# Steam Inhalation based Sustained Release Phytosome for the Treatment of Allergic Rhinitis

**Praseetha**
*Department of Biomedical Science*
*Alagappa University, Karaikudi, Tamil Nadu, India*

**OPEN ACCESS**

Volume: 12

Special Issue: 1

Month: July

Year: 2024

P-ISSN: 2321-788X

E-ISSN: 2582-0397

Received: 15.05.2024

Accepted: 20.06.2024

Published: 10.07.2024

Citation:
Praseetha. "Steam Inhalation Based Sustained Release Phytosome for the Treatment of Allergic Rhinitis." *Shanlax International Journal of Arts, Science and Humanities*, vol. 12, no. S1, 2024, pp. 105–14.

DOI:
https://doi.org/10.34293/sijash.v12i1.8023

**Abstract**
*Clinical illnesses involving respiratory tract infections are quite common and potentially dangerous. An introduction to respiratory pathophysiology and the interplay between infections and immune responses is necessary before tackling issues. The current study uses a phyto-based combination of Vitex trifolia, Ocimum sanctum, and eucalyptus oil to treat allergic rhinitis. The presence of flavonoids and phenol components may have contributed to VOE (Formulation)'s increased antioxidant activity. These results led to the conclusion that it was a superior ex vivo nasal mucosa permeability booster. Conclusion: Because there is a permeation enhancer that helps reduce respiratory complaints and relieve pain, intranasal administration of VOE (formulation) has a great potential for enhanced formulation penetration via nasal mucosa*

## Introduction

Infections that affect the bodily components used for breathing, such as the sinuses, throat, and lungs, are known as respiratory tract infections, or RTIs. A chronic inflammatory illness of the upper respiratory tract, allergic rhinitis significantly lowers a patient's quality of life. An inflammatory condition of the nasal mucosa caused by exposure to allergens that initiates IgE-mediated inflammation is known as allergic rhinitis [1]. Four main symptoms—rhinorrhea, sneezing, nasal irritation, and nasal congestion—are indicative of the condition clinically. Despite not being a serious condition, allergic rhinitis has clinical significance. [1].

When an inciting allergen is present, a variety of inflammatory cells, such as mast cells, CD4-positive T cells, B cells, macrophages, and eosinophils, enter the nasal membrane and cause allergic rhinitis. The majority of T cells are T helper cells, and they release cytokines like interleukin to encourage plasma cells to produce immunoglobulin E (IgE). Histamine and leukotrienes, two mediators that cause arteriolar dilatation, increased vascular permeability, itching, rhinorrhea (runny nose), mucous secretion, and smooth muscle contraction, are released when IgE is produced [2].

A phytosome is a plant medication that is contained in vesicles and is sold in nanoscale form. The drug's active ingredient is encased in an envelope-like coating by the phytosome. Typically, to make phytosomes, a precise amount of phospholipid—soy lecithin—is added to plant extracts in an aprotic solvent. It causes a lipid complex to develop that is more stable and bioavailable [3]. The majority of

phytomedicines' bioactive ingredients are compounds that dissolve in water, such as flavanoids, glycosides, and phenolics.

However, due to their poor absorption whether administered topically or eaten orally, water soluble phytoconstituents have limited efficiency. the application of formulation technology to boost absorption and deliver herbal products and medications, leading to superior outcomes compared to traditional herbal extracts. A liposome is an aggregate of several phospholipid molecules that encloses other phyto-active molecules without specifically connecting to them, whereas a phytosome is a unit of a few molecules bound together. With guaranteed delivery to the tissues and a dramatic increase in bioavailability, phytosome technology is a game-changer in clinical benefit and nutrient safety.[3]

Vitex trifolia Linn belongs to the verbenaceae family. Tropical and subtropical areas are home to this plant. Gray-green trifoliate evergreen leaves with white edge variegation are present. The tender leaves have a strong scent when crushed and have brownish pubescence on the underside. The plant is known to contain a variety of active ingredients, including essential oils, diterpens, and viterfolins, which have a number of pharmacological characteristics including antipyretic, antibacterial, and anti-allergic effects[4].

Ocimum sanctum is a member of the Labiateae family and is significant due to its potential for therapeutic use. Ocimum sanctum L. (Labiatae) is a tiny annual plant with a potent smell. With antipyretic, anti-inflammatory, anti-cancer, and neuroprotective qualities, it is also therapeutic [5][6].

