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FLORAL ESSENTIAL OILS: IMPORTANCE AND USES FOR MANKIND

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ABSTRACT : Global turnover of Essential Oil Industry business is estimated to around US$14 billion. In this turnover India's share is just about 10% though potential is much more. Based on population ratio, the potential is estimated to be 18%. The lack of coordination is responsible for not exploiting the potential to the full extent. There are 400,000 plant species of both aromatic and medicinal plants known to the scientists. Of these about 2000 species come from nearly 60 botanical families of essential oils. Total production of essential oils in the world is over 100,000 tonnes. India's share is estimated to be about 15%. India is one of the few countries in the world having varied agro climatic zones suitable for the cultivation of a host of essential oil bearing plants. Due to increased awareness of health hazards associated with synthetic chemicals coupled with the increased cost of petroleum products, the use of essential oils have been gradually increasing. The consumers are showing increasing preference for natural material over the synthetic. During the last few years with the spurt in the production of essential oils it is emerging as a potential agro based industry in India. With the increase in production of above essential oil, it would be possible for the country to save more valuable foreign exchange in the coming years.

Keywords *: Essential oil, flowers, extraction, aromatherapy.*

Floral essential oils are basically produced or extracted from the flowering part of the plant. Most flowers possess naturally sweet and floral scent that is responsible for the same type of aroma produced from its natural essential oil. They are most famous for use in perfumes and other type of fragrances. They are commonly available in the market and are therefore easily accessible, regardless of whether you are going to use it for fragrant or medicinal purposes. The concern for nature and the love for all things which are basic and natural has been spearheading to a green movement of everything natural and nature-based consumer products all over the world. Thus, because of a large spectrum of usage in the day to day life, the essential oil and aroma industry has a bright future. Apart from the hitherto known applications of essential oils, more areas are opening up which will benefit the industry. An essential oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils, or simply as the "oil of" the plant from which they were extracted, such as oil of clove. An oil is "essential" in the sense that it carries a distinctive scent, or essence, of the plant. Essential oils do not form a distinctive category for any medical, pharmacological, or culinary purpose.

Present Status

Essential oils contain on average 100 chemical components and have myriad functions. Some are antibacterial, antiseptic or digestive while others are antidepressant. According to industry sources, more than 3,000 essential oils are known. Out of these, some 300 are used for commercial purposes on a regular basis. These are obtained mostly from agricultural plants, some from wild plants that may be seasonal or perennial. Oil can be extracted from any part of plants *viz.,* leaves, flowers, fruits, roots etc. Whatever the source of essential oils, they have complex compositions, containing alcohol, aldehydes, ketones, phenols, esters, ethers and turpenes in varying proportions. The flowers used commercially for oil extraction are jasmine, rose, tuberose, marigold, plumeria, champaka, magnolia, millingtonia and *ylang-ylang*. The Indian Floriculture Industry which has been growing at an annual growth rate of 25% over the past decade comprises the florist trade, nursery plants, potted plants, bulbs and seeds, micro propagated plants and essential oils from flowers. In recent days, there is a growing demand not only for fresh flowers but also for value added floriculture products, coupled with the associated need for flavouring compounds from natural sources, have provided a major boost to the essential oils and oleoresins market. The world production of essential oils is growing at more than 10 per cent annually and at present it is estimated at about 1,10,000 tonnes valued at over 11 billion US dollars. India contributes 16 per cent to the world production, next only to Brazil and USA. India is the second largest exporter of jasmine oil in the world accounting for over 40% of total world exports in jasmine oil. Europe continues to be the largest destination of India's floriculture exports. In recent years, Indian exports of floriculture products have also extended to the Japanese and Australian markets (Ganga *et al*., 7).

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Opportunities in the Essential Oil Industry

Besides very high unit price fetched by the produce, the advantage of essential oil lies in the fact that they are not amenable to synthesis because of complex aroma which is made of a large number of compounds, say 275 in oil of rose. Demand is generated from home market as well as export market. The source of demand is from end use industries which are primarily personal care products, food products, pharmaceuticals. The demand for essential oil by fragrance industry is 60%, flavour industry 20% and pharmaceutical industry 20%. The use of essential oils in the fragrance, food and pharmaceutical industries and also by paint, pesticide, mining and petroleum industries is well known. Of late, the significance of essential oils has surged because of the new-found popularity of aromatherapy, which is based on the curative effects possessed by the peculiar aromas of these oils. Aromatherapy is a form of alternative medicine in which healing effects are ascribed to the aromatic compounds in essential oils and other plant extracts. Many common essential oils have medicinal properties that have been applied in folk medicine since ancient times and are still widely used today. Many are also claimed to have an uplifting effect on the mind. The essential oil industry holds abundant opportunities for new and existing entrepreneurs.

