Perfume Extraction and Formulation from Lemongrass Leaves

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Abstract- Extracting aromatic compounds from raw materials using procedures like distillation, solvent extraction, expression, or effleurage is called perfume extraction. The wax content in the extracted substance determines the kind of extract, which may range from essential oils to aroma oils. After extraction, aromatic substances lose their smell and flavour due to the decomposition of the molecules using heat, chemicals, or oxygen exposure. This study employed solvent extraction using two systems and steam distillation to get the essential oil out of lemongrass. Methods I and II of solvent extraction yielded 2.08 percent and 1.96 percent essential oil, respectively, while method III yielded 0.95 percent. Formaldehyde and methanol were used as carrier solvents to create a perfume from the extracted essential oil.

Indexed Terms- Extraction, Formulation, Perfume, Lemongrass, Leaves.

I. INTRODUCTION

1.1 BACKGROUND OF STUDY

Fragrant essential oils and aroma compounds are combined with fixatives and solvents to produce perfume, which is applied to the skin and other surfaces, as well as food and household items. Using fragrances that mimic the pleasant scents of nature has been a long-standing human tradition since the dawn of time (Ameh et al., 2021; Marag, 2019; Weiss, 1997). The industrial synthesis of chemicals like vanillin and coumarin in the late 19th century allowed the formulation of fragrances with aromas previously impossible purely from natural aromatics (Maysarah et al., 2019).

Plants numerous components have provided essential oils and aromas utilized in perfumery for centuries. Cymbopogon (Cymbopogon citratus) obtained from lemon grass yields an essential oil that is extensively utilized in the perfume business. It is a genus of roughly 55 tropical and semi-tropical Asian plant species that are also widely farmed in South and Central American nations, Africa, and many other tropical locales throughout the world. Green & Keville,(1997) said that this perennial crop is made of tufted perennial grasses on rhizomatous rootstock. The Greek words "kymbe" (boat) and "pogan" (beard) give rise to the term "cymbopogan," which refers to the flower spike arrangement (plants database).

This plant is also known as lemongrass or citronella (in English), Cymbopogon, citron grass, or citronella (in Swedish), and capim-adrao in Brazil (in the USA). The lemony flavor and aroma are the inspiration for the name. Lemongrass leaves and blooming tips are used to make the oil (Camps, 2009). The distinctive aroma of the oil makes it ideal for use in the scenting of soaps, detergents, and insecticides. As a source of citral, which is used in perfumes and cosmetics, and as a starting material for the production of ionones which produces vitamin A. It has germicidal, therapeutic, and flavoring properties because it contains a lot of citral in it (National Horticulture Board of India 2014).

1.2 STATEMENT OF PROBLEM

There are many trees, grasses, and plants in Nigeria, but little has been done to investigate their potential for human use. The little known about them is still quite rudimentary, poorly categorized, and without qualitative data. For instance, some herbalists employ lemongrass to cure malaria and typhoid infections in a rudimentary method—boiling in water and drinking and bathing in the water. Another challenge is obtaining the components from the lemongrass for the therapy of malaria and typhoid (Willcox et al., 2004). Many lemongrass varieties are still traditionally boiled in pots (Iwu, 2014). Lemongrass can be used in various ways to treat a variety of ailments (Weiss, 1997).

In this research, the lemongrass oil will be extracted, examined, characterized, and blended to generate a perfume.

1.3 AIM AND OBJECTIVES

The main aim of this research is to extract and formulate perfume from lemon grass. The objectives are as follows:

1. To evaluate the preferred method of extraction of the lemon grass essential oil.
2. Know the essential constituents of lemon grass oil

1.4 SIGNIFICANCE OF STUDY

1. This project focuses on the production of perfume oil from natural/plant source as against synthetic chemicals which will reduce possible side effects resulting from synthetic chemicals.
2. The success of this work will facilitate the advancement of the perfume industry locally because of the availability of cheap raw materials.
3. There will also be a reduction in the resources spent on importation of synthetic lemon grass fragrance by manufacturers and all other users.
4. More jobs will be created for those that will be engaged in planting/cultivation of the plant as well as establishing small scale extraction plants.

1.5 SCOPE OF WORK

This research work is on how perfume oil can be extracted from lemon grass. It further entails:

1. Lemon grass oil characterization
2. The extraction methods and formulation processes involved.
3. Economic importance of lemon grass and the uses of lemon grass oil in perfume production process.