The tall, evergreen tree or shrub Eucalyptus globulus is a member of the myrtaceae family. It has been used in folk medicine for a very long time due to its many medical benefits. Strong antiseptic, astringent, expectorant, inhalant, and supurative qualities have all been associated with the plant [7].

The most popular do-it-yourself method for preventing respiratory tract infections is steam inhalation. However, using steam therapy or steam inhalation alone will only help to clear the respiratory tract and nose, not the infection itself. Only a small number of trials have been conducted thus far with encouraging outcomes. Ayurveda suggests inhaling steam while employing several herbs, particularly Vitex trifolia and Ocimum sanctum, to maintain a healthy respiratory system. The goal of the current effort is to generate phytosomes for the use of eucalyptus, Vitex trifolia, and Ocimum sanctum oil.

## Materials and Methods

Leaves of Vitex trifolia and Ocmium sanctum were gathered from Paramakudi. Purchased eucalyptus oil at a medical supply store in Mathur, Trichy. The leaves were divided and let to dry in the shade. For future research, the dried leaves were ground into a fine powder and kept in an airtight container. Phosphatidylcholine, or lecithin soya, was acquired from HIMedia Laboratories Pvt. Ltd. in Mumbai.

## Preparation of Leaves Extract

5g of powdered Vitex trifolia, or Ocmium sanctum, leaves soaked in 100ml of methanol and kept for two days at room temperature. Following filtering, the extract was evaporated in a heated stirrer at 60°C and 200 rpm, collecting the crude extract [9].

## Fourier Transform Infrared (ft-ir) Spectroscopy

The FT-IR spectroscopy where the Vitex trifolia, Osimum sanctum leaves extract and Eucalyptus oil and formulation sample, phosphatidylcholine was scanned over a wave-number range 4000-400cm-1 in FT-IR spectrometer (ACIC FT-IR)

**Preparation of Voe Phytosome Formulation**

Solution A 100mg of soy phosphatidylcholine added 5ml of methanol in a beaker then sonicated for 10 mins and kept under magnetic stirring for 2 hrs at 700rpm.

Solution B 100mg of Vitex trifolia, Ocimum sanctum ,100µl of eucalyptus oil added 5 ml of methanol and mixed well.

Solution B transferred into solution A using insulin syringe, kept under stirring 700 rpm for 12 hrs, next day collected by dispersing in water.

**Particle Size and Zeta Potential Analysis**

Particle size and zeta potential was determined by zeta sizer (Malvern s4700 PCS system). VOE formulation were diluted in 2ml of milliq water for analysis.

**Quantification of uv Spectrophotometer**

0.2ml formulation was treated with 2ml of methanol sonicated for 15 mins further dilution was made with 0.2ml to 2ml of buffer (7.4 pH) twice and the absorbance was measured at 252nm using UV spectrophotometer.

**Transmission Electron Microscope**

A transmission electron microscope (TEM) equipped with a JEM-2100 (JEOL-JAPAN) was used to examine the precise morphology of the VOE Formulation. To produce the TEM sample, a drop of the diluted formulation was added.

**Stability Studies**

The optimized formulations were stored at room temperature (37℃), refrigerator condition (8℃).) for 30 days. Further, the particle size and zeta potential were measured during initial and at the 30 days.

**In Vitro Release Study**

The dialysis bag method was used to verify the phytosomes' in vitro release. One milliliter each of phytosomes and buffer were added to the dialysis bag. After tying up, the bag was put in 100 milliliters of 7.4 pH buffer. A 1 ml release sample was removed every 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours, 6 hours, 7 hours, 8 hours, and 9 hours, and a similar volume of buffer was added at each interval. Using a UV spectrophotometer set at 252 nm, the amount of phytoconstituent released in the buffer was measured.

**Ex Vivo Nasal Permeation Study**

Franz diffusion cell was used to test VOE formulation's ex vivo nasal permeability. The nasal membrane used in this investigation was taken from the head of a recently killed goat that was procured from the closest slaughterhouse in Mathur, Tiruchirappalli. Through the septum, the head was divided into two hemispheres. Afterwards, each nose's nasal membrane was removed and divided into square pieces to preserve the franz diffusion cell's diameter. For 60 minutes, the nasal membrane was delipidized (1:2 v/v) with chloroform and methanol. The receptor chamber was filled with around 20 mL of phosphate buffer (pH 7.4) and kept under magnetic stirring about 200 µl of VOE formulation was instilled over the membrane which was properly clamped between receptor and donor chambers. Samples (1mL) were withdrawn at each time point for 3h and replaced with fresh phosphate buffer (pH 7.4) through the sampling port. The absorbance was measured at 415 nm using a UV spectrophotometer. the nasal membrane was visualized under a microscope

before and after the permeation enhancer and its response compared with the formulations without permeation enhancer [8].

