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Abstract

Citronella Java oil is an essential oil which is an important source of perfumery chemical like geraniol, citronella, citral, nerol, etc and find extensive use in soap, cosmetic, perfumery, and flavouring industries throughout the world. It has rose like odour and is bitter in taste. Citronella grass is mainly grown for its commercial essential oils and systematic study of its chemical composition resulted in several other benefits apart from the development of analytical method for quality assessment of the oil gives a basic insight into the chemical composition and the extent to which the main constituent varies in proportion. The present study emphasizes on extraction and analysis of citronella oil obtain through two distillation techniques, namely steam and hydro distillation. Then the yield of citronella oil is investigated using GC-MS analytical tool. The results found to give higher yield of citronella oil through steam distillation process than hydro distillation.

Keywords: Distillation, citronella grass, citronella oil, GC-MS.

1. INTRODUCTION

Essential oil also referred to as essences, are botanical extracts of various plants materials and do not originate from flower but from the herbs and various other plants materials. The essential oils are extracted from the botanical material using variety of extraction method to suit the material extracted from and are highly odoriferous liquids. Essential oils have gained very important role in industry due their wide applications in perfumery and flavouring of all kind of consumable finished products. There are two types of citronella oil: Ceylon type and Java type. The former is produced almost exclusively on the island of Ceylon. The latter is chiefly on island of Java and Farmarosa, In India, the crop is grown in the state of Assam, Gujarat, Jammu and Kashmir, Karnataka, Tamil Nadu, West Bengal and Uttar Pradesh. In Maharashtra grown in Pune, Henagar Aurangabad marinated avatar napery and Jalgaon district. Citronella oil came into prominence rather slowly during slowly second half of last century, at which time it was only produced in Ceylon. In fact until about 1900, the market depended almost upon the Ceylon oil. Today, however the java type of oil of far greater importance prior to world war 2 export figure of Ceylon oil average 600 tonnes per year, while the java exported about 2000 metric tones. So far, the difference between Ceylon type and Java type of oil is concerned, here should mentioned that java oil is much more valuable and useful, as it contains 85% of total geraniol (including at least 33% of citronella) where Ceylon oil contains only 55 to 65 % of total geraniol (including 7 to 15 %

citronella). Citronella is perennial grass however, it does not produce viable seeds. Therefore the species can be propagated only vegetable by slip. This is achieved by splitting well-grown clumps. It has been observed that an year old clump yield on an average about 30-50 slips. The clump is gently separated into number of slips and each slip contains 1-3 tillers. Citronella thrives under the tropical and ranging from 10-50°C. subtropical region with temperature. The citronella oil is used mostly in perfumery, both directly and indirectly. Soaps, soap flakes, detergent, mosquito's repellent, etc, the greatest importance of citronella lies in its importance.

2. DISTILLATION

A process in which a liquid or vapour mixture of two or more substances is separated into its component fractions of desired purity, by the application and removal of heat. Hydrodistillation is one of the technique of distillation.

There are three types of hydrodistillation for isolating essential oils from plant materials:

1. Hydro / water distillation
2. Water and steam distillation
3. Direct steam distillation.

2.1 Water Distillation

In this method, the material is completely immersed in water, which is boiled by applying heat by direct fire, steam jacket, closed steam jacket, closed steam coil or open steam coil. The

main characteristic of this process is that there is direct contact between boiling water and plant material. When the still is heated with the aid of direct fireplace, good enough precautions are necessary to save you the price from overheating. While a steam jacket or closed steam coil is used, there's less threat of overheating, with open steam coils this chance is averted. However with open steam, care should be taken to prevent accumulation of condensed water in the still, therefore, the nevertheless have to be nicely insulated. The plant cloth within the still need to be agitated because the water boils, otherwise agglomerations of dense fabric will determine the lowest and emerge as thermally degraded. sure plant materials like cinnamon bark, that are wealthy in mucilage, need to be powdered so that the price can with no trouble disperse within the water; as the temperature of the water increases, the mucilage could be leached from the ground cinnamon. This significantly increases the viscosity of the water-price combination, thereby allowing it to char. consequently, earlier than any discipline distillation is done, a small-scale water distillation in glassware need to be carried out to have a look at whether or not any modifications take area throughout the distillation system.