II. LITERATURE REVIEW

2.1 HISTORICAL DEVELOPMENT OF PERFUME

The term "perfume" is derived from the Latin words "per" (meaning through) and "fumus" (meaning smoke) (perfumery at Lymington). Natural ingredients were the primary components of the first fragrances. Ancient terra-cotta perfume vials were uncovered in 1974 by archaeologists working in the Indus Valley. According to the history of perfume, aromatic plants, refined oils, fragrances, and temple incense were documented in papyrus texts, as were the medicinal salves prepared from fragrant resins (Keville et al. 1995). Human civilizations as far back as the Neolithic Age used perfumes. Late 19th-century commercial synthesis of aroma compounds like vanillin and coumarin enabled the formulation of perfumes with scent qualities previously unavailable from natural aromatics alone (Konstantinantiques, 2021).

Perfumes are food for the spirit, the prophet Mohammed is claimed to have written.(Madehow, 2014). Between 6 and 4 BC during the birth of Jesus as recorded in the Bible (Matthew 2:11), myrrh and frankincense were brought to Jesus by three wise men to honour his birth. Ancient Egyptians offered sacred gifts by burning "kyphi," an incense made from henna, myrrh, cinnamon, and juniper. Aromatic wood, gum, and resins were steeped in water and oil before being applied to the skin as a scented lotion. It was not only the ancient Egyptians who used perfume on their deceased. "Fragrance of the gods" translates into their term for perfume (Widhalm et al., 2018).

Egyptian fragrances were eventually adopted by the Greeks and the Romans, who were affected by Egyptian perfumes (Poucher, 1973). For hundreds of years after the fall of Rome, perfume was predominantly an Oriental craft. Crusaders returning from Palestine with samples in the 13th century disseminated it across Europe. During the 17th century, Europeans began to learn about the therapeutic benefits of scent (World History Encyclopedia, 2021). Doctors treating plague patients wore leather pouches containing fragrant cloves, cinnamon, and other species they believed would protect them from illness.

The royalty widely used the perfume during this time. France's monarch, Louis XIV was dubbed the "perfume king" for his frequent usage of it (Gruhme.co.uk,2020). Fragrant dried flowers were arranged in bowls throughout the palace to refresh the air, and there was a flowery pavilion in his court. Grasse, an area in southern France home to a wide variety of flowering plants, became a significant producer of fragrances during this period. In this era, aromatics were kept in lockets and in the hollow heads of canes in England, where the owner could inhale them (Madehow, 2014).

2.2 PERFUME NOTES

In a musical metaphor, the harmonic smell accord is defined as having three sets of notes in a perfume. Top, middle, and base notes make up the composition of a scent. The perfumer's evaporation technique is taken into consideration while creating these notes. The three distinct components blend to form a harmonious whole whose consistency and scent complement one another (perfumery) (Newton, 2020; Aftel, 2001; Groom, 2012).

Top Notes:

When a perfume is applied, the wearer's fragrance may be instantly detectable. Perfume's top notes are first perceived by the wearer. It is common to describe the fragrances in this category as crisp, firm, or sharp. Scent-rich, highly volatile, and short-lived are all constituents that make up top notes. Citrus and ginger fragrances are examples of top notes, also referred to as headnotes (Newton, 2020)

Middle Notes:

This is an aftertaste of a perfume; the aroma that remains after the top notes of the perfume has faded away. Compounds in the middle note section of a perfume work as a disguise for the base notes, which may become abrasive with time. It embodies the fragrance's overall theme, such as lavender or rose (Aftel, 2001; Groom, 2012).

Base Notes:

The perfume's base note is the aroma that emerges after the top notes have faded away. A perfume's base note adds depth and solidity. (Newton, 2020; Groom, 2012).

2.3 SOURCES OF PERFUME (AROMATIC SOURCES)

For centuries, plants have been employed as a source of essential oils and fragrance compounds in perfumery. These aromatics are often secondary metabolically produced and also serve to attract pollinators. Perfumes rely heavily on the aromatic chemicals found in plants. They may be found in many different areas of the plant. For example, the aerial parts and seeds of coriander have very diverse scents from one another. A plant may provide more than one fragrant source (Collins & Mitchell, 1999; Surburg & Panten, 2016).

