



Extraction of petrichor and essential oils for the production of Novelty fragrance products

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Abstract

Petrichor or the smell of the first rain is a concept that always seems to get every human being excited. The rain has always been appreciated by humans and it is especially true for Indians as we all are extremely connected to the monsoon. The objective of this project is to exploit that nostalgia factor of humans and produce a fragrance product that will contain this smell of rain by incorporating the extraction of Geosmin, the compound responsible for the muddy smell and incorporating various other components into this perfume to make it a pleasant yet nostalgic product that can be efficiently extracted and enter the fragrance market.

Key Words: Petrichor, Geosmin, Fragrance, Perfume.

INTRODUCTION

History of Perfumes

A perfume is a combination of various aroma compounds, essential oils, fixatives as well as oils and carriers. It has been used for many years all over the world to give an agreeable scent to humans, animals and even objects and food. Many ancient texts and also archeological excavations show that perfumes were used in many of the earliest civilizations of humans. Modern perfumery was started somewhere in the late 19th century when compounds such as vanillin and coumarin was being synthesized artificially. This allowed for the production of perfumes with scents that could not have been attained with just natural aromatics.

Solvent Types

A perfume oil is often diluted with some kind of solvent, usually alcohol in order to change the concentrations to various levels. The dilution mixture usually consists of ethanol and water or any rectified spirit. There are other ways that perfume oils can be diluted and these include the use of neutral smelling carrier oils like coconut oil fractionated, or liquid waxes like jojoba oil. Carrier oils help generally is diluting as well as the blending of various other essential oils and components together to create a fine finish which is not contaminated by any unwanted scent. Coconut and jojoba oils are used mainly because they do not possess a lot of aromatic compounds are tend to smell neutral.

METHODOLOGY

- Ecological survey for finding the available species of flowers and plants: A survey was conducted to identify the most widely available flowers indigenous to the Bengaluru area, inexpensive and with great atoms. This was done by visiting the various markets, gardens and parks in the city and also by observing the plants growing in abundance in certain areas.
- Identification and procurement of flowers and other specimen: The flowers were observed, photographed and documented for identification and useage.
- Procurement of soil from various sources: Soil was procured from two different sources. The two types of

soils that were used include agricultural soil and mountain soil.

- Extraction of essential oils using steam distillation: Essential oils from selected sources were extracted in the laboratory using the steam distillation equipment followed by purification and concentration methods.
- Isolation of bacterial species from soil for geosmin fermentation: A colony of *Streptococcus greicius* was isolated and allowed to grow.
- Baking of soil for petrichor production: The soil from the two sources was baked in the presence of sunlight.
- Extraction of petrichor: This was conducted by the steam distillation of the two soils directly as well as produced by the isolated bacteria.
- Mixing of essential oils to produce novelty fragrances: Done with the help of carrier oils like jojoba and diluted using ethanol.

Soil Sample

Two soil samples were taken. One from an agricultural land with high loam content. And the other from a Mountain region with a higher silt content.

Steam distillation of the two soils was carried out as the trapped volatile compounds can be released when water evaporates and drags the volatile compounds with it.

Distillation was carried out directly.

- The components were taken together in a simple distillation set up. Distillation was done to get a blend of essential oils.
- To remove the aqueous layer, liquid – liquid separation was carried out.
- As the quantity of oil is very low, removal of the oil from the water was done using centrifugation at 4000RPM for 2 mins.
- The oil layer was carefully transferred into an epindroff tube with a micro pipette.
- .75 ml of Jojoba oil and .25ml of sandalwood oil was added to the extract to get the final product.

The smell of wet soil is mainly given by the compound Geosmin.

Geosmin is produced mainly from the bacteria *Streptomyces griseus*. The production of Geosmin is very high during sporulation.

For the synthetic creation of Petrichor, Geosmin will be mixed with a lot of other products that are present naturally in the soil.

Serial dilution and plating was conducted to isolate *Streptomyces griseus*.

Serial dilution was done by taking 1gm of soil sample and was added in 10ml of autoclaved water.

It was mixed thoroughly and 1ml of this was transferred into 9ml of Clear autoclaved water to get a 10X-1 concentration.

The same was done until a 10X-5 concentration was obtained.