Floral Essential Oils

Floral essential oils are basically produced or extracted from the flowering part of the plant. Most flowers possess naturally sweet and floral scent that is responsible for the same type of aroma produced from its natural essential oil. Floral essential oils are typically feminine in nature and producing delicate aroma. Hence, they are most famous for use in perfumes and other type of fragrances. However, the sweet and balancing aroma is also ideal for treating a wide range of female conditions. They are commonly available in the market and are therefore easily accessible, regardless of whether you are going to use it for fragrant or medicinal purposes. Essential oils are concentrated volatile aromatic compounds produced by plants. They are made up of different chemical compounds like alcohols, hydrocarbons, phenols, aldehydes, esters and ketones. Oil is “essential” in the sense that it carries a distinctive scent or essence of the plant. Essential oils are extracted from oil ‘sacs’ in flowers, leaves, stems, roots, seeds, wood and bark. It is generally extracted by distillation, though other methods like expression and solvent extraction are also used. Technically speaking, oils obtained through the process of solvent extraction are known by different names like oleoresins, concretes and absolutes, depending on the solvent used for extraction and the plants from which these are obtained. Factors such as types of plants, chemical make-up of oil and the plant part influence the extraction of oils from plants. The flowers used commercially for oil extraction are jasmine, rose, tuberose, marigold, plumeria, champaka, magnolia, millingtonia and *ylang-ylang*.

Description of Flowers for Extraction of Essential Oil

Rose

Rose is a popular flower given as a gift as its deep red colour is known to be a symbol of love and passion. Rose is also one of the most fragrant flowers in the world, which is why it is a famous aphrodisiac essential oil. The fragrance produced by the rose essential oil is inspiring and balancing that no other synthetic compound has been able to successfully duplicate its aroma. If you’re wondering why rose essential oils are so expensive, it is because the rose blossoms from which the oil is extracted produces only about 0.02% of oil. Hence, it takes a large amount of roses to produce enough a pound of rose essential oil. Rose essential oil is good for sensitive skin and produces more radiance than any type of skin nourishing product. Other benefits of using rose essential oil in aromatherapy include cure for various conditions such as troubling menopause or some other gynaecological conditions.

Rose oil is the perfumery product obtained from rose petals. Rose oil has its use in ayurveda, perfuming soaps, cosmetics and has antibacterial property against Shigella dysentriae and *Mycobacteriaum tuberculosis* (Yako, 20). The important oil yielding rose species are *Rosa damascena, R. bourboniana, Rosa centifolia, R. alba* and *R. galliaca.* In India, R. damascena and R. bourboniana are cultivated for rose oil (Pal, 14) Bulgaria is the major producer and exporter of ‘otto of roses’. France, Cyprus, Greece, India, Iran, Italy and Morocco are the other major countries. Among the different species, *R. damascena* gives the maximum oil yield of 0.057-0.058 per cent followed by *R. bourboniana* containing 0.040-0.042 per cent oil (Srivastava and Gupta, 17).

Jasmine

Jasmine essential oil is in common use. Its flowers are either extracted by the labour-intensive method of enfleurage or through chemical extraction. It is expensive due to the large number of flowers needed to produce small amount of oil. The flowers have to be gathered at night because the odour of jasmine is more powerful after dark. The flowers are laid out on cotton

cloths soaked in olive oil for several days and then extracted leaving the true jasmine essence. Some of the countries producing jasmine essential oil are India, Egypt, China and Morocco. The important species of jasmine yielding concrete are *Jasminum sambac, J. grandiflorum, J. auriculatum and J. odorotissimum.* Jasmine oil is regarded as unique as it blends well with other floral extracts and is highly valued for producing high grade perfumes. It is also used for perfuming expensive soaps and cosmetics, mouthwashes and dentifrices, bath salts and tobacco. The odour of jasmine cannot be imitated by any known synthetic aromatic chemical thus having a unique status in the perfume world. France, Germany, Belgium, The Netherlands, Italy, Algeria, Turkey, Morocco and Tunisia are the important jasmine oil producing countries of the world. Jasmine flowers owe their fragrance to a volatile oil present in the epidermal cells of the inner and outer surface of both petals and sepals. Abdul Khader *et al.* (1) reported the concrete recovery of the three commercially important species of jasmines (Table 1).