Bark: Cinnamon and cascarilla are two of the most regularly utilized barks. Safrole, the primary ingredient of sassafras root bark's aromatic oil, is also employed in manufacturing other fragrant chemicals.

Flower & Blossoming Plants: Among the primary sources of aromatics are the blooms and blossoms of particular species of rose and jasmine, as well as osmanthus and plumeria, and the blossoms of citrus and ylang-ylang trees. Clove flower buds, which are not open, are also often utilized, even though they are not generally considered flowers. Vanilla, an orchid, must first be pollinated and harvested into seed pods before being utilized in perfumery as an essential oil or pure (Ashley, 2012).

Fruits: When extracted, fresh fruits like apples, strawberries, and cherries do not produce the anticipated odors; if similar pleasant notes are present in perfume, they are manufactured. Cubeba, sea, vanilla, and juniper berries are notable outliers. Citrus fruits, including oranges, lemons, limes, and grapefruit, have fragrant rinds that are widely utilized in cooking (Surburg & Panten, 2016). .

Leaves and Twigs: The leaves and twigs of the eucalyptus tree, lavender, patchouli, sage, violets, rosemary, and citrus leaves are often used in fragrance. Hay and tomato leaves are two common examples(Collins & Mitchell, 1999).

Resins: Resins have been used in incense and perfumes for millennia. Many civilizations have utilized resins and resin-based fragrances to treat a wide range of diseases. For example, labdanum, frankincense/olibanum, myrrh, Peru balsam, gum benzoin, pine, and fir resins are among the most frequently utilized resins in perfumery for the production of various synthetic and naturally occurring aromatic compounds(Surburg & Panten, 2016).

Roots, rhizomes, and bulbs: These include iris rhizomes, vetiver roots, and different rhizomes of the ginger family, which are used in perfumery.

Seeds: There are a variety of seeds that are typically used in spice blends, including black pepper, nutmeg, mace, cardamom, and anise.

Woods: In perfumery, wood oils and distillates play a crucial role in creating the base notes of ascent. These include rosewood, birch, cedar, juniper, and pine.

Animal Sources: The sperm whale produced and discharged the antecedents of ambergris, which are lumps of oxidized fatty molecules.

Castoreum: North American beaver odorous sacs are the source of castoreum.

Civet: Animals in the family Viverridae, which includes the mongoose-like mongoose civet, produce civet musk extracted from the civets' odorous sacs.

Honeycomb: the honey bee's honeycomb is the source of this deliquescent.

Musk: It was originally made from the musk sacs of the Asian musk deer, which produce musk. Since its high cost and ethical concerns have prompted the switch to synthetic musk, it has been supplanted. Lichens and seaweed are two other possibilities.

Synthetic sources: Fragrances that are not present in nature may be made synthetically. A wide variety of chemical substances, such as petroleum distillates, pine resins, and other readily available organic feedstock, may be used to synthesize synthetic aromatics for use in pharmaceuticals. When natural sources of a substance are not available, synthetic aromatics are often utilized as a substitute. Linalool and coumarin, for example, are naturally occurring chemicals that are quickly produced from terpenes at a low cost of energy and resources (Collins & Mitchell, 1999; Surburg & Panten, 2016).

2.4 ESSENTIAL OILS

"Essential oil" or "volatile oil" cannot be defined scientifically. However, it is possible to define them as odoriferous oily bodies obtained almost exclusively from vegetable sources, generally liquid (sometimes semi-solid or solid) at ordinary temperatures, and volatile without decomposition in this definition (Worwood, 1991; Baser & Buchbauer, 2009; Linskens & Jackson, 2012).

Many different plants, shrubs, and tree species produce essential oils. These oils may be extracted from many plant anatomical components such as roots, rhizomes, wood bark, and other plant sections such as leaves and stems (Linskens & Jackson, 2012). Essential oils are utilized in flavoring and perfumery because they have a distinct aroma. Oils infused in vegetable oil are aroma oils, whereas oils infused with essential oils and other aromatic compounds are essential oils: concrete and absolutes. Complex combinations of hundreds of fragrance components are typical in essential oils (Baser & Buchbauer, 2009; Linskens & Jackson, 2012).