**Ex Vivo Nasal Toxicity Study**

The goat nasal mucosa was used in the ex vivo nasal toxicity testing for the VOE formulation. From a newly killed goat's head in a slaughterhouse close to Mathur, Tiruchirappalli, the nasal mucosa was removed and kept in regular saline buffer. Because it can cause nasal toxicity, isopropyl alcohol was employed as a positive control while separating and cutting the nasal membrane into small, desired-sized pieces. Each piece of membrane was then treated with a blank formulation.

All the samples were properly rinsed with normal saline buffer after 2h of treatment and stored in 10% formalin solution for histopathological evaluation [8].

**Result and Discussion**

**FTIR Analysis**

Vitex trifolia displayed two peaks: one at 1385.18 cm 1 and another at 2924.91 cm 1, which represents the C-H bending of an alkane group and the other at 3388.26 cm 1, which represents the O-H stretching of an alcohol group. The C-H stretching of an alkane (2958.53 cm -1), an aldehyde (2730.32 cm -1), and an alkane (2874.67 cm -1) are the top values for eucalyptus oil. The highest values of phosphatidylcholine were 3375.40 cm -1, corresponding to the stretching of an alcohol, and 1378.47 cm -1, corresponding to the bending of an alcohol. Ocimum sanctum displayed a peak at 3438.14 cm-1, which is equivalent to an alcohol's O-H stretching, and 2092.98 cm-1, which is equivalent to an aldehyde's C-H stretching. Formulation showed peak at 3445.09cm -1 which corresponds to the N H stretching of primary amine.

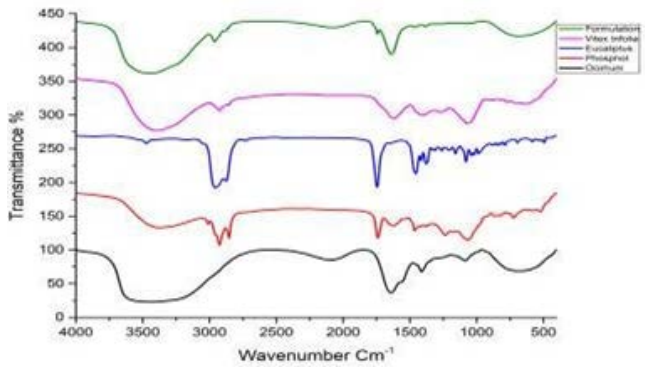



**Figure 1 FTIR Spectra of VOE Formulation, Vitex Trifolia, Osimum Sanctum, Eucalyptus Oil, Phosphatidylcholine**

**Development of Voe Formulation**

Solvent evaporation was used to manufacture the VOE formulation. The composition contained eucalyptus oil, Vitex trifolia, and Ocimum sanctum. A surfactant called phosphatidylcholine was utilized to create phytosomes. In a recently developed technology known as phytosome, the bioactive phytoconstituents isolated from herbs are encapsulated and bound by a phospholipid. Plant extracts exhibit a significant increase in bioavailability as a result of their complexation with phospholipid and enhanced absorption. An integral component of the cell membrane utilized in phytosome technology is phosphatidylcholine, acts as a carrier and also nourishes the skin. they offer a better stability profile because both nourishes and serves as a carrier for the skin.

Because of the formation of chemical interactions between the phosphatidylcholine molecules and phytoconstituents, they provide a superior stability profile. The new liquid formulation with continuous release for inhaling steam. The most popular do-it-yourself method for preventing respiratory tract infections is steam inhalation. Compared to commercial goods, the developed product is entirely soluble and miscible in water, which makes it a dependable and effective source of steam inhalation therapy with a continuous release of the active components to maximize patient benefit.

