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ESENTIAL OILS EXTRACTION STEAM DISTILLATION

Mr.Wagh Abhishek[1] Mr. Chaudhari Arbaj[2] Mr. Murade Harshal[3] Mr. Waghmare Akash

Department of Chemical Engineering

Padmashri Dr. Vitthalrao Vikhe Patil Polytechnic College, Loni

Abstract:

Steam distillation is known to be the most prevalent method of essential oil extraction. Despite many studies on extraction methods, there is no report about the impact of distillation process duration on the yield and oil quality. A steam distillation process for extraction of plant essential oils is presented. For improving the total yield, prolonged and continued isolation was used. A selection of plant species from Lamiaceae and Apiaceae families was subjected to direct steam distillation and essential oils were collected at different times (1, 2, 3, 6, 12 and 24 h). The analysis included either annual or perennial species monitored in terms of different harvesting time. From these studies, it is conclusively that there is no rule about appropriate extraction time, and different plants need different periods for the essential oils to achieve the desired quality or quantity of extract. Thus, extraction duration is directly dependent on what the study is conducted for.

I) Introduction :

Essential oils are used in a wide variety of consumer goods such as detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages (hard drinks) and insecticides. The world production and consumption of essential oils and perfumes are increasing very fast.

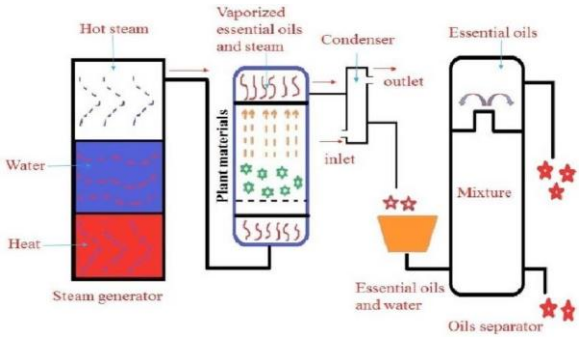

Fig.1Diagrammatic-illustration-of-steam-distillation-method

- **Sources of natural essential oil:**

Essential oils are generally derived from one or more plant parts, such as flowers (e.g. rose, jasmine, carnation, clove, mimosa, rosemary, lavander), leaves (e.g.

mint, Ocimum spp., lemongrass, jamrosa),

leaves and stems (e.g. geranium, patchouli, petitgrain, verbena, cinnamon), bark (e.g. cinnamon, cassia, canella), wood (e.g. cedar, sandal, pine), roots (e.g. angelica, sassafras, vetiver, saussurea, valerian), seeds (e.g fennel, coriander, caraway, dill, nutmeg), fruits (bergamot, orange, lemon, juniper), rhizomes (e.g. ginger, calamus, curcuma, orris) and gums or oleoresin exudations (e.g. balsam of Peru, Myroxylon balsamum, storax, myrrh, benzoin).

II) Methodology :

Steam Distillation is a method of separating temperature-dependent substances. It's a particular type of distillation. Explaining in other terms, this is to separate the miscible liquid base according to its volatilities. For example, aromatic compounds. It plays a vital role in certain industrial regions. There is no chemical reaction taking place here. It's a physical process.

At a very high sustained temperature level, few organic compounds can decompose. Often, it is used to separate volatile essential oils from the plant materials.

Earlier, steam distillation was one of the popular laboratory methods used for the purification of organic compounds. But now, it has been replaced in many such uses by supercritical fluid extraction and vaccum distillation. However, it is more economical and straightforward than those alternatives and remains vital in specific industrialsectors.

Steam distillation is a method by which we can remove oil from plant matter. In the apparatus, a chamber with holes in the bottom is present to enable steam to flow through either fresh or dried herbs.

It consists of a lid that prevents the oil from diffusing into the air when steam is applied. Then, we can collect the water and oil droplets that have undergone consideration. Therefore, the separation of water and oil happens by passing through the filter.

Essential oils are types of oils that capture the scent, flavor, or essence of a plant. For thousands of years, they've been widely used for a broad range of applications— from medicinal purposes to cosmetic use. In order to create an essential oil, the plant's active botanical constituents must be extracted from a plant.

There are a wide variety of different essential oil extraction methods used to obtain the oil. Each method applies different amounts of temperature and pressure, which ultimately impacts the quality of the resulting essential oil. Depending on the essential oil being created, some essential oil

extraction methods are better suited to certain plant types and parts.

III) Steam Distillation

Let us discuss the steam distillation working briefly. The majority of the complex organic compounds do not dissolve in water. Alternatively, they create a mixture that can be separated if it is allowed to settle when the water settles down, and the organic compounds float to the top.