2.4.1 CHEMICAL CONSTITUENTS OF ESSENTIAL OILS

Two essential oil ingredients define the chemistry of essential oils. Hydrocarbons and oxygenated chemicals make up the majority of their composition (Clarke, 2009; Sterrett, 1962; Oliveira et al., 2020; Kumar & Mathela, 2018).

Hydrocarbons: Hydrogen and carbon are the primary building blocks of essential oils, broken down into smaller molecules.

Terpenes: Essential oils are made up of many compounds that have the formula C10H16, which are generally volatile liquids and seldom solids (Oliveira et al., 2020; Kumar & Mathela, 2018). Terpenes prevent toxins from accumulating in the liver and kidneys. Monoterpenes, sesquiterpenes, and diterpenes are all types of terpenes.

Monoterpenes: Almost all essential oils include monoterpenes. They improve the medicinal properties of other components and serve as the oil's balancing component. Once the sesquiterpenes and phenolics have done their work, they return the DNA to its original state(Kumar & Mathela, 2018).

Sesquiterpenes: Essential oils nearly always include these antibacterial and anti-inflammatory compounds as well as compounds that help clear out old data from the cells' internal memory. From studying the chemistry of essential oils, we know that they contain the most terpenes of any plant or animal. In the perfume business, they are employed as fixatives since they are big monoterpenes and also

viscous. Diterpenes are chemicals with a C20 backbone that are found in all plant groups. Diterpenes' antifungal, expectorant, hormonal, and hypotensive properties are well-known (Oliveira et al., 2020; Kumar & Mathela, 2018).

Alcohols: oxidation-resistant and restoring normal cell processes are two characteristics of this compound. Their antibacterial and antiviral properties are well-known (Clarke, 2009; Sterrett, 1962; Kumar & Mathela, 2018).

Esters: The oil's perfume value may be attributed in considerable part, or perhaps totally, to the esters it contains, which are formed when an alcohol and an acid are combined (Oliveira et al., 2020; Kumar & Mathela, 2018). Relaxing and soothing essential oil ingredients include these oils. Essential oils have an essential role in regulating the nervous system and are antifungal and anti-inflammatory.

Phenolics: Oils' scent is created by a chemical compound called phenolics. They have a positive effect on the nervous and immune systems, respectively. It helps sesquiterpenes get rid of erroneous information from cells by clearing receptors. They are rich in oxygenated compounds and have anti-oxidant capabilities(Clarke, 2009).

Aldehydes: The beautiful aromas of essential oils are due to their antiviral, anti-inflammatory, and relaxing effects on the nervous system (Oliveira et al., 2020; Kumar & Mathela, 2018).).

Ketones: Unlike monoterpenes and alcohols, ketones are not as common as you would think. They are relaxing and tranquil, with unique scents. Moreover, they stimulate cell regeneration, promote new tissue development, and dissolve mucus. Ketones may be very harmful, although this is not always the case (Clarke, 2009; Kumar & Mathela, 2018).

Oxides: It is via the process of reduction and oxidation that oxides are formed. They are a moderate stimulant and an expectorant (Clarke, 2009; Sterrett, 1962; Oliveira et al., 2020; Kumar & Mathela, 2018). Essential oils may include minor quantities of chemicals that are not mentioned in this article. They are not the majority; they make up less than 20% of the population on average.

2.4.2. STORAGE OF ESSENTIAL OILS

Essential oils degrade primarily due to light, heat, and oxygen exposure. Refrigeration or a dedicated box are the best places to keep oils, which should be kept at 5^{o}C. In order to prevent the oil's volatile components from evaporating too quickly, the bottles that hold it should be dark, amber, or cobalt blue, never transparent (Jankowski et al., 2020).

2.5 PERFUME EXTRACTION METHOD

Essential oils are extracted from plants through the following process

(a) Collection
(b) Expression
(c) Solvent Extraction
(d) Effleurage
(e) Maceration
(f) Expression

2.5.1 COLLECTION

Many plants are harvested; many flowers are gathered for use.

2.5.2 EXPRESSION

Essential oils from citrus fruits like lemon and lime may only be extracted via the expression process (also known as cold pressing). Crushing or breaking the essential oil glands in the peel to release the oil is what this word alludes to (extraction methods of natural essential oils). Sponge pressing was a standard method of expression in the past, and it was done entirely by hand. However, centrifugal force is used in the bulk of current expressiveness methods. The centrifuge spins the apple juice to remove the bulk of the essential oil (Toller & Dodd, 1993).