**Figure 2 VOE Formulation**

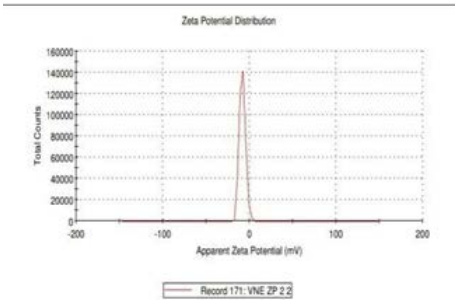



**Figure 3 Particle Size Analysis**

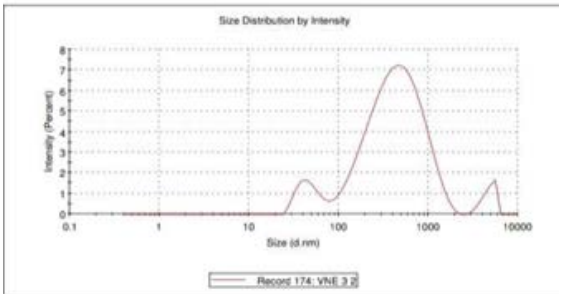



**Figure 4 Zeta Potential Analysis**

**Table 1 Formulation Layout and Invitro Characterization Data (Particle Size, Zeta Potential, Quantification) of VOE Formulation**

| Formulation | Ratio of Solvent & Surfactant | Particle Size (nm) | PDI | Zeta Potential (mV) | Quantification (mg) |
|---|---|---|---|---|---|
| F1 | 1:1 | 527.9 ± 25.7 | 1.00 | 0.695 ± | 185 ± 4.34 |
| | | | ± | 0.433 | |
| | | | 0.065 | | |

| | | | | | |
|---|---|---|---|---|---|
| F2 | 1:1 | 979 ± 159.8 | 0.418 | 8 ± 0.035 | 114 ± 5.02 |
| | | | ± | | |
| | | | 0.061 | | |
| | | | | | |
| F3 | 1:1 | 301 ± 9.81 | 0.499 | 33 ± 0.971 | 278 ± 1.96 |
| | | | ± | | |
| | | | 0.021 | | |

**Particle Size and Zeta Potential Analysis**

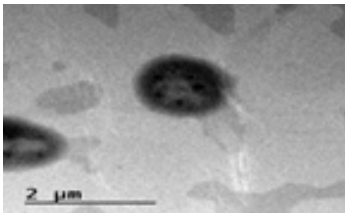
All formulations showed mean sizes below 700nm, making them suitable for pharmaceutical drug delivery. The particle size and zeta potential (VOE F1, VOE F2, VOE F3) ranged from (527.9 ± 25.7nm, 979 ± 159.8 nm, 301 ± 9.81nm), whereas the zeta potential ranged from (0.695 ± 0.433mV, 8 ± 0.035mV, 33 ± 0.971mV).

**Quantification of VOE Formulation**

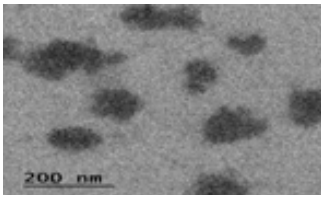
The 0.2 ml VOE formulation was subjected to a 15-minute sonication process using 2 ml of methanol. Subsequently, a dilution was made using 0.2 ml to 2 ml of buffer (7.4 pH) twice. The absorbance was measured at 252 nm using a UV spectrophotometer, revealing the drug content levels in the formulation to be (VOE F1 - 4.34, VOE F2-5.02, VOE F3 - 1.96).

**Morphological Analysis of TEM**

Analysis with transmission electron microscopy was utilized to examine the structure of VOE – formulation. Individual spherical vesicles without any particle aggregation were visible in the TEM pictures, suggesting the production of phytosomes. The typical range of particle sizes is 200nm to 2µm, and TEM pictures of the phyto-phospholipid complexes show a shape resembling a vesicle.[8]




**A**




**B**

**Figure 5 TEM Images of VOE Formulation**

**Stability Studies**

According to the in-vitro stability testing, the created formulation did not exhibit significant changes in particle size over the course of 30 days (322.6 ± 10.431) as compared to day 0 (245.2 ± 3.134). This suggests that the VOE formulation will remain stable throughout storage. Room temperature (20–21 degrees Celsius) and freezing temperature (-18 degrees Celsius) are used in VOE formulation. Over the course of 30 days, the nanoparticles' mean size varied little under three distinct storage environments.

