Essential Oil Extraction from Flower Crops

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Introduction

Essential oils are concentrated, volatile fragrant chemicals that are derived from the bark, roots, peels, flowers, and leaves of plants. They are obtained using a variety of extraction techniques, each of which is customized to the unique properties of the plant material and the required oil quality. Environmental variables like altitude, location, and methods of harvesting can influence the chemical makeup of these oils.In terms of aroma, authentic essential oils emit delicate, plant-inspired fragrances, while on a spiritual level, each plant is thought to carry healing properties and has historically been used for protection.

Characteristics of essential oil

- Highly concentrated and these are liquid at ambient temperature because they contain oleates, which are unsaturated fatty acids.
- They possess a distinctive aroma
- They do not go rancid due to the high vitamin E content.
- They can volatilize without breaking down.
- They do not leave greasy marks on paper because of their high vapor pressure
- They are generally insoluble in water due to their hydrophobic properties.
- They are typically soluble in organic solvents, fatty acids, and mineral oils
- They have a high boiling point.
- They exhibit a high refractive index, indicating a level of thickness.

Different methods of oil extraction

Distillation - Water distillation,Steam distillation,Steam and water distillation. Other Methods –Solvent extraction, Expression,Maceration, Enfleurage, Supercritical fluid extraction,Hydro distillation and Microwave assisted hydro distillation.

Water distillation

This method involves completely immersing the material in water that has been heated to a boiling temperature using either an open steam coil, a closed steam jacket, a steam jacket, or direct fire. The direct contact between the plant material and the boiling water is a crucial aspect of this procedure. As the water boils, the plant material inside the still needs to be agitated to prevent dense material from clumping together and degrading thermally.

Plant material is placed in a round-bottom flask, and water is added to it just enough to submerge it plus an extra 10%. One end of the condenser is attached to the material-containing flask, while the other end is attached to an empty flask that will be used to collect the oil.

Steam distillation

The most popular technique for obtaining essential oils is steam distillation. The volatile chemicals in the plant material are vaporized during this procedure by passing steam through it. After that, these vapors are collected after condensing back into liquid form. After separating from the water, the essential oil is gathered separately. This technique works well with a range of herbs, such as eucalyptus, peppermint, and lavender.

Direct steam distillation

The process of distilling plant material using steam produced outside the still in a satellite steam generator—also known as a boiler—is known as direct steam distillation. The plant material is supported on a perforated grid above the steam input, just like in water and steam distillation. No heat is applied to the plant material above 100°C.

Water steam distillation

Distilled water is created by boiling water to vapor and then condensing it back into liquid in a different container.Both water distillation and steam distillation are commonly utilized in rural areas. The steam and water distillation method is quicker than water distillation. The overall distillation process takes approximately 6-8 hours.

Solvent Extraction

For fragile flowers that can be harmed by heat, such roses and jasmine, solvent extraction is used. The aromatic chemicals in plant materials are dissolved by soaking them in a solvent such as ethanol or hexane.

A concentrated extract known as a "concrete," which is then processed to get the pure essential oil known as a "absolute," is left behind after the solvent has evaporated.

This method of extraction is among the most contemporary and is primarily utilized for expensive and fragile flower oils, like those from jasmine, rose, and tuberose.

- From a technical standpoint, the products of solvent extraction should not be classified as essential oils; they are better described as 'absolutes.'
- This technique employs solvents such as petroleum ether, hexane, benzene, and alcohol.
- When solvent is introduced to the plant material, it is absorbed, facilitating the release of aromatic compounds.

Cold pressing [Expression]

Oil extraction from citrus fruits, such as oranges, lemons, and limes, is the main application for cold pressing, sometimes referred to as expression. The oils are extracted by mechanically pressing the fruit peels. This technique maintains the oil's inherent qualities and scent because no heat is used.

Expression[cold fat extraction]

Essential oil is extracted through the application of high mechanical pressure to extract oil from the plant material. A cold press machine features one inlet for feeding the material and two exits to release the oil and the non-oiled presscake .**Advantage**: It is user-friendly, a quick process, inexpensive, requires only a small amount of raw material, and produces a by-product in the form of presscake. **Disadvantage**: More than 7% of oil remains in the seed.