2.5.3 ENFLEURAGE

Enfleurage was a standard extraction method used in the early days of perfumery to extract floral scents. Fat has a high absorption capacity; hence, enfleurage, a cold fat extraction method is based on this idea. Even after harvest, flowers that continue to bloom and release their perfume may be treated this way. Due to its high cost and the development of more efficient and effective extraction methods, this approach is not often employed in today's business. The odour of aromatic

compounds is first absorbed into wax or fat and then extracted with alcohol during the enfleurage process. Today, Greece is one of the few places where the enfleurage extraction process is still used (Orji, 2012; Verrill, 2013).

2.5.4 SOLVENT EXTRACTION

An alternate approach is needed for certain plant products that are too delicate to distil. A soluble lipophilic substance may be extracted from plants using solvents such as petroleum ether, methanol, ethanol, or hexanes. The solvent will also draw out the extraction of chlorophyll and other plant tissue. Concrete is the first product to be produced. Concentrated plant waxes and odoriferous compounds are found in plant concrete. The mixture is then diluted with alcohol, removing the concrete's aromatic components. An absolute is a term used to describe the ultimate result (Orji, 2012; Khopkar, 2007).

2.5.5 MACERATION

Enfleurage employs heated fats dissolved in alcohol to absorb the floral scent, while maceration uses warm fats dissolved in alcohol. Essential oils are extracted by dissolving grease and fat in alcohol, a process similar to solvent extraction. In the end, a block of concrete is what comes out of the process.

2.5.6 DISTILLATION

Distillation separates two or more substances into their components by heating and then cooling the mixture. Vaporizing oils from the herb's plant cell membranes at high temperatures and moisture, then chilling the mixture to separate the oil from the water, is all that is required.

Today distillation is still the most common practice for extracting essential oils from plants.

There are three methods / types of distillation
(a) Water distillation
(b) Steam distillation
(c) Water and steam distillation

2.6 FORMULATION OF PERFUMES

Fragrances include between 78% and 95% ethyl alcohol, properly denatured. This proportion may range from the essential oils obtained from blooming plants. (History of Perfume Fashion, 2001).

- Perfume is the costliest form of fragrance with 22% essential oils
- Eau de Parfum (EDP) comes next between 15 and 25 essential oils
- Eau de Toilette (EDT) 8 TO 15% essential oils
- Eau de Cologne has just 4% essential oils

Fragrant extracts are commonly referred to as "essential oils," but the fragrance industry employs a more technical terminology to define the source, purity, and processes used to create each fragrant extract.

Absolute: using the ethanol purification of a pomade or concrete to provide a highly concentrated viscous semi-solid or solid scent ingredient. Ethanol can be used to get most of the aromatic chemicals from waxy sources without breaking down the more waxy molecules. Oily liquids contain absolutes.

Concrete: Volatile hydrocarbons are used in solvent extraction to remove aromatic compounds from raw materials. Due to the solvents' ability to dissolve different hydrophobic chemicals, concrete often contains a significant quantity of wax. To further purify concrete, ethanol-based solvent extraction distillation is often used.

Essential oils: The oily liquid form of aromatic compounds that have been taken directly from a source material by distillation or expression are called aromatic oils. An essential oil is a highly volatile and fragrant liquid that contains the main ingredients that make a plant smell unique. It is produced by expression or distillation from a single botanical form of a species, or even a particular component thereof.

Pomade: Enfleurage is the process by which the smelly molecules in raw materials are absorbed into animal fats, making a fragrant mass of solid fat that smells good. Pomades come in the shape of a solid, greasy substance.

Tincture: Alcoholic extracts are made by directly soaking and infusing raw ingredients in ethanol. Tinctures tend to be thin liquids, but they may be thicker.

2.6 LEMON GRASS

Many of the tropical and subtropical South East Asia and Africa sections are home to lemongrass (Cymbopogon flexuosus), a naturally scented long plant (family: Poaceae). It is a tall perennial sedge with a short rhizome that produces thick fascicles of leaves. Long, thin, linear, glaucous green leaves taper upwards and along their edges; liquid extremely short; sheaths terete; barren shoots broad and tightly clasping at the base; others narrow and separate; culm up to 1.8 meters tall; liquid extremely short; sheaths terete. In South India, it is a short-day plant that produces many flowers. Flower panicles are 30–60 cm in length, and the inflorescence reaches a height of 1 meter. (National Horticulture Board of India, 2014).