**Table 2 Stability Studies**

| S.No | 0th Day | Room Temperature (30th day) | Refrigerator Temperature (30th day) |
|---|---|---|---|
| Particle Size | 249.5± 3.134 | 308.86± 2.119 | 318.63± 10.43 |
| Zeta Potential | 36.733± 1.644 | 17.633± 0.737 | 37.5± 0.519 |

**In Vitro Release Study**

The VOE formulation's in vitro release exhibits an exponentially higher release rate. When compared to the end release rate, the beginning of the release exhibits a lower amount of drug release. Comparing the three formulations, the entire VOE formulation within nine hours showed the ability. VOE fs -1 showed a 25 % release within nine hours, followed by 27.877±14.097 % after, VOE fs -2 showed 31% within nine hours, followed by 25.915±4.854 % after, and VOE fs -3 showed 26 % release within nine hours, followed by By comparing the three formulations, VOE fs -2 efficiently controls release at 28.561±3.116 % as opposed to another formulation.

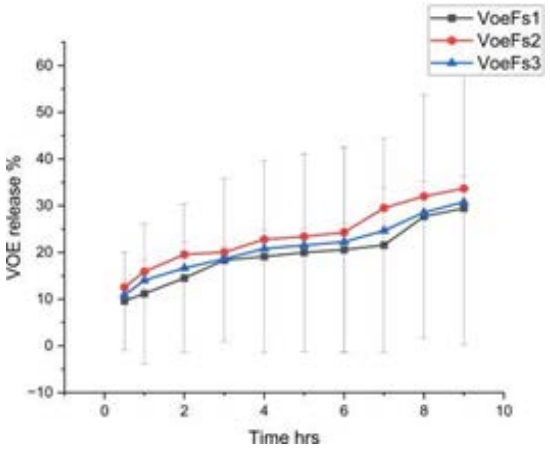



**Figure 3 In Vitro Release VOE Formulation Showing Sustained Release Rate of 25 % at 9hrs**

**Ex Vivo Nasal Toxicity Study**

The optical microscopic images of all the mucosal tissues are shown in FIG N. Compared to other groups, such as the negative control, VOE-F (formulation), and VOE-sNF (without formulation) treated groups, the positive control, which received isopropyl alcohol treatment, showed epithelial tissue damage along with a decrease in the number of secretary gland and lymphatic dilatation. This study validates the safety of soy phosphatidylcholine-containing VOE formulation for the efficient intranasal treatment of allergic rhinitis without harming nasal mucosal tissue [7].

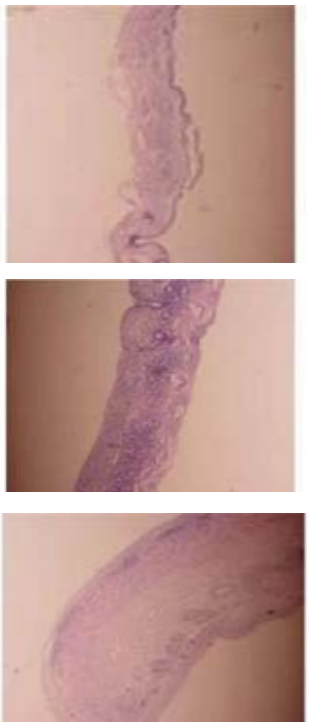


**Figure 4 Nasal Toxicity Studies A) Isopropyl Alcohol B) Blank Formulation C) VOE Formulation**

**Ex Vivo Nasal Permeation Study**

Studies on ex vivo nasal permeability provide useful information for predicting the formulation's in vivo pharmacological action. Using sheep mucosa and topical application, the ex vivo nasal permeation potential of the VOE formulation was effectively tested in a Franz diffusion cell. It demonstrated a quick penetration in less than 30 minutes, proving that there was no delay in passing through the nasal mucosa. According to Fig. 7, 18 % of the medication release was absorbed in less than 120 minutes. The nasal mucosa allows VOE to pass through, and a persistent permeation profile is seen for almost three hours[8].

