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## DEVELOPMENT OF EYEMASK USING *TABERNAEMONTANA DIVARICATA*

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### ABSTRACT

Eye strain is a term generally used in the digital age. It occurs when your eyes get tired after concentrating on a particular task for an extended period of time. Its signs consist of sore, worn-out, burning or itching eyes, dry eyes, even sometimes watery eyes, blurred or double imaginative and prescient, headache and multiplied perceptivity to light. Eyestrain can be annoying and unwelcome. It also leads to serious or long- term consequences like problems with your retina, cataracts, age- related macular degeneration and sleep disturbance. Eyestrain is substantially affecting two sectors of people; drivers and software engineers. Drivers, especially truck drivers, may need to push for a long hours of driving with unfixed routine driveways and weather conditions. Being continuously exposed to bright light or flare, they suffer from eyestrain and sleep disturbances. Software engineers who view computer screens and other digital bias for long time are enduring ‘Computer vision syndrome’ also called as digital eyestrain. Their prolonged viewing of blue light of screen is dangerous to eyes in the long term. These symptoms are mild and it can be relieved by giving relaxation to eyes. The symptoms of eyestrain can be reduced using a cool eye mask while sleeping can help as it'll relax the veins around the eyes, and gives soothing sense. This article aims to develop an eyemask using *Tabernaemontana divaricata*, generally known as crepe jasmine flower. This flower is well-known for its medicinal and cooling property in Ayurvedic treatment. It's used to treat sore eyes due to extreme heat in eyes. The application of medical grade non – woven cotton materials in eye mask adds to the cooling effect.

**KEYWORDS:** Eyestrain, drivers, software engineers, sleep disturbances, sore eyes, eyemask, cooling property, crepe jasmine flower.

## INTRODUCTION

Nowadays, the term eyestrain is more frequently used in this digital world. It is a circumstance that happens whilst your eyes get worn-out from excessive use, along with at the same time as driving lengthy distances or watching pc monitors and different virtual gadgets. This medical condition of eye strain is often used by people to classify a list of indistinct symptoms correlated to visual activity. Eyestrain is stressful and but it is not serious and can be relieved by resting our eyes or by taking other steps to reduce our eye discomfort <sup>[1]</sup>. In a few cases, these symptoms can imply a rudimentary eye circumstance that desires diagnosis and medication. Signs and symptoms of eye strain include sore, worn-out, burning, or itchy eyes, watery or dry eyes, blurred or double imaginative and prescient, headache, neck pain, or shoulder pain, increased sensitivity to light, difficulty concentrating, feeling that you cannot keep your eyes open, mild tearing or dryness and tightness of the temples.

Asthenopia is the clinical term for eye stress. The common causes of eyestrain include looking at mobile screens, reading without to rest your eyes, driving long distances and doing other activities involving prolonged concentration, exposure to bright light or glare, difficulty seeing in low light conditions, an underlying eye problem, such as dry incorrect eyes or vision, stress or fatigue, and exposure to dry moving air from a fan, heating or air conditioning. Some of them, while focusing on a visually intense task like reading the small print, use the computer for hours, or while trying to see in the dark, subconsciously contract your muscles eyelids, face, temples and jaws and develop discomfort or pain due to overuse of this can result to a continuous ring of straining these muscles more and which causes greater distress <sup>[2]</sup>. Many people experience decreased blinking compared to normal time when performing prolonged visual activities. This decrease in blinking leads to dryness of the eye surface and symptoms of dry eye. Using refractive lenses for vision correction can also lead to symptoms of eye strain. The inability to operate both eyes binocularly can also generate symptoms of eye strain. Wearing glasses with a wrong prescription might also additionally reason eye stress. In people who already have headaches or blurred vision from eye strain, also can make the ones signs and symptoms worse.

Prolonged use of digital devices, especially computers and mobile screens, is the most common cause of eye strain. The American Optometric Association identifies this as 'artificial vision syndrome'. People who look into screens for greater hours at a stretch each day are most at risk of getting this disease. Computer use strains eyes more than reading print material because people tend to blink less while using computers (blinking is key to keeping your eyes moist). This condition is worsened by viewing screens of digital gadgets at less than optimized distances or angles, using devices that have glare or reflection, use devices with poor contrast between the text and the background <sup>[3]</sup>. The prognosis of eye strain is made by a doctor based on the patient's history and the absence of serious eye disease.

There aren't any unique exams to show that the signs and symptoms are certainly because of eye pressure. There aren't any strategies to particularly to scale the level of eye pressure.

Eyestrain would not have severe or lengthy-time period consequences; however it may be tense and unpleasant. The signs and symptoms of eye pressure can also additionally result in bodily fatigue, reduced productivity, expanded numbers of labor errors, and tension. However, eye strain can also lead to sleep problems. Sleep is one of the simple human desires required for fitness and electricity conservation, look and bodily well-being <sup>[4]</sup>. During sleep, the release of sleep and growth hormones and chemical changes and increased cellular nutrition take place as preparation of the body for the next day. In addition, repair, re-organization, reminiscence enhancement, and mastering arise within side the apprehensive system. Furthermore, sleep reasons discount in stress, tension and neurological pressures and enables the man or woman in recuperating electricity for higher focus, adaptability, adjustment and active participation in daily activities. Therefore, sleep disturbances are also linked to health, well-being and mortality. Deprivation of sleep is the root cause of a number of health issues for human body and mind.

However, eye strain can be troublesome and create disturbance in your capacity to pay attention and work. These symptoms are mild and it can be relieved by giving relaxation to eyes. Using a cool eye mask while sleeping can help as it will relax the veins around the eyes, and gives soothing feel. There are a lot of natural herbs and flowers available in Ayurveda, which helps to give a cooling and medicinal effect to our eyes, without any side effects actually. One of such flower is *Tabernaemontana divaricata*, commonly known as Crepe jasmine flower. It is an evergreen shrub or small tree native to South Asia, Southeast Asia and China. These flowers are one of the maximum extensively used plants for prayers and it desires little or no maintenance. Its common name is "Nandiyavattai" in Tamil and "Moon Beam" in English. These are beautiful white flowers also used for adoration in Indian homes. These flowers have amazing property of reducing the burning feel in the eyes after a prolonged visual work and are recognized to loosen up and refresh the eyes.

An eye mask using this herb would be a great solution for the problem of eyestrain faced by especially software engineers and truck drivers frequently. Drivers, especially truck drivers, may need to push for a long hours of driving with unfixed routine driveways and weather conditions. Being constantly uncovered to shiny mild or glare, they are afflicted by eyestrain and sleep disturbances. Software engineers who are staring at computer screens and other digital devices for long time are experiencing digital eyestrain. Their prolonged viewing of the blue light from the screen is harmful to the eyes in the long run.

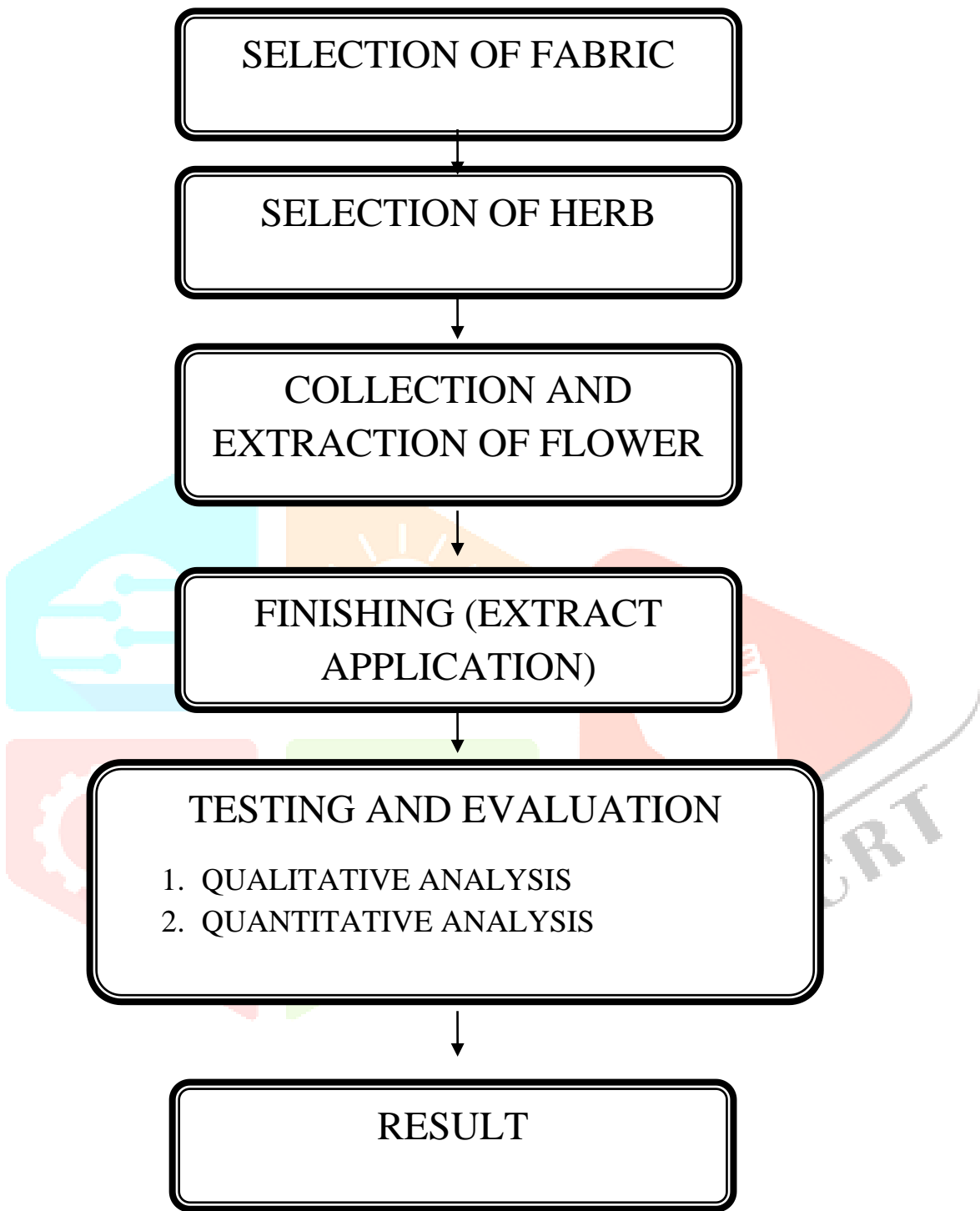
Eye masks or sleep masks are one of the practical solutions for eye stress as they help block light in the sleeping environment. Particularly, light at the sleep time can disturb the biological clock which plays a vital role in maintaining balanced sleep-wake pattern of the human body <sup>[5]</sup>. The exposure to light during sleep may give rise to sleeping disorders like insomnia are due to the suppressed amount of a sleep hormone, melatonin. Eye mask assist to dam out this artificial light through performing as a shield. This helps in the compatible adjustment of the human body with the sunrise and sunset, therefore, helps in the maintenance of proper sleep cycle. These masks works by developing screen among the pores and skin across the eyes, stopping the drafts and dusts and low moisture air content from permeating in. Sleeping with mask is generally useful for the ones who've incomplete eyelid closure.

This present study is based to develop of an eye mask using *Tabernaemontana divaricata*, which is renowned for its medicinal and cooling property in Ayurvedic treatments to treat sore eyes due to extreme heat in eyes, especially for software engineers and truck drivers with following objectives:

## OBJECTIVES

- To develop an eye mask using *Tabernaemontana divaricata*
- To extract the essence of *Tabernaemontana divaricata* for its medicinal and cooling properties for eyes.
- To apply the extracted essence on the cotton pad used inside the eye mask
- To test the developed mask for its anti-microbial properties
- To evaluate the effectiveness and cooling property of the developed eye mask by quantitative analysis

### METHODOLOGY FLOW CHART



### MATERIALS AND METHODS

## SELECTION OF FABRIC- Spunlace non woven fabric

Spunlace nonwovens are produced by bonding webs of carded fibers using high speed water jets. This technique of hydro entanglement is based on the emission of high momentum of water from narrow spout on the carded web of fibres. The potency of the water flow and the design of the drum or support belt will entangle, rotate and wind the web fibers on top of each other. The entanglement of the fibers and the friction among the fiber webs produces a coherent bond. This method of production results in a softer, stronger, bulkier fabric, which drapes well and has good flexibility than textiles produced by weaving or knitting. The fiber composition in spunlace nonwovens is regenerated viscose and synthetic polyester in various percentages. The range of machine width ranges from 10 cm to 320 cm. The measurement of the rolls is highly dependent on the need. The mixing, carding and water jet nozzle plants are the main segments of the spunlace production row. The Characteristics of Spunlace Nonwoven are:

1. Flexible entanglement of fibers
2. Resemble to woven and knitted fabrics in appearance
3. High toughness with less hairy texture
4. High moisture absorption, rapid moisture absorption
5. Good ventilation
6. Soft, good shape
7. Various of Patterns
8. Non-reinforced adhesives

**GSM of the spunlace fabric used: 45**

**Composition of fabric: 100% Viscose**

### Cotton pad

Cotton pad plays an important role in the medical and cosmetic industry. Cotton pads are primarily used to prevent bleeding from cuts and bruises. Cotton pads are usually placed over the injured area using medical adhesive tapes. In cosmetic industry, cotton pads are used for applying and removing the makeup products. Since they are so soft, they help to clean the babies. Absorbent Cotton is a scoured and bleached cotton fibre to possess some advantageous properties like hydrophilic nature, free from contamination and to be maintain its sterility.

## SELECTION OF HERB- *Tabernaemontana divaricata*

*Tabernaemontana divaricata* generally known as Pinwheel Flower or Crepe Jasmine is a local perennial shrub for the areas of Southeast Asia. This plant is domesticated in many regions for its appealing flowers and herbage. The stem of this plant releases a milky liquid when cut, this flower is also known as the milk flower. This plant commonly grows upto 5-6 feet tall and follows the pattern of dichotomous branching. These leaves of this plant are usually large, 6 inches long and 2 inches wide.

These leaves are also glossy shine in appearance. The flower blossoms are waxy in texture and usually grow in groups at the stem nodes. These white flowers come in two varieties with a single flower shape and a multiple flower shape. The usual blooming season for this plant is spring, but it also blooms occasionally throughout the year. These flowers release a pleasing aroma when fully bloomed. There are more than 65 alkaloids produced in the plant which includes catharanthine, coronaridine, dregamine, ibogamine, tabersonine, voacangine, voacamine and voacristine.

## Description and taxonomy of *Tabernaemontana divaricata*

*T. divaricata* belongs to the family Apocynaceae and the genus *Tabernaemontana*. This species is found widely in the tropic which is cultivated in homes with single and double fragrant flowers. More than hundred species of this type are found in tropical countries around the world. The leaves which are 6 inches in length and 2 inches wide, and waxy blossoms with white, five-petal pinwheels, gathered in small clusters on the stem tips.

### Phytochemistry of *T. divaricata*

*T. divaricata* has a lot of medicinal potential and used in conventional medicinal practices. The phytochemicals present in this plant species are mainly alkaloids and non-alkaloids. These include a number of chemical constituents such as flavonoids, phenolic acids, terpenoids, etc. Studying the phytochemical facts of each alkaloid provides records of its biosynthesis. Such information can assist in the search for new, medically potential compounds that may be useful against diseases.

### Pharmacological properties of *T. divaricata*

*T. divaricata* is separated from the plant material with the aid of extractions of crude ethanol or alkaloid fractions. These biologically active alkaloids are identified for its pharmacological effects.

### Medicinal uses of *Tabernaemontana divaricata*

*T. divaricata* is considered a medicinal plant in tropical regions. Indeed, this herb has a wide range of applications in Ayurvedic medicine. It is commonly used to treat stomach, bowel, genitourinary problems, intestinal worms and skin infections. This flower is best herb for all eye diseases as well as a rejuvenator for eyes. The roots are astringent. A root decoction is used to treat diarrhea and gastrointestinal complaints. It is also brewed as an injection to treat jungle fever. These roots have applications in modern treatments of high blood pressure, migraines and skin infections. The painful condition of the eyes can be improved by applying the crushed paste of these roots. These roots are also used as an analgesic and masticated to relieve dental pain as a home remedy. The pulp of the chopped



leaves is used as the main ingredient in cold and cough syrups. An infusion of leaf decoction of this herb is used in treating influenza. The flowers of this herb are said to heal sore and dry eyes when mixed and applied with mild oils. The latex of these leaves is applied to wounds to avoid inflammation, which gives a cooling effect, as this has anti-inflammatory properties.

Additionally, this milky juice combined with oil and applied in the eyes and forehead regions to cure eye pain. In some countries like Thailand, this herb is consumed for its emetic properties. The roots and other vegetative parts of this plant are used in the treatment of snake and scorpion venom. The juice or puree of the blossoms can be directly or mixed with essential oils and can be utilized as eye drops for treating eye problems. Application of this flower extract mixed with oil has been shown to improve skin diseases. The leaf essence of this plant is also used water pills and it has anti-hypertensive properties. Other uses of this flower are anti-inflammatory, in ophthalmia; local anodyne, vermifugal, anti-odontalgic, anti-diarrhoeal, to clear opacity of cornea; in sore eyes and skin diseases.

## **COLLECTION AND EXTRACTION OF FLOWER**

### **Collection of flower**

The flowers were collected early in the morning when the oils are at their peak. Blooms that are just beginning to open contain the most fragrance. Avoid flowers that are in full bloom, as their scent has begun to fade. Started in the morning on a sunny day, gathering flowers still fresh with morning dew is thought to bring the most beneficial effects. And these essences rely on sunlight to release the plant's energy. Since we removed all plant material from the essence, these remedies are safe. However we should still exercise caution and pick only those good ones. We used clear glass for infusing the flowers. Traditionally clear glass is used to prepare the infusion, as it allows the sun's rays to better penetrate the water. We Used glass jar to store the flower essences. Traditionally, glass jar is used to maintain the "bioactivity" of the remedy. Avoid alcohol, vinegar or vegetable glycerin to store this essence.

### **Extraction of essence from flower- Oil based extraction:**

The petals and other parts of the flower were removed from the flower and placed in a zippered food storage bag. The bag was sealed, and then tapped it lightly with a wooden mallet to bruise the petals and release the fragrance oils.

The bruised petals were placed in a glass jar and cover with oil. Olive oil is inexpensive oil that works well as carrier oil. Sweet almond oil is a bit more expensive, but adds a pleasing, distinctive fragrance of its own. Shake the jar to distribute the oil.

The container was set on a sunny windowsill and allowed the flower petals to soak in the oil for 24 hours. It was gently shake frequently for 2 days and the oil was strained through a double layer of cheesecloth



or a filter. The old petals were discarded .we Prepared new petals, following previous steps with the same oil. We allowed the petals to steep for 24 hours. We repeated the process, using the same oil, for 3 days or until the fragrance reached the desired strength. This extracted oil was stored in a glass bottle in a cool dry place.

## Finishing given in cotton

Finishing in the narrow sense is the final step in the fabric manufacturing process, the last chance to provide the properties that customers will value. Finishing completes the fabric's performance and gives it special functional properties including the final touch. In the whole textile manufacturing process from spinning of yarn to finishing of the fabric or garment is the valuable process. Finishing of the textile accomplish 16% of total. Finishing of various textile fabrics to make it more marketable and its demand is increasing due to global competition, and increasing globalization has created many challenges to the textile researchers and industrialist. The rapid growth in technical textiles and their end uses has generated many opportunities for the application of innovative finishes. The next phase of growth and development of this industry will be focused on three main aspects: Value-added products with enhanced, functionality Apparels and Sustainable products.

Essential oils are volatile, natural, complex compounds characterized by a strong odor and are formed by aromatic plants as secondary metabolites. An oil is "essential" in the sense that it contains the "essence of" the plant's fragrance- the characteristic fragrance of the plant from which it is derived known for their antiseptic, i.e. bactericidal, virucidal, fungicidal, medicinal and fragrance properties etc.

The cotton pad which is used inside the eye mask is finished with the prepared flower oil extract along with olive oil. The oil droplets were let on flat laid cotton pad piece through a oil droplet or applied on it with the help of a brush. The oil penetrated through the micro layers of the cotton pad giving it a good finish.



**PLATE -I**

**Freshly plucked flowers**



**PLATE -II**

**Removed petals**



**PLATE-III**  
Shadow dried petals



**PLATE -IV**  
Bruised petals slightly



**PLATE-V**  
Olive oil used as carrier oil



**PLATE-VI**  
Bruised petals were soaked for 2-3 days



**PLATE-VII**  
Soaked oil was filtered for the essential oil



**PLATE-VIII**  
Finishing on cotton pad

## TESTING AND EVALUATION

### QUALITATIVE ANALYSIS

#### Anti bacterial test

The development of antibiotic resistant bacteria stems from a number of factors, including inappropriate use of antibiotics in human and animal health and their prolonged use as growth promoters at sub-clinical doses in poultry and livestock production. We were interested in investigating plants that could be useful in protecting humans or animals against diarrhoea. We decided to work on extracts of nine plant species with good activity against *Escherichia coli*.

#### Anti- fungal test

The increasing clinical and microbiologic resistance of *Candida albicans* isolates to several antifungal agents is becoming a serious problem. It is now reasonable to propose the use of antