture, after a minute then thus titrated against potassium thio sulphate solution (0.1M) using starch indicator .

$$V = 0 \text{ml}$$

$$PV = \frac{N \cdot V \cdot 1000}{W_s}$$

$$PV = \frac{0.1 \cdot 0 \cdot 1000}{5} = 0.00 \text{meq/Kg}$$

1.2.2.4 Determination of Iodine Value:

0.2 gm of oil was mixed with 20 ml of wij's solution and 10 ml of chloroform then the mixture left in the dark for 30 minutes . Next 10 ml of potassium iodide solution (10%) and 100 ml of demonized water were added then this solution titrated against sodium thiosulphate (0.1M).

Basic titration V1 = 10.7 ml

Blank titration V2 = 16.00 ml

$$SV = \frac{(V_2 - V_1) M. 12.69}{W_s}$$
$$= \frac{5.3 \times 0.1 \times 12.69}{0.2} = 33.62$$

Chapter Three

Discussion and Results

Discussion

A substance of oily consistency and feel, derived from a plant and containing the principles to which the odour and taste of the plant are due (essential oil); in contrast to a fatty acid, a volatile oil evaporate when expose to the air and thus is capable of distillations. It may also be obtained by expression or extraction, many volatile oils identical to or closely resembling the natural oils, can be made synthetically.

Volatile oils are used in medicine as stimulants, stomachic, correctives, carminatives and for purpose of flavoring, (e.g. peppermint oil).

The name ginger is derived from the Sanskrit word *sringavera* (meaning shaped like a horn) and the plant originates from India, being found in South East Asia.

The term (ginger) itself only refers to *Zingiber Officinale*, and not to any related species (or false gingers) all from ginger family, such as *alpina*, *amomum*, *curucuma*, *Elettaria*, *headyichiumand kaempferia*, *zingiber officinale* belongs to the botanical family of the *zingeraceae*. The essential oil of ginger is extract from the rhizome by distillation.

Ginger oil is one of the most useful essential oils. It form an important constituent of many pharmocpoeial ayurvedic formulations.

Ginger in conjunctions with other pungent ayurvedic herbs, increased the bioavailability of a number of drugs by promoting their absorption and / or protecting them from being metabolized in their first passage through the liver.

Ginger has been reported to contain usually 1-3% of volatile oil, pungent principles viz, gingerols and shogols and about 6-8% lipids and others. Ginger oil contain zingiberane and bisabolone as a major constituents along with other sesquidi and monoterpenes.

The volatile oil of ginger was subjected specification tests, such as saponification value (SV), acid value (AV), iodine value (IV) and peroxide value (PV) and that was found as follow:

- 5- Saponification value (SV) = 90.1 mg/g
- 6- Acid value (AV) = 1.123 mg/g
- 7- Iodine value (IV) = 33.62 mg/g
- 8- Peroxide value (PV) = 0.00 meq/kg

The peroxide value is found 0.00 meq/kg because the peroxide value is indicate to the rancidity and because the oil was new so the rancidity is equal zero.

The essential oil has hypertensive properties and should not be used on people with high blood pressure. It can be a skin irritant and can cause irritation on people with sensitive skins or with eczema.

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