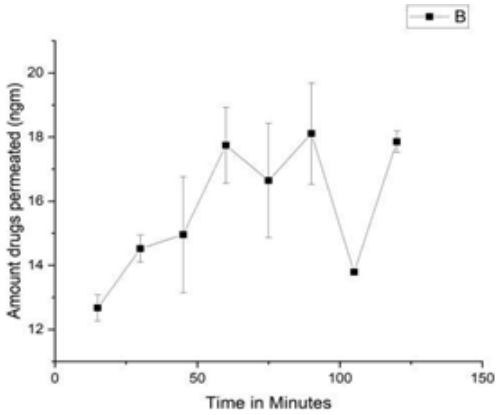



**Figure 7 Ex Vivo Nasal Permeation of VOE Formulation as Function of Time from the Phytosome through Sheep Mucosa which is Mounted onto a Franz Diffusion Cell**

**Summary**

Any infectious condition of the upper and lower respiratory tract is referred to as a respiratory tract infection (RTI). Among the illnesses of the upper respiratory tract is allergic rhinitis. To treat allergic rhinitis, eucalyptus oil, phosphatidylcholine, Vitex trifolia, and Ocimum sanctum plant leaf extracts are employed. Traditional plant-based remedies are still widely used since plants are generally inexpensive to produce and have therapeutic properties.

"Some" refers to something resembling a cell, and "phyto" indicates a plant. Phytosomes are a unique medicine delivery method made of plant extract phytoconstituents. In order to prepare phytosomes, phytoconstituents and phospholipids must complex, particularly with phosphatidylcholine, which results in the formation of lipid stable molecular complexes. In comparison to other traditional herbal extracts, they have better bioavailability. Particle size, in-vitro release behavior, and other characteristics of the proposed formulation were further studied. A sustained release pattern was seen in the in vitro release investigations using the dialysis bag method, which was verified by a UV spectrophotometer.

This formulation providing prolonged release of the herbal ingredients to the patient during the entire steam therapy session. The liquid can not only be used in steam therapy but can also be inhaled by sprinkling over the kerchief or napkin to see results right away. A screened phytosome (VOE: soy phosphatidylcholine) with a particle size of 527.0 ± 25.7 nm and a PDI value of 1.000 ± 0.065 was employed for the formulation development process. It had an immediate in vitro release at 60 minutes and a maintenance period of up to 480 minutes. Significant in vitro nasal mucosa penetration was demonstrated by the VOE formulation without producing skin irritation. In comparison to the marketed products, the developed product is capable of being entirely soluble and miscible in water, which makes it an effective and dependable source of steam inhalation therapy with a continuous release of the active components to achieve maximal advantages for the patients.

**Conclusion**

Herbal products always have great concern of denaturation and bioavailability. There are so many novel approaches are available. These delivery systems have improved the pharmacotherapeutics and pharmacokinetics of herbal drugs. This kind of delivery system is also utilized in the field of nutraceuticals and cosmetically for improving therapeutic effect and permeability in the skin. The formation of phytosomes is simple and reproducible a part of that phospholipids used in the preparation of phytosomes have their own beneficial effects in the body.[9] VOE (Formulation) exhibited better antioxidant which may be due to the presence of phenol compounds, flavonoids. Based on these results, it showed better ex vivo nasal mucosa permeation enhancer. It can be concluded that the intranasal administration of VOE Because (formulation) contains a permeation enhancer that relieves aching muscles, increases immunity, and helps to alleviate respiratory symptoms, it has a great deal of promise for better formulation penetration through nasal mucosa.

**Acknowledgement**

I would like to express my gratitude to Alagappa University for providing lab space for this research over the entire duration of my study.

**References**

1. Small, P., Keith, P.K. and Kim, H., 2018. Allergic rhinitis. Allergy, asthma & clinical immunology, 14(2), pp.1-11.
2. Small, P. and Kim, H., 2011. Allergic rhinitis. Allergy, Asthma & Clinical Immunology, 7(1), pp.1-8.
3. Kumar, A., Kumar, B., Singh, S.K., Kaur, B. and Singh, S., 2017. A review on phytosomes: novel approach for herbal phytochemicals. Asian J Pharm Clin Res, 10(10), pp.41-47.

