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Extraction and Formulation of Perfume from *Cymbopogon citratus* (Lemongrass)

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ABSTRACT: This work aimed to extract perfume from the leaves of *Cymbopogon citratus* using three extraction methods viz: distillation, solvent extraction and expression or effleurage. About 150 g of dried lemons grass were extracted using ethanol as the solvent to obtain essential oils required for the formulation of perfumes. The result of the hydrodistillation process showed that 1.23 g of essential oil per 130g of dry lemongrass produce 0.95% oil at 78 °C, while the effleurage method was 2.55 g of essential oil per 130 g of dry lemongrass sample thereby producing 1.96% oil yield. The solvent extraction method gave 2.7 g of essential oil per 130 g of dry lemongrass sample. This gives about 2.08 % yield of essential oil at a temperature of 78 °C i.e. the boiling point of ethanol. The solvent extraction method yielded 2.08%, the effleurage method yielded 1.96% and the hydrodistillation method yielded 0.95% essential oil respectively. In conclusion, solvent extraction gave the highest yield because of less exposure to air and heat, which is highly recommended as the most suitable method for the extraction of essential oil.

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Since the existence of man, humans have been using fragrances from natural products to produce pleasant-smelling perfumes. These perfumes could be in the form of dried herbs, burning wood or pressed oil. The word perfume was obtained from the Latin "*per fumum*" meaning through smoke. Nowadays, it is mostly a fragrant liquid that is applied or sprayed on the skin, clothes or environment to create a pleasant aroma or smell to humans (Alex, 2018). The sense of smell in human is considered a right-brain activity, which rules emotions, memory and creativity. Perfumes are used to mask body odour, make people feel good, heal and cure physical and emotional problems. Also, perfumes are being revived to help balance hormonal and body energy. It helps to boost the immune system when inhaled or applied topically. Smelling sweet smells also affects one's mood and can be used as a form of psychotherapy (Venkat *et al*., 2015). Perfume and flavours find application in human food, animal feed, cosmetic, pharmaceutical and chemical industries. They represent over 25 per cent of the world market and most of the flavouring and perfume compounds are products of natural resources like plant and animal, produced by the extraction or via chemical synthesis (Gupta *et al*., 2015; Ewa *et al*., 2019).

Lemongrass scientifically known as *Cymbopogon citratus* is a widely used perennial herb with long leaves. It is indigenous to several tropical countries, especially Southeast Asia. It is an aromatic, evergreen, clump-forming grass, with numerous stiff stems that arise from a short rhizomatous rootstock. It grows to about 1.5 m in height and rarely produces flowers. The leaves are blue-green, linear in shape, erect and characterized with lemon flavour when crushed (Majewska *et al*., 2019). The leaves have a very high content of citrate (70-80%) which is extensively used in perfumes, bath salts, cosmetics and toilet soaps production. Distillation of lemongrass leaves yields reddish-yellow oil which possessed a strong odour and taste of lemon (Moncada *et al*., 2014). Lemongrass oil is used as a fragrance component in soaps, detergents, and cosmetics. It is also used in aromatherapy as a tissue toner, and it improves circulation and muscle tone. It tightens, refines and firms a lacklustre, sluggish and oily skin (Simon *et al*., 2014). In medicine, it is used as an antispasmodic, anticonvulsant, analgesic, antiemetic, antitussive, antirheumatic, antiseptic, treatment of the hypotensive, treatment of nervous and gastrointestinal disorders and fever (Shah *et al*., 2011; Ewa *et al*., 2019).

Natural essential oils refer to volatile, odoriferous oils acquired from plants that are found in special glands or cells located in various parts of the plant such as the roots, barks, leaves, fruits, flowers and represent the

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typical aroma or flavour of that very plant. However, the essential oil found in lemongrass is mainly produced by the leaves, which contain about 1-2% of essential oil in a dry matter (Majewska *et al*., 2019). The characteristic feature of lemongrass essential oil is lemon-like odour, sherry colour, and pungent taste. The chemical composition of the essential oil obtained from lemongrass leaves has been extensively studied using GC and GC/MS methods and was reported that the plant contains compounds such as esters, alcohols, aldehyde, ketones and terpenes. Other phytoconstituents which were reported to be present in lemongrass essential oil include citral α, citral β, nerol geraniol, citronellal, terpinolene, geranyl acetate, myrcene and terpinol methylheptenone as well as others like flavonoids and phenolic compounds. However, the main component of lemongrass essential oil is citral (Ewa *et al*., 2019).

Extraction of perfume and other aromatic substances from plants and their products are conducted over the years using different extraction techniques. These techniques to a greater extent influence the yield of the perfumes. Hence, this study was conducted to investigate the influence of extraction techniques on the yield of perfume from *Cymbopogon citratus*

MATERIALS AND METHODS

Sample collections: Fresh lemongrass sample was collected from the biology garden of the Department of Biological Science, Faculty of Sciences, Kogi State University Anyigba, Kogi state. It was allowed to dry for about three days in the laboratory. The leave was later cut into slices to reveal the tighter inner stem till when ready to use.

Solvent extraction method: About 130 g of the dry sample of lemongrass was washed from the sliced lemongrass sample and placed in a 500 mL clean flat bottom flask. 600 mL of N-hexane solvent was pounded into the 500 mL flask and shopped. The flask and content were allowed to stand for 24 hours for complete extraction. After which the extract was decanted into another 500 mL beaker. 200 mL of ethanol was added to extract the essential oil since essential oil is soluble in ethanol. The mixture was then transferred to a 500 mL separating funnel and separated by a process called the liquid/liquid separation process. The content of the separating funnel was then allowed to come to equilibrium which separated into two layers (depending on their different density). The lower ethanol extract and the upper hexane layer were collected into two separated 250 mL beakers and was placed in a water bath at 78 °C. This was done to remove the ethanol leaving only the natural essential oil. The yield of oil was determined by weighing the extract on an electronic weighing balance. The difference between the final weighing of the beaker with extract and the initial weight of the empty beaker gave the weight of the essential oil (Zhang *et al*., 2012).