Streptomyces is Actinobacteria and can be identified by the filamentous structure formed on the petri plates.

The petri plates were plated with Himedia E.coli Luria Broth with 4% Agar.

RESULTS AND DISCUSSION

The survey was conducted over a span of 3 months, where the samples and species were discovered by going through the general hotspots of flowers in bangalore. As bangalore is a garden city, the whole widespread of parks gardens and other nature hubs could not be covered. Lal Bagh, Cubbon park, Freedom park, and the roads of various constituents of bangalore were covered including Jaynagar, J.P.Nagar, Basawanagudi, Malleshwaram, Bannerghatta and many others.

The survey played a key note in finding the right complementary flowers which helped enhance the smell of petrichor without diminishing the light smell of mud from it.

Table 1. Plant species identified and documented.

Sl. No.	Name of the plants
1	<i>Anthrocephalus cadamba</i>
2	<i>Bauhinia variegata</i>
3	<i>Bombax malabaricum</i>
4	<i>Brassaia actinophylla</i>
5	<i>Butea frondosa</i>
6	<i>Callistemon lanceolatus</i>
7	<i>Careya arborea</i>
8	<i>Cassia fistula</i>
9	<i>Cassia javanica</i>
10	<i>Cassia siamea</i>
11	<i>Cassia spectabilis</i>
12	<i>Castanospermum australe</i>
13	<i>Cochlospermum gossypium</i>
14	<i>Cordia sebestena</i>
15	<i>Colvillea racemosa</i>
16	<i>Couroupita guianensis</i>
17	<i>Delonix regia</i>
18	<i>Dolichandrone platycalyx</i>
19	<i>Enterolobium cyclocarpum</i>
20	<i>Erythrina indica</i>
21	<i>Firmiana colorata</i>
22	<i>Gliricidia sepium</i>
23	<i>Grevillea robusta</i>
24	<i>Jacaranda mimosaeifolia</i>
25	<i>Kigelia pinnata</i>

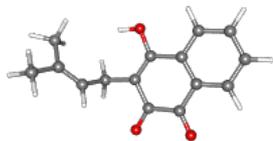
26	<i>Lagerstroemia flos-reginae</i>
27	<i>Michalea champaca</i>
28	<i>Milletia ovalifolia</i>
29	<i>Millingtonia hortensis</i>
30	<i>Parkia biglandulosa</i>
31	<i>Peltophorum pterocarpum</i>
32	<i>Plumeria sp.</i>
33	<i>Polyalthia longifolia</i>
34	<i>Pongamia glabra</i>
35	<i>Pterospermum acerifolium</i>
36	<i>Samanea saman</i>
37	<i>Santalum album</i>
38	<i>Saraca asoca</i>
39	<i>Solanum grandiflorum</i>
40	<i>Spathodea companulata</i>
41	<i>Swietenia macrophylla</i>
42	<i>Syzygium cumini</i>
43	<i>Tabebuia argentea</i>
44	<i>Tabebuia avellaneda</i>
45	<i>Tabebuia rosea</i>

It was noticed that there were a lot of flowers that could easily be mistaken for indigenous flowers due to their abundant availability.

Out of all the materials that were considered for use in this project, the following were selected for various purposes including the fragrance it produces, irritability, result of combination with other materials, ease of availability, cost, etc. They are: 1. *Tabebuia rosea*: The common name of this flower is Pink Poui. It originates from Mexico, Venezuela and Equador in particular. This plant is known to grow very large and leavy, providing enough shade. Leafs take after the silk cotton leaves and borne on branches that develop at an angle to the primary trunk (this element can be utilized well to separate the T. rosea from a fundamentally the same as species T. pallida). In the same way as other blossoming trees, it is practically leafless when in sprout. The pale pink blooms develop in bunches like the different *Tabebuia*s. The main active component is Lapachol is a natural phenolic compound isolated from the lapacho tree. This tree is known botanically as *Handroanthus impetiginosus*, yet was some time ago known by different other botanical names such as *Tabebuia avellaneda*. Lapachol is likewise found in different species of *Handroanthus*.