4. Talreja, S. and Tiwari, S., 2023. An In Depth Exploration of Ginkgo Biloba: A Review. An In Depth Exploration of Ginkgo Biloba: A Review, 1(07), pp.1-1.
5. Bhatt, K.J., 2012. Ocimum Sanctum: The Indian Medicinal plant. International Journal of Chemtech Application, 3(1), p.53.
6. Siva, M., Shanmugam, K.R., Shanmugam, B., Venkata, S.G., Ravi, S., Sathyavelu, R.K. and Mallikarjuna, K., 2016. Ocimum sanctum: a review on the pharmacological properties. Int. J. Basic Clin. Pharmacol, 5, pp.558-565.
7. Kesharwani, V., Gupta, S., Kushwaha, N., Kesharwani, R. and Patel, D.K., 2018. A review on therapeutics application of eucalyptus oil. Int. J. Herb. Med, 6(6), pp.110-115.
8. Rajamma, S.S., Krishnaswami, V., Prabu, S.L. and Kandasamy, R., 2022. Geophila repens phytosome-loaded intranasal gel with improved nasal permeation for the effective treatment of Alzheimer's disease. Journal of Drug Delivery Science and Technology, 69, p.103087.
9. Larson, E.C., Pond, C.D., Rai, P.P., Matainaho, T.K., Piskaut, P., Franklin, M.R. and Barrows, L.R., 2016. Traditional preparations and methanol extracts of Medicinal plants from Papua New Guinea exhibit similar cytochrome p450 inhibition. Evidence-Based Complementary and Alternative Medicine, 2016.
10. Jose, S., 2019. A Study to Assess the Effectiveness of Steam Inhalation with Tulsi Leaves and Turmeric Powder to Reduce Common Cold in 5 to 15 year Old School Going Children at Selected Rural Areas Coimbatore (Doctoral dissertation, PPG College of Nursing, Coimbatore).
11. Gowrishankar, S., Muthumanickam, S., Kamaladevi, A., Karthika, C., Jothi, R., Boomi, P., Maniazhagu, D. and Pandian, S.K., 2021. Promising phytochemicals of traditional Indian herbal steam inhalation therapy to combat COVID-19–An in silico study. Food and Chemical Toxicology, 148, p.111966.
12. Osborne, D.W. and Musakhanian, J., 2018. Skin penetration and permeation properties of Transcutol®—neat or diluted mixtures. Aaps Pharmscitech, 19, pp.3512-3533.
13. Emami, A., Tepper, J., Short, B., Yaksh, T.L., Bendele, A.M., Ramani, T., Cisternas, A.F., Chang, J.H. and Mellon, R.D., 2018. Toxicology evaluation of drugs administered via uncommon routes: intranasal, intraocular, intrathecal/intraspinal, and intra-articular. International journal of toxicology, 37(1), pp.4-27.
14. Binter, A.C., Alonso, L., Philippat, C., Mon-Williams, M., Chatzi, L., Vrijheid, M., Nieuwenhuijsen, M., Sunyer, J. and Guxens, M., ISEE Young Virtual Conference, Basel, Switzerland, 18-19 February, 2021.
15. Pattanayak, P., Behera, P., Das, D. and Panda, S.K., 2010. Ocimum sanctum Linn. A reservoir plant for therapeutic applications: An overview. Pharmacognosy reviews, 4(7), p.95.
16. Shah, S., Dhanani, T. and Kumar, S., 2013. Comparative evaluation of antioxidant potential of extracts of Vitex negundo, Vitex trifolia, Terminalia bellerica, Terminalia chebula, Embelica officinalis and Asparagus racemosus. Innov. Pharm. Pharmacother, 1, pp.44-53.
17. Kim, K.Y., Seo, H.J., Min, S.S., Park, M. and Seol, G.H., 2014. The effect of 1, 8-cineole inhalation on preoperative anxiety: A randomized clinical trial. Evidence-Based Complementary and Alternative Medicine, 2014.
18. Amin, T. and Bhat, S.V., 2012. A review on phytosome technology as a novel approach to improve the bioavailability of nutraceuticals. Int. J. Adv. Res. Technol, 1(3), pp.1-5.
19. Pawar, H.A. and Bhangale, B.D., 2015. Phytosome as a novel biomedicine: a microencapsulated drug delivery system. Journal of Bioanalysis & Biomedicine, 7.
20. Naclerio, R.M., 1991. Allergic rhinitis. New England Journal of Medicine, 325(12), pp.860-869.
21. Small, P. and Kim, H., 2011. Allergic rhinitis. Allergy, Asthma & Clinical Immunology, 7(1), pp.1-8.
22. Pawar, H.A. and Bhangale, B.D., 2015. Phytosome as a novel biomedicine: a microencapsulated drug delivery system. Journal of Bioanalysis & Biomedicine, 7.