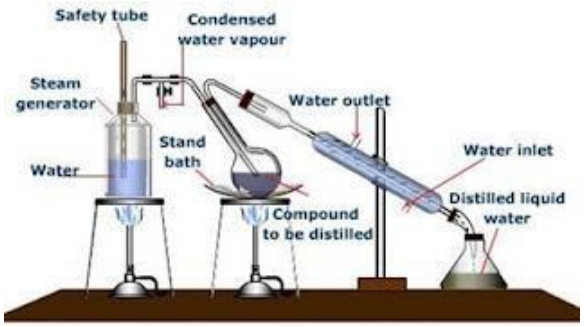

Fig. 2 Steam Distillation

The principle of the steam distillation method is that, when the heating of a mixture of two or more immiscible liquids happens, the vapour pressure exerted by the system will be increased. This happens because the sum of the vapor pressures of all the components of the mixture is now combined. This enables elements with high boiling points to evaporate at even lower temperatures by merely allowing them to form a mixture with water.

IV) Steam Distillation Extraction Procedure/Working

Let us discuss the working of steam distillation. In the extraction procedure, steam flows through the organic matter that comprises the separating compounds. The steam is condensed and produces a mixture of both steam and matter.

- The non- aqueous liquid is placed in the flask. A small quantity of water is added to it. Steam can is filled with water.
- The steam generator and the flask are heated simultaneously, so that a uniform flow of steam passes through the boiling mixture. The mixture gets heated.
- The steam carries the volatile oil and passes into the condenser, which is cooled by cold water.
- The condensed immiscible liquid is collected into receiver. Distillation is continued until all the non- aqueous liquid has been distilled. In the receiver, water and organic liquid form two separate layers, which can be easily separated using a separating flask.

V) Principle of Steam Distillation

When a mixture of two liquids that are immiscible (e.g., water and organics) is heated and disturbed, each liquid's surface exerts its own vapour pressure as though another component of the mixture wasabsent.

Here, the specific constituent independently extracts the vapour pressure on its own, and the vapour pressure of the system consequently increases.

The two immiscible liquids tend to boil when the vapour pressure of these liquids exceeds the atmospheric pressure. Most of the organic compounds are insoluble in water. At an absolute temperature, we can purify it because that is below the point at which such compounds decompose.

The mixture is then heated by passing additional steam, which proceeds to flow over the matter, evaporating the mixture. Due to reduced vapour pressure, the necessary organic compounds evaporate as part of the mixture. Moreover, the extraction of the mixture takes place from organic matter.

VI) Advantage :

Few of the advantages of using Steam Distillation are:

- This process generates organic solvent-free products
- There is no need for subsequent steps after the steam distillation process
- It possesses a large capacity at the industrial scale for processing of oils.
- The equipment is quite inexpensive
- In the steam distillation of essential oils process from steam boiler, it requires very less amount of fuel
- Majorly, this method is used for oil production on an industrial scale
- Participates in extracting materials from the body of plants such as stem and roots
- It is used as an oil steam distillation that possess high boiling points
- Extraction of essential oils by steam distillation can be done easily

VII) Applications of SteamDistillation

The steam distillation process is used to separate organic compounds that are temperature-sensitive like aromatic substances. It also helps to extract oils from natural products like citrus oil, eucalyptus oil, and more natural substances that are derived from the organic matter. Due to this reason, the steam distillation method is widely used in producing perfumes and

cologne, and in the production of a few cooking materials.

Majorly, this method is used for extracting the orange oil on a big range in industries. In addition, the steam distillation application can also be found in the production of petroleum and food product industries used to separate fatty acids from the mixtures.

Steam distillation's partial modification technique is used for the isolation of dairy flavours from the dairy products.

Fig.3 Steam distillation oils and perfumes

Crude oil contains a broad range of components where every component is isolated in a stepwise manner in oil refineries using the steam distillationprocess.

Steam distillation is widely used in the manufacturing of essential oils and perfumes. Mainly orange oil and eucalyptus oil are extracted using this method.

It is also used during consumer food products produced to the separation of fatty acids from the component of the mixture.

A modification of steam distillation is also used for the isolation of dairy flavours from dairy products.

Steam distillation is widely used in the petroleum industry. Also, for the separation of components from crude oil, steam distillation is used.

VIII) Conclusion :

Steam distillation, the method used in this lab for essential oil extraction, takes advantage of the volatility of a compound to evaporate when heated with steam and the hydrophobicity of the compound to separate into an oil phase during condensation.

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