2.2 Water And Steam Distillation

In water and steam distillation, the steam can be generated either in a satellite boiler or within the still, although separated from the plant material. Like water distillation, water and steam distillation is widely used in rural areas. Moreover, it does not require a great deal more capital expenditure than water distillation. Also, the equipment used is generally similar to that used in water distillation, but the plant material is supported above the boiling water on a perforated grid. In fact, it is common that persons performing water distillation eventually progress to water and steam distillation. It follows that once rural distillers have produced a few batches of oil by water distillation, they realize that the quality of oil is not very good because of its still notes (subdued aroma). As a result, some modifications are made. Using the same still, a perforated grid or plate is fashioned so that the plant material is raised above the water. This reduces the capacity of the still but affords a better quality of oil. If the amount of water is not sufficient to allow the completion of distillation, a cohobation tube is attached and condensate water is added back to the still manually, thereby ensuring that the water, which is being used as the steam source, will never run out. It is also believed that this will, to some extent, control the loss of dissolved oxygenated constituents in the condensate water because the re-used condensate water will allow it to become saturated with dissolved constituents, after which more oil will dissolve in it.

2.3 Direct Steam Distillation

As the name suggests, direct steam distillation is the process of distilling plant material with steam generated outside the still in a satellite steam generator generally referred to as a boiler. As in water and steam distillation, the plant material is supported on a perforated grid above the steam inlet. A real advantage of satellite steam generation is that the amount of steam can be readily controlled. Because steam is generated in

a satellite boiler, the plant material is heated no higher than 100° C and, consequently, it should not undergo thermal degradation. Steam distillation is the most widely accepted process for the production of essential oils on large scale. Throughout the flavor and fragrance supply business, it is a standard practice. An obvious drawback to steam distillation is the much higher capital expenditure needed to build such a facility. In some situations, such as the large-scale production of low-cost oils (e.g. rosemary, Chinese cedarwood, lemongrass, litsea cubeba, spike lavender, eucalyptus, citronella, cornmint), the world market prices of the oils are barely high enough to justify their production by steam distillation without amortizing the capital expenditure required to build the facility over a period of 10 years or more.

3. MATERIALS AND METHOD

3.1 Raw Materials

1. Citronella Grass (Java)
2. Water

3.2 Experimental Procedure

1. For Hydro Distillation:

A 100gm quantity of citronella grass was chopped and taken in a round bottom flask of Hydro distillation apparatus. 850ml of water was added in the same flask so that grass was totally immersed in water. The mixture of grass and water was then subjected to heating process via heater. The process was continued for 2 hours of time span. After sometime, steam of mixture of oil and water vapours evolved from the flask, then it passed down through condenser. The condensate, containing oil and water, was then collected in a conical flask. The layer of oil was visible which was then separated from water by separating funnel. The oil obtained, was then measured. The same process was repeated for further two consecutive runs and the volume of oil was measured in all the three runs.

2. For Steam Distillation:

The only difference in Hydro and Steam distillation was that, in Steam distillation, both water and grass were not taken in the same flask, rather they were taken in two different flasks. The upper bottom flask contained 100gm of Citronella grass. The lower bottom flask contained 850ml water, which was then subjected to heating. The steam was allowed to pass through the grass and then the mixture of vapours of water and oil was allowed to pass through the condenser. The condensate containing water and oil was collected in a conical flask. The layer of oil was visible which was then separated from water through separating funnel. The oil obtained, was then measured. The same process was repeated for further two consecutive runs and the volume of oil was measured in all the three runs.

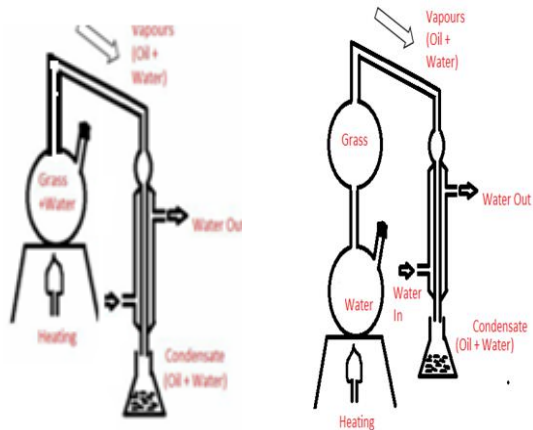


Fig-1: Hydro distillation and steam distillation

obtained for three runs were 2ml, 3ml and 3ml respectively. We found that the yield of oil obtained in Steam distillation was almost double the yield of oil obtained in Hydro distillation.

As per the analytical graph obtained by GC technique, the components which is of immense importance present in almost sufficient proportion was found to be Geraniol, a-Citronellol. The area% in oil samples of steam and hydro distillation for trans-geraniol was found to be 27.7646 and 4.965184 resp. and area % for a-Citronellol was found to be 53.10649 and 40.62171 resp. i.e. comparatively more in steam distillation. Other than Geraniol and a-citronellol, other compounds found which are of immense importance are citronellal, Limonene, D-limonene, a-linalool, thujaketone, Melonal, etc.