Tabebuia rosea plant



Structure of Lapachol

2. *Magnolia champaca*: The common name of this flower is Champak. It is known to have originated in South Asia and Southeast Asia. This evergreen tree does not require any presentation. It is to a great extent developed for its fragrant flowers. It is very notable to individuals as they utilize its flowers for religious services. Much of the time planted in the region of sanctuaries, it is viewed as holy. The tree requires moderate measure of daylight and does well in damp atmosphere. This tree has sensibly thick foliage and can become expansive.

*Magnolia champaca* flower

3. *Rosa abyssinica*: The common name of this is Rose which is known to have originated in Asia. Rose is found to be a woody perennial flowering plant belonging to the genus *Rosa*, in the family Rosaceae or the flower that it bears. There is known to be over three hundred different species and thousands of rose cultivars all around the world. The rose plants form a group of plants that can be either erect shrubs, climbing, or trailing, with some stems that contain many sharp thorns as a protection mechanism and to save water. The rose flowers vary greatly in size as well as shape and are usually big and showy, in various colours including white, various yellows and most commonly, reds. Most of the rose species are native to Asia. There are a few smaller numbers that are native to Europe, North America, as well as northwestern Africa. The species, cultivars and the hybrids are widely grown mainly for their beauty and distinct fragrance. Roses are known to have acquired cultural and religious significance in many societies and cultures. Rose plants can range in size from compact shrubs, miniature roses plants, to tall climbers that can grow up to seven meters in height. The different species of rose are known to hybridize easily, and

this has also been used for the development and creation of the wide range of garden roses can be found in many homes commonly. Damascenones are said to be a series of very closely related chemical compounds which are components of a large variety of fragrant essential oils. The damascenones are a part of a family of chemicals that are known as rose ketones. This also includes damascones and even ionones. *beta*-Damascenone is one of the major contributors to the distinct and distinguishable aroma of roses, though it is very low in concentration, and is an extremely important fragrance chemical that is used extensively in the perfume industry. The damascenones are derived from the degradation of carotenoids.

*Rosa abyssinica* plant

4. *Plumeria sp.* : The common name of this plant is Frangipani, Temple Tree and Pagoda Tree. This plant is said to have originated in the West Indies and Mexico. There are 2 distinct species of the Temple Trees that are can be identified easily on the streets. The Red Frangipani variant *Plumeria rubra* is a tree that looks distinctly odd while the other White Frangipani *Plumeria alba* is more pleasant to look at. Both of them are of a small stature; the former is deciduous and the latter is evergreen. Both these plants have leaves that are known for being very thick. The leaves as well as the stem exude a somewhat white and milky substance when they are injured. Both, the Red as well as the White Frangipani plants, bear very fragrant flowers in the form of clusters at the tips of the tree's branches.

Flowers of the *Plumeria sp.*

5. *Bauhinia variegata* & *Bauhinia purpurea*: These flowers are commonly known as Variegated Bauhinia & Purple Bauhinia and have their origin in India. *Bauhinia variegata* and *Bauhinia purpurea* are both very similar to each other and it is often hard to distinguish between them. *Bauhinia variegata* has a very pale pink or even whitish coloured flowers and some of the petals are variegated. The flowers of *Bauhinia purpurea* often fall in between the shade ranges of pink and purple. Similar to all Bauhinia plants, the leaves are seen to split in the middle. This is its characteristic feature of these plants. Both the species are considered to be indigenous to Bangalore. *B. purpurea* enters the flowering season with all of its leaves intact however the *B.variegata* variety sheds most of its leaves during the flowering season.



Bauhinia purpurea flower

6. *Azadirachta indica*: This plant is commonly known as Neem. Neem is known to have originated in the Indian Subcontinent including India, Nepal, Pakistan, Bangladesh Sri Lanka and the Maldives. The *Azadirachta indica* plant, commonly known as neem or neem tree or the Indian lilac, belongs to the mahogany family, Meliaceae. This is one of the two only species in the genus *Azadirachta*. This plant is typically grown in most tropical and semi-tropical regions and climatic conditions. The neem trees are also grown in various islands that are located in the southern parts of Iran or Persia. The fruits and the seeds of this tree are what provide the major amount on neem oil are hence the source for the same.