Table 1 : Concrete recovery of *Jasminum* spp.

Species	Concrete recovery	
	%	Kg/ha of flowers
J.auriculatum	0.28-0.36	13.44-28.24
J.grandiflorum	0.25-0.32	13.85-29.42
J.sambac	0.14-0.19	1.18-15.44

The clonal selection of *J. grandiflorum*, CO-1 yields 0.291 per cent concrete. Appavu *et al*. (2) evaluated different species and varieties of jasmine and concluded that *J. grandiflorum* clone 'Thimmapuram' (29.42 kg/ha) followed by *J.auriculatum* clone 'Long round' (28.24 kg/ha) had the highest concrete yields.

Tuberose

Tuberose concrete and absolute prepared from the flowers of tuberose (*Polianthes tuberosa*) is also a valuable item of perfumery. Tuberose flowers emit a powerful and delightful fragrance. Tuberose is grown in the Grasse region of South France and in Morocco for the extraction of essential oil and the French perfume is considered one of the best in the world. Concrete is prepared by extraction of flowers with petroleum either which can be converted into tuberose absolute by alcohol washing. There are three varieties of tuberose available-single, semi-double and double. Of these only the flowers of single type are suitable for concrete production as the double varieties contain lower oil content (Hussain, 10). From 30,000 kg of loose flowers, 27.5 kg of concrete and 5.5 kg of absolute can be obtained. The concrete content in single flowered cultivars ranges between 0.08 – 0.11 per cent (Guenther, 9).The main chemical constituents of tuberose absolute are geraniol, nerol, benzyl alcohol, methyl benzoate, methyl salicylate, eugenol, benzyl benzoate and methyl anthranilate (Hussain, 11).

Marigold

Marigold is one of the most aesthetically pleasing flora in the world but did you know their floral essence is also beneficial? In fact, marigold essential oil is used in various products such as facial creams, salves, and other cosmetic products because of its natural skin nourishing effect. Thus, marigold is among the most common type of essential oil used in baby products. The flowers and stems are used for the extraction of marigold essential oil. These can then be used for a variety of medicinal use. Depending on the method of application, marigold essential oil can be used to remedy a variety of diseases such as varicose veins, chronic ulcer, jaundice, mild fever, measles, small pox, sore eyes, severe cold, cough, and pain or swelling. The essential oil of *Tagetes* finds use in perfumery industry. Essential oils of *T. minuta and T. erecta* are commercially produced in France and Africa for use in perfumes (Gopal, 8). The yield of essential oil content of fresh matured flowers is 1.25 per cent (Thappa *et al*., 19). The essential oil is extracted by steam distillation of flowers at full bloom.

Other lesser known flowers producing floral oils

Champaka

Michelia champaca yields a golden yellow oil with a recovery of 0.064 – 0.68 per cent (Dhingra *et al.*, 4). The concrete content of *Michelia champaca* ranges from 0.16 – 0.20 per cent (Hussain, 10).

Plumeria

Oil can be obtained from *Plumeria acutifolia* by steam distillation (Menon, 13) and solvent extraction with petroleum ether (Lewis *et al*., 12).

Magnolia

The buds and flowers of *Magnolia biondi* are used for oil extraction using solvent with a yield of 0.03 – 0.16 per cent (Chen *et al*., 3).

Ylang-ylang

Cananga odorata yields high quality oil by solvent extraction with a concrete recovery of 0.8-0.95 per cent (Gopal, 8).

Indian Kadamb

Anthocephalus cadamba flowers on yield oil which has a unique gentle, soft and sweet aroma. The oil is used in perfume industry. As its aroma helps in mediation and spirituality, in India, it is also extensively used in aromatherapy based applications.

Nerium

Richard Kennedy (15) made an attempt to exploit the perfume potentials of 24 non-conventional flower species and found that *Plumeria alba* and *Nerium indicum* cv. Double pink were promising in terms of concrete yield (0.339 and 0.328 percent). The major constituents of *Plumeria* oil were eugenol and geraniol whereas the nerium oil was dominated by benzyl acetate and benzyl alcohol.

Geranium

This type of essential oil is taken from a specific variety of the Geraniaceae plant family, which is the *Pelargonium adorantissimum.* The floral scent produced by Geranium essential oil is quite strong with a touch of mint. This particular floral essential oil has established its use in aromatherapy, especially in treating emotional and mental conditions. When its floral aroma is inhaled, it stimulates the adrenal cortex and creates a balance in your hormones. There are several methods of application for Geranium essential oil such as baths, massage oil, or vaporizer. The balancing effect is also ideal for stress relief.