Macreation

This method, which is similar to enfleurage, allows you to make essential oil at home in a pre-diluted state. After crushing some of the oil glands or cells in the flowers or leaves, they are submerged in warm vegetable oil. After the essential oil is absorbed by the vegetable oil, the plant matter is filtered off. The reheated carrier oil is mixed with fresh plant material, and this process is repeated until the vegetable oil or fat is adequately concentrated.

Super critical Fluid Extraction: This modern technique utilizes carbon dioxide (CO_2) at elevated pressures and low temperatures to extract essential oils. By merging the properties of a liquid and a gas, CO_2 becomes a supercritical fluid that can dissolve oils and penetrate plant materials. Once CO_2 is depressurized and reverts to its gas form, a pure essential oil devoid of solvent residues remains. This method is efficient and safeguards the integrity of heat-sensitive substances.

Enfleurage

Enfleurage is a classic and intricate technique employed to extract oils from sensitive flowers such as jasmine and tuberose. Fresh blooms are arranged on layers of fat that gradually take in their scent. This fat is subsequently treated with alcohol to isolate the essential oil. While it is a lengthy process, enfleurage effectively captures the intricate fragrances of specific flowers.

Cold enfluerage

Palm wax was heated to 80°C for 2 hours and then poured into rectangular glass containers. After cooling, the wax was allowed to reach room temperature. Next, tuberose flowers were placed on the wax in each container and covered with another tray of wax. Fresh flowers were changed every 24 hours.

Hot enfluerage

Palm oil was heated to 60°C, and flowers were warmed for 30 minutes before cooling to room temperature. • The palm oil was then heated again to 60°C overnight at 8-10°C.

Hydrodistillation

Hydrodistillation consists of submerging plant materials in water and heating the mixture to a boil. The steam transports the volatile components, which are subsequently condensed and gathered. This technique is especially effective for obtaining oils from hardwood species such as sandalwood and cedarwood.

MAHD (Microwave Assisted Hydro Distillation).

The Technokit Chen microwave oven was used to carry out the microwave hydrodistillation process. After adding 300ml of water, 100g of plant material was cooked for 30 minutes. All of the essential oils could be extracted from the sample in this amount of time. At least three extractions were performed for each.

COMMON NAME	SCIENTIFIC NAME	FAMILY	OIL CONTENT
Rose	*Rosa damascena, Rosa bourboniana*	Rosaceae	1-citronellol (40-65%), Nerol, Geraniol, linalool
Jasmine	*Jasminum auriculatum*	Oleaceae	Methyl salicylate, Methyl anthranilate
Jasmine	*J.grandiflorum*	Oleaceae	Single Mogra, Double Mogra, Gundu Malli
Marigold	*Tagetes erecta*	Asteraceae	Piperitone, D-limonene Estrugol Tagetone
Tuberose	*Polianthes tuberosa*	Agavaceae	cis-3,7-Dimethyl-2,6-octadien-1-ol, Methyl aminobenzoate
Gernium	*Pelargonium X hortorum*	Geraniaceae	Citronellol (37.5); Geraniol (6%); Caryophyllene oxide (
Calendula	*Calendula officinalis*	Asteraceae	sesquiterpene alcohol, a-cadinol
Chrysanthemum	*Chrysanthemum indicum*	Asteraceae	Camphor, Isoborneol, α-Terpinene, Caryophyllene oxide
Daffodil	*Narcissus poeticus,*	Amaryllidaceae	Cinnamyl alcohol, Benzaldehyde
Carnation	*Dianthus caryophyllus*	Caryophyllacae	Linalool,Terpinol

Conclusion

The cultivation of essential oil flower crops presents a multifaceted opportunity, intertwining economic growth with environmental stewardship. By integrating these crops into agricultural practices, especially in regions like Tamil Nadu, India can bolster rural economies, promote sustainable land use, and meet the rising global demand for natural products.

Refrences

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