The neem tree

7. *Cinnamomum verum*: This plant is commonly called as Cinnamon and is a well known household ingredient for cooking. It is a spice of woody nature that originated in Sri Lanka. The *Cinnamomum verum* plant, also called as true cinnamon tree or sometimes as the Ceylon cinnamon tree, is a small evergreen tree that belongs to the family of Lauraceae. The Lauraceae family is known to have originated in Sri Lanka. Among various other species, the inner bark of this plant is used to make the well known spice, cinnamon. The previously used botanical synonym for this tree, *Cinnamomum zeylanicum*, is said to be derived from Sri Lanka's previous name, Ceylon. The country of Sri Lanka is still the top producer of cinnamon in the world producing about 80–90% of the entire world's Cinnamon supply.



Cinnamon

8. *Santalum album*: This plant is known for its medicinal properties and well used for various purposes including religious purposes in several countries. This is commonly known as Sandalwood. Sandanwood was originated in Nepal, India, Bangladesh, Sri Lanka, Pakistan and even countries like Australia, Hawaii, Indonesia and several other Pacific Islands. The Sandalwood is a part of a class of woods trees belonging to the genus *Santalum*. These woods are quite heavy and sturdy, yellowish in color, and also fine-grained. Unlike many other existing woods of aromatic nature, these woods are very popularly known for their ability to retain their fragrance for many decades without a dent. The sandalwood oil is extracted from the bark of the sandalwood tree for various uses. For all the properties that it possesses, the sandalwood is said to be the second-most expensive of woods in the entire world. Both the oil as well as the wood produce a fairly distinctive fragrance that has been valued greatly for many centuries. As a result, the species of these beautiful and slow-growing trees have been overharvested greatly in the past century leading to the decrease of the occurrence of these trees in nature.



Sandalwood oil

9. *Simmondsia chinensis*: This component is most commonly referred to as Jojoba Oil. It is said to have originated from the southern Arizona, the southern California, and the northwestern regions of Mexico. Jojoba oil is a liquid that is produced within the seeds of the *Simmondsia chinensis* plant. The plant is a shrub. The jojoba oil makes up nearly 50% of the jojoba seed by weight. The terms "jojoba wax" and "jojoba oil" are quite often exchanged as the waxes are visually found to be similar to a mobile oil, but since a wax it is composed almost completely (~97%) of many monoesters of long-chain fatty acids as well as alcohols, that are accompanied by only a very tiny fraction of the triglyceride esters. It is this composition that accounts for the extreme shelf-life and stability as well as extraordinary resistance to very high temperatures, when compared with the counterparts, true vegetable oils.



The *Actinomyces* species were isolated from the various bacterial colonies living in soil. The identification of the species was fairly easy due to the characteristic doughnut shape of the colony.

The essential oils were extracted from the key ingredients of the perfume by the process of steam distillation. Since the amount of oil that could be extracted from a large amount of sample was very less, we carried out the combined steam distillation of all the products and were able to collect a good amount of essential oils. This was

then combined with jojoba oil, a carrier, in order to create a smooth blend of the components. This blend was then diluted using ethanol in order to produce a novelty fragrance product.



It was noticed that the first notes are that of the floral and neem elements. Typically consisting of rose, champak and neem however, the neem scent dominates that of the floral. These notes were detectable for about 30 minutes from the time of application.

The middle notes are where we notice the peculiar muddy smell which highly resembles the smell of the first rain. This is known as petrichor. This element was added by the production of Geosmin, which when combined with spices like cardamom, produce a study backbone for the fragrance in the form of the middle notes. These notes were detectable for a long time and blended to the bottom notes very smoothly making it nearly impossible to tell the difference between the two.

The final note of the sandalwood oil leaves a lasting smell. Sandalwood oil was not extracted for the purpose of this project. A readily available sandalwood oil from the market was used instead and was found to be extremely concentrated and potent. Due to this, we can observe the traces of this note to be present several hours after the application.



Final essential oil blend

CONCLUSION

In our current world, we have various perfume houses from all over the world working on various intriguing smells, each evoking different memories to different wearers. Also living in our current world, we can get lost and buried under the enormous amounts of stress and responsibilities we need to fulfill. Between having to juggle between all these tasks, we can often become exhausted and waiting for a chance to be free again.

Our fragrance product has been designed to evoke the feeling of nostalgia in people. It reminds them of a time when they were young and free. The smell of wet mud after the heavy rains brings a feeling of peace and satisfaction.

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