Lotus

Lotus essential oil is most famous for wearing as perfume due to its unique and sweet floral scents. The plant from which the lotus oil is extracted from is generally big in space and leaf. Only the flower and leaves are visible on the water surface while the stem is located beneath the water as it connects to the muddy base. Aside from using its floral scent as a fragrance, lotus essential oil is also used traditionally as a medicine. It has been known to treat a variety of ailments including fungal infections, fever, cholera, and some other skin conditions. It is currently being studied for treatment of diseases such as arthritis and diabetes.

Cestrum nocturnum

With its flowers opening only at night, to spread pleasing, though strong, fragrance, this shrub is rightly known to Indians as 'Raat ki Rani' (Queen of the Night). *Cestrum nocturnum* is a common shrub of Indian gardens, but it has its home in the West Indies. The genus comprises about 200 species, which are natives of the Western hemisphere. Attars of *Cestrum nocturnum* flowers are prepared in india by co-distillation with sandal wood oil or by distilling the essential oil of *Cestrum nocturmum* into a receiver with sandal wood oil. These 'attars' find use in East Indian perfumery (Farooqi *et al*., 6).

Table 1 : Therapeutic properties of common essential oils.

Sl No.	Therapeutic properties	Oils	Botanical name
1	Sedative	Sandal wood Lavender Bergamot Chamomile Sweet marjoram	*Santalum album* *Lavandula officinalis* *Cirus bergamia* *Matricaria chamomilla* *Majorana hortensis*
2	CNS stimulant	Basil Clove Jasmine Peppermint Ylang Ylang	*Ocimum basilicum* *Syzygium aromaticum* *Jasminum officnale* *Mentha piperita* *Cananga odorata*
3	Adaptogen	Geranium Ylang Ylang	*Pelargonium graveolens* *Cananga adorata*
4	Bronchitis	Eucalyptus Angelica Pumilio pine	*Eucalyptus globulus* *Angelica archagelica* *Pinus mugo*
5	Antiseptic	Geranium Sandal wood Thyme	*Pelargonium graveolens* *Santalum album* *Thymus vulgaris*
6	Anti stress	Borneol Lemon Patchouli	*Drybalanops aromatica* *Citrus lemon* *Pogestmone patchouli*
7	Muscle relaxant	All spice	*Pimento dioica*
8	Carminative	Dill Spearmint Chamomile	*Anethum graveolens* *Mentha spicata* *Matricaria chamomilla*
9	Haemostatic	Achillea	*Achillea millefolium*
10	Antispasmodic	Clove Thyme	*Syzgium aromaticum* Thymus vulgaris
11	Analgesic	Clove	*Syzgium aromaticum*
12	Prostat gland inhibitor	Nutmeg	*Myristica fragrans*

Nyctanthes arbor-tristis

Commonly known as *'Parijata'*, *Nyctanthes arbor-tristis* is sacred to the hindus and is an essential part of a temple garden. It owes theie special status, no doubt, to its beautiful flowers and their delightful perfume. An essential oil is water distilled (compare to neroli and *ylang-ylang*) from the large white or creamy-white flowers which open only at night and wither the following day. The receptacle next the stalk contains benzene or petroleum ether, in order to prevent loss of the very small yield of oil which is partly water-soluble. A direct extraction of the flower yields a concrete, but the yield in this operation is equally poor. Oil of *Nyctanthes arbor-tristis* is a pale yellow to orange yellow coloured liquid of fresh and strong *Gardenia jasminoides* type odour. The so called *'attars'* of *Nyctanthes arbor-tristis* are produced in India by co-distillation of the flowers with sandal wood oil or by extraction of the flowers with mixed oils.

Table 2 : Essential oils for creation of perfume.