Geraniol is a monoterpenoid and an alcohol. Research has shown that Geraniol is an effective plant-based mosquito repellent. Due to its aroma and flavor, it is an important ingredient in a variety of consumer products made by flavor and fragrance industries. It also has antibacterial, antiseptic and anti-inflammatory properties. It is a Natural Oxidant and used in preventing various types of cancer. Citronellal has insect repellent properties. Limonene is used in chemical synthesis as a precursor to carvone. It is also used as a solvent in some model airplane glues and as a constituent in some paints. a-citronellol is used as a raw material for the production of rose oxide. It also finds its use in insect repellents.

As per our study, the reason behind the difference in the yield obtained through both Hydro and Steam distillation is, as in Hydro system, the plant material near the bottom of the flask comes in direct contact with the heat from heater. As the plant material is directly in contact with the water, some of the oil vapours released from Citronella Java grass are mixed with water itself which cannot be recovered. Prolong action of hot water with the plant material can cause deterioration of some constituents of essential oils such as esters, etc which reacts with water at high temperature to form acids and alcohols.

It is therefore, can be concluded, as per convenience and yield is concerned, the efficient way of obtaining Citronella Oil is by Steam distillation process.

4. CONCLUSION

From the above mentioned observations, we can conclude that the yield obtained in Steam distillation is almost double of the yield obtained in Hydro distillation. Also, as per the analytical graph obtained by GC technique, the component which is of immense importance present in almost sufficient proportion was Geraniol and a-Citronellol. It is therefore, can be concluded, as per convenience and yield is concerned, the efficient way of obtaining Citronella Oil is by Steam distillation process.

Research has shown that Geraniol is an effective plant-based mosquito repellent. Due to its aroma and flavor, it is an important ingredient in a variety of consumer products. It is therefore, can be concluded, as per convenience and yield is concerned, the efficient way of obtaining Citronella Oil is by Steam distillation process. It also has antibacterial, antiseptic and

4. RESULTS AND DISCUSSION

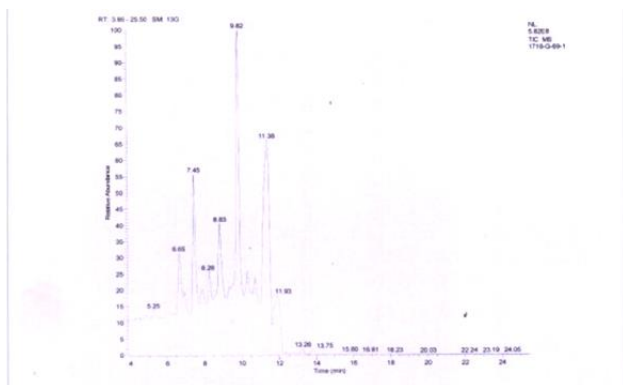


Fig-2: Analytical Graph For Citronella Oil Trough GC (Hydro Distillation)

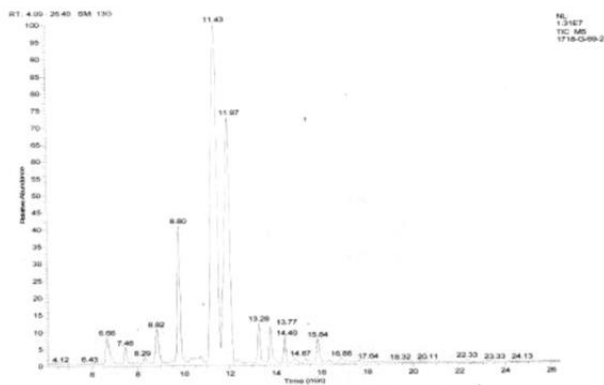


Fig-3: Analytical Graph For Citronella Oil Trough GC (Steam Distillation)

Two types of distillation techniques, namely Hydro and Steam distillation were performed on Citronella Java grass. In hydro distillation, volume of oil obtained for three runs were 1.1 ml, 1.3 ml and 1.1 ml. And in steam distillation volume of oil

anti-inflammatory properties. It is a Natural Oxidant and used in preventing various types of cancer.

Other than Geraniol and a-citronellol, other compounds found which are of immense importance are citronellal, Limonene, D-limonene, a-linalool, thujaketone, Melonal, etc. Citronellal has insect repellent properties. Limonene is used in chemical synthesis as a precursor to carvone. It is also used as a solvent in some model airplane glues and as a constituent in some paints. a-citronellol is used as a raw material for the production of rose oxide. It also finds its use in insect repellents.

Citronella oil can act as the source of several invaluable constituents for the production of different valuable products like repellents, fragrances, rose oxides etc.

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