Effleurage method: About 130 g of the dry sample of lemongrass was weighed out and pounded with mortar and pestle (to reveal the tighter inner stem). The pounded sample was then placed in a 500 ml beaker of about 70 mL of light-flavoured olive oil was warmed and mixed with the mashed lemongrass (to allow for efficient absorption of the essential oil). The beaker was covered with aluminium foil and shaken until the lemongrass was distributed throughout the oil. It was then allowed to stand for 24 hours at room temperature for proper absorption. Ethanol (140 mL) was added to absorb the essential oil leaving behind the lemongrass residue. The Ethanol extract was decanted and placed on a water bath at 78^{O}C to vaporize the Ethanol leaving behind the essential oil. The yield of oil was determined by weighing on an electronic weighing balance. The differences between the final weight of the beaker and the initial weight gave the yield of essential oil (Upadhyay *et al*., 2010).

Hydro distillation Method: Fresh lemongrass (130 g) sample was placed into a 500mL round bottom flask containing 250 mL of distilled water. The flask was fitted with a rubber stopper connected to a condenser and heater. Water at 0 °C flowed counter currently through the condenser to condense the ensuring steam. When the water reached 100 °C it started boiling ripping off the essential oil from the lemongrass. When the lemongrass got heated up, the essential oil that was extracted from the leaf mixture with the water vapour, both passed through the condenser and the vapour was condensed into the liquid with the use of an ice block, cooling was made possible and volatilization of the Essential oil was avoided. The condensation was directly collected using a 500 mL beaker and then pounded into a separating funnel. This formed two layers of oil and water. The tap of the separating funnel was opened to let out water while the oil was immediately collected into a 100 ml stopped. The bottle was closed tightly to prevent evaporation of the essential oil. The oil was collected and the volume of the oil obtained was weighed (Lucchesi *et al.*, 2004).

Formulation of performing with essential oil produced, 10 mL of lemongrass essential oil extract was measured and placed in a 120 mL beaker containing 5 mL for Methanol, 5 mL of the fixative was added to the mixture (to improve the longevity

and the perfume). The solution was shaken and poured into a 50 mL bottle.

RESULT AND DISCUSSION

The amount of essential oil obtained by solvent extraction method was 2.7 g of essential oil per 130g of dry lemongrass sample. They give about 2.08 g yield of essential oil per 130 g of dry lemongrass. The temperature used was 78 °C i.e. the boiling point of Ethanol the volume of oil was measured at every 4 hours interval to determine the oil yield at the varying time. As the time increase, the ethanol solvent reduces, thereby leaving the essential oil in the mixture. The oil produced was pale yellow, with an aromatic odour and cooling taste because of its high volatility. It was stored in an airtight container and protected from direct sunlight. The essential oil was insoluble in water-miscible in alcohol and oil.

Table1: Solvent extraction method

Weight of oil (g)	Time(mins)
0.2	240
0.3	480
0.7	720
0.72	960
0.78	1200

Table 2: Effleurage extraction method weight of the oil concerning the time

Weight (g)	Time(mins)
0.31	240
0.41	480
0.55	720
0.58	960
0.70	1200

Table 3: Hydro Distillation Method

Weight(g)	Time(min)
0.10	240
0.14	480
0.26	720
0.35	960
0.38	1200

Table 4: Essential Oil Extraction from *Cymbopogon citratus* (lemongrass)

Solvent extraction	**2.08**
Effleurage	1.96
Hydro- distillation	0.95

The essential oil produced by the effleurage method was 2.55g weight of essential oil per 130g of dry lemongrass sample thereby producing1.96 g oil yield at 78 ˚C. From the experiment carried out it was observed that the best method used in extraction is a solvent extraction method because it gave more oil than any other method. This conforms to work done by researchers (Zhang *et al*., 2012; Schaneberg *et al.*, 2002). The Effleurage method, yield less oil when compared to the solvent extraction, this is because most volatile content gets lost during the pounding process while hydrodistillation was low because the extraction of the essential oil was not always complete due to variable rate of distillation caused by heat (Kimbaris *et al*., 2006). The essential oil produced with this method is not usually used for perfume production because of the burnt smell of the essential oil (Bustamante *et al* ., 2016). The experiment was not carried out with the steam distillation method because the requirement was not easily found and they are expensive. This makes steam distillation a rear method of essential oil extraction. Literarily steam distillation yields about 3 -4% aromatic compound of a given weight at the sample. The quantity of essential oil has the highest yield in solvent extraction. The essential oil was pale yellow and completely soluble in a solvent in water. Has a lemongrass fragrance. It is volatile and has a cooling effect on the skin. Most of the essential oils of commercial purpose are steam volatile, reasonably stable to action of heat and practically insoluble in water and hence suitable for processing by steam (Tandon, 2008). All these methods of extraction are a special type of separation process used for heat-sensitive materials like essential oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point (Taylor, 2018). The temperature of the steam must be high enough to vaporize the essential oil present, yet not destroyed or burned the essential oils.

Conclusion: The extraction of essential oils from *Cymbopogon citratus* (lemongrass) by distillation is governed by the sensitivity of the essential oil to the action of heat; water and alcohol. Thus essential oils with high solubility in water are susceptible to damage by action of heat, therefore, cannot be steam distilled. The oil must be steam volatile for steam distillation to be feasible. The data revealed that solvent extraction had more yield, followed by the effleurage method.

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