Herbs & their Essential oils	Perfumery note
Bergamot	Sweet freshness, lemony
Lemon grass	Citrus
Cedar wood oil	Use as such
Citronella oil & hydroxyl citronellol	Directly used in perfume
Clove leaf oil	spicy
Geranium oil	Fine perfumery Rose base
Jasmine	Most precious floral use
Lavandin / Lander oil	Refreshing odour
Oak mass	Long lasting odour
Orsis	Fine perfume
Orange flower	2nd most precious after jasmine for floral use
Patchouli, Palmarosa	Spicy woody balsamic, Floral, rosy
Peppermint	Minty soothing
Rose oil	Most important floral perfume

(Singh, 16)

Extraction of Essential Oil

Essential oil is a generic term applied to all aromatic products, such as essence oils, absolutes, resinoids, and concretes. To extract essential oils, aromatic essence molecules of the plants are targeted and extorted by various methods. Different parts of the plants are used for the process. For instance, lavender is extracted from its flowers, while orange comes from the rind of its fruit. For producing a good essential oil, the plants need to be blessed with good quality oil and favourable climatic and geographic conditions. Coming to the extraction process, there is an assortment of methods used for extracting essential oils. Depending on the method and the quantity of the raw material used, the price and quality of the essential oil is determined (Sumangala and Sidhu, 18).

Distillation: An age old practice, distillation is believed to have its roots well laid in the 8th century. The most popular amongst other essential oil extraction methods, it is mostly used for leaves, flowers, seeds, roots, and stems. The technique of low pressure produces the best quality of essential oil for aromatherapy purposes. For the process, two large containers are used. The first container is filled with aromatic raw materials and steamed water, heated at low pressure, is made to pass through it. The steam simmers the contents, causing the release of essential oils from the plant. This essential oil moves from the outlet into the other container. The second container, containing cold water and serpentine, changes the form of the essential oil from vapour to liquid. The water and essential oil mixture is further passed through a vessel called an alembic, wherein essential oils separate from the water. While the oils are used for the aromatherapy process, the by-product is used as floral water, examples of which are rose water, orange water and lavender water.

Expression: This method is usually used for extraction of essential oils from their fruit. It is basically a cold pressed method of extraction. Mainly essential oils extracted from citrus fruit, such as lemon, mandarin, bergamot and lime, make use of this process. Expression is a simple method and uses machines for the purpose of extraction. The machines apply a centrifugal force, squeezing the rind of the fruits, there by producing the essential oil.

Enfleurage: Enfleurage is usually practiced to extract oil from delicate flowers, such as rose, jasmine, neroli, and violet. The process involves the use of fixed oil, such as oil, animal fat. For the process, a sheet of glass layered with fixed oil is mounted on a wooden rack. The raw materials and flower petals are placed on the glass, which is later exposed to sun. The heat of the sun causes saturation of the fixed oil, with essential oil of the raw materials. This fixed oil is then dissolved in alcohol. Later on, alcohol is evaporated, giving rise to pure essential oil. The oil produced in the process is labelled as 'absolute', rather than 'essential oil'. Since the process is extremely expensive one, it is rarely practiced.

Maceration: The method of maceration is almost same as that of enfluerage. The only difference between the two is that while the latter uses natural heat (i.e. heat from the sun) for the process, in maceration, fixed oil is artificial heated to facilitate the release of essential oil.

Solvent Extraction: The process of solvent extraction is usually practiced in case of delicate flowers, such as rose, jasmine, violet, and mimosa. The method uses volatile solvents, such as petroleum ether, to extract essential oils. In this method, flower petals are kept on perforated metal trays and sprayed with the solvent. This solvent gets absorbed by the flowers and makes them release their essence. Alcohol is then added to extract the essence. Though the oil extracted from this method is also termed as 'absolute', the process is slightly less expensive than enfleurage.

Supercritical fluid extraction: This is the most important method of extraction of essential oil from materials of plant origin where the fragrance and flavour ingredients resemble their sources. Supercritical carbon dioxide has the density of a liquid, low viscosity and diffuses like a gas. Through this method a broad range of low to medium molecular weight compounds like esters, aldehyde and terpenes can be extracted. As the extraction is conducted low enough (31 ^{0}C), the organoleptic properties are unimpaired (Farooqi and Srinivassappa, 5).

Future prospects

The introduction of synthetic perfumes in the market led to decline in markets for the natural perfumes during the past two decades. However, the demand for natural perfumes is reviving rapidly in recent days. The growth in demand of the perfumery raw materials is very fast in the world trade. The overall picture for future developments in the sector is bright considering the existing strong research base in this sector and the high local technological skill which may allow India to emerge as a provider of technological services in the perfumery sector. The increasing importance of natural extracts as pharmaceutical & natural cosmetic aid and their use as nutraceutical ingredients in recent times has opened up new vistas for this sector besides their widespread use as flavour & fragrance ingredients. India will play a dominant role in the production & processing of these natural extracts. Country's biodiversity coupled with competent scientific force, make our country as the best choice to become a foremost leader in aroma business in the coming years.

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