2.7.1 PROPAGATION AND MANAGEMENT

Many sections of tropical and subtropical Southeast Asia and Africa are home to the scented lemongrass (Cymbopogon flexuosus), which belongs to the Poaceae family. Perennial lemongrass grows to a height of two to three feet and produces thick spikes of leaves from a short rhizome. Tightly clasping at the base with widening at the base of the liquillodes and narrowing at the base of liquillodes on barren shoot liquillodes; liquillodes are very short and the sheaths terete; the sheaths of barren shoot liquillodes are widening, and the sheaths of other barren shoots are narrowing and separating (Orji, 2012). In South India, the days are short, and the plant produces many flowers. The flowers are 30–60 cm long, and the inflorescence is around 1-meter long. (The National Horticulture Board of India NHB, 2014).

2.7.2 ECONOMIC IMPORTANCE

Health Benefits

(a) Lemon grass oil mixed with other essential oils such as coconut oil is used as a liniment for back pains, rheumatism, neuralgic and other body pains.
(b) Lemon grass as herbal medicine for gastrointestinal problems, stomach aches, diarrhea, headaches taken as tea.
(c) Lemon grass oils mixed with other essential oils such as lavender or jasmine oil used in baths or vapour scents can revitalize the body and relieve symptoms of jet lags and stress related exhaustion.
(d) To treat circulatory disorders.
(e) Lemon grass has natural anti-microbial properties, is an antiseptic suitable for use on various types of skin infections usually a wash or compress and is effective on ringworm, infected sores, acne and athletes foot.
(f) Lemon grass is effective in killing cancer cells.
(g) It is useful with respiratory infections such as sore throats, laryngitis and fever.

Culinary and Food Preparation

(a) Lemon grass is widely popular as spice for various culinary and food preparation.
(b) Lemon grass is popular for its citrus flavor which is widely used in a variety of Asian cuisines.

Industrial Uses of Lemon Grass

(a) A very important ingredient of lemon grass is citral. It can be further processed to extract or obtain violet like fragrance for perfumery and is a source of vitamins A and E.
(b) Lemon grass oil is used in deodorants, waxes, polishes, detergents and insecticides where its low cost is attractive.
(c) Lemon grass oil is used as fragrance component in soaps, detergents and cosmetics.
(d) It is also used in aromatherapy and improves circulation and muscle development.

Soil erosion control: a good crop for checking soil erosion as a mulch material.

2.7.3 LEMON GRASS OIL

Lemon grass oil has a lemony, sweet smell and is dark yellowish to amber and reddish in colour with a watery viscosity.

2.7.4 CHEMICAL COMPOSITION

The main chemical components of lemon grass oil is citral, Geranial, neral, Geraniol, limonene and β-mycerene are the major constituents of the stalks and leaves.

Extraction: - Lemon grass oil is obtained by steam distillation of lemon grass.

III. MATERIALS AND METHODS

3.1 SAMPLE SOURCE AND PREPARATION

Fresh lemongrass (figure 3.1) was collected from Amassoma and Yenegoa communities in Bayelsa state

and cut in the laboratory using a knife to reveal the inner tighter stem.

Figure 3.1: Fresh lemon grass

3.2 APPARATUS AND SOLVENTS

1. A retort stand
2. 500ml Separation funnel
3. 250ml and 100ml Beakers
4. Electronics weighting balance (500g/0.01g. DT-500B)
5. Rotary Evaporator
6. Mortar and pestle
7. 500ml Round bottom flask
8. Knife
9. Aluminium foil
10. Electric heater
11. Distilled water
12. Petroleum Spirit (40-60)
13. Hot plate
14. Locally fabricated steam distillation apparatus
15. Buckets
16. Rubber tubes

3.3 SOLVENT EXTRACTION METHOD USING PETROLEUM SPIRIT (40-60) AS SOLVENT

132.8 gram of freshly cut lemon grass was loaded into the soxhlet in batches of 40g. 250ml of petroleum spirit (40-60) boiling range turned into a conical flask placed in an electric heater. The flask is fitted to the soxhlet apparatus connected to a condenser. It is clamped to a retort stand. The procedure lasted for about 30min with the extract refluxing severally to obtain oil. The system apparatus is shown in fig 3.2. Another batch of lemongrass sample was run with the same process continuously. A total of 850ml of solvent was used and 136.816g of lemon grass. Using the rotary evaporator to recover the solvent and the lemon grass oil, it was separated.

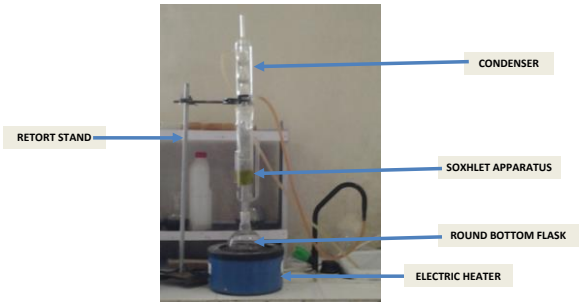

Figure 3.2: Solvent Extraction Method I

3.4 STEAM DISTILLATION METHOD USING A FABRICATED STEAM DISTILLATION APPARATUS

250ml of water and 200g of freshly chopped lemongrass were put into the fabricated flask. To prevent oil leakage, the flask was sealed with foil paper and a rubber stopper. The flask's tiny tube aperture, via which steam was collected, was linked to a Liebig condenser, and then connected to a flowing water faucet. The opposite end of the condenser was attached to a conical flask filled with ice-blocked water through a rubber tube slanted at an angle. Lemongrass essential oil vaporizes when heated to a steaming vaporization temperature.

All of the vapor flowed through the condenser and became liquid. Cooling was made possible thanks to an ice block, which prevented the essential oil from evaporating. A 500ml beaker was used to collect the condensate, then placed into a separating funnel for further separation. The water layer was dissolved, but the oil layer was preserved. While the water was being drained from the separator funnel, the oil was being collected in a bottle. To prevent the essential oil from evaporating, the container was firmly shut. Afterward, the oil was gathered, and the amount of recovered oil was weighed. The system apparatus are shown in fig 3.3.

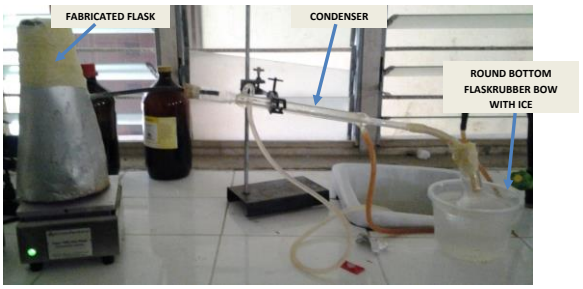

Figure 3.3: Steam Distillation

3.5 SOLVENT EXTRACTION METHOD USING A SOXHLET APPARATUS IN REVERSE AND WATER AS SOLVENT

525.8g of the cut lemon grass was weighed and loaded into a 500ml conical flask with 350ml of distilled water as solvent for extraction using a soxhlet apparatus as shown in fig 3.4. The flask was placed into the electric heater. The condenser was then set up and connected to the soxhlet to aid the cooling process with water from a bucket flowing through. The soxhlet served as the extract collector and the set up run severally to extract all the oil present. The same method was carried out for another batch of lemon grass. After extraction the extract was poured into large bottles for settling and separation. Thereafter the lemon grass extract was put into a separating funnel and 100ml of petroleum spirit added gradually to ensure proper separation in the funnel. Three layers where formed in the order water, petroleum spirit and lemon grass oil. The oil was collected and others discarded. After which the lemon grass oil was placed in a bath to remove any remnant of water or petroleum spirit present. The oil was weighed and turned in bottle.

Figure 3.4: Solvent Extraction Method II

3.6 FORMULATION OF PERFUME WITH ESSENTIAL OIL PRODUCED

3.6.1 Apparatus and Reagents

- Pipette
- Funnel
- 50ml and 100ml beakers
- Perfume bottle
- Fixatives (Formaldehyde)
- Methanol
- Distilled water
- Lemongrass essential oil

3.6.2 PROCEDURE

A 100ml beaker was filled with 2.5ml of Methanol and 5ml of lemongrass essential oil extract. It was mixed with 2.5ml of the fixatives (to improve the perfume's longevity). poured into a 25ml container after being shaken.

IV. RESULTS AND DISCUSSION

4.1.1 SOLVENT EXTRACTION METHOD USING PETROLEUM SPIRIT (40-60) SOLVENT

136.816g of fresh lemon grass resulted in 5.30g of lemongrass oil. This gives a yield of 3.897% per 136.816g of lemon grass (table 4.1). The yield was low due to losses during the extraction process. This is as a result of the volatility of the lemon grass oil.

4.1.2 STEAM DISTILLATION METHOD

The amount of essential oil obtained by the steam distillation method using the locally fabricated steam generator was 2.50g and a yield of 1.25% (table 4.1). The yield was poor due to poor lagging and the volatility of the oil.

4.1.3 SOLVENT EXTRACTION METHOD USING WATER AS SOLVENT

The weight of lemon grass oil obtained from this method was 23g from a total mass of 924g. The yield was 2.5%. (See table 4.1)

Table 4.1: Extraction Methods and Yields

Method of Extraction	Mass of lemon Grass used(g)	% Yield of oil
Steam distillation	200	1.25
Solvent extraction using petroleum spirit	136.81	3.387
Solvent extraction using water as solvent	924	2.5

4.2 PHYSICAL AND CHEMICAL PROPERTIES OF LEMONGRASS OIL

Lemon grass oil was detected in the oil, which had a light-yellow color and had an aromatic, pungent scent. As a result of its extreme flammability, it was kept in a dark, cold, and airtight location away from direct sun exposure. The essential oil was insoluble in water but soluble in alcohol and oil. The oil is further characterized as shown in table 4.2

Table 4.2 characterization of lemon grass oil

Parameter	Standard oil values	Extracted oil values
Viscosity (25)	4.16	3.873
Specific gravity	0.9253g/mL at 25	0.918
Refractive index	1.480-1.490	1.453

From Table 4.2 above, the characterized extracted oil values where within the range of the standard values for the various parameters of lemon grass oil and shows that good lemon grass oil was obtained.

4.3 COMPARISON WITH PREVIOUS WORK.

The table below shows the lemon grass oil yield using different extraction methods from past works carried out.

Table 4.3: Reference to Previous Work

Method of extraction	% yield
Solvent extraction	2.08
Hydro distillation	1.96
Enfleurage	0.95

(Orji Oyinyechi, 2012)

The solvent extraction technique was shown to be the most effective way of extracting oil since it yielded more oil than any other method. As seen in fig. 4.3, this is in line with previous efforts. Due to a lack of distillation equipment, the essential oil extraction was not always completed because of the fluctuating rate of distillation produced by heat. Equipment was hard to come by and pricey. As a result, steam distillation is an uncommon process for extracting essential oils. This makes steam distillation a rare method of essential oil extraction

4.4 GENERAL OBSERVATION OF PERFUME PRODUCED

i. The perfume formulated had a strong lemon fragrance
ii. It was light yellow in colour.
iii. It was slightly volatile and had a cooling effect on human skin.

V. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

In the experiment, lemongrass essential oil which has a high citral concentration and is employed in perfume production was extracted. Essential oils were extracted to determine how much oil each technique generated and how much oil might be used in a perfume. According to the experiment, oil extraction utilizing petroleum spirit as a solvent in the soxhlet produced the most oil, followed by extraction using water and steam distillation. The process of extraction mainly determines the yield of oil. An essential oil's ability to resist heat, water, and alcohol determines its extraction via the distillation method. Steam distillation is only possible with oil that is steam volatile.

Most commercially available essential oils are steam volatile, which means they are relatively stable under heat action and essentially insoluble in water, making them ideal candidates for steam processing. Essential oils, resins, hydrocarbons, and other heat-sensitive compounds, which are insoluble in water and may break down at their boiling point, are all separated using one of these extraction processes. The steam's temperature must be high enough to evaporate the essential oil but not so high that it destroys or burns the oil. Chemical engineering separation and evaporation processes were employed in these approaches.

5.2 RECOMMENDATION

It is recommended that solvent extraction methods be used and further developed to obtain the maximum oil yield. However, the steam distillation method can produce a high yield when the appropriate apparatus is available, but cost constraints restrict accessibility. Also, more research should be carried out to generate a cheaper means of volatile oil extraction. Finally, further characterization work should be carried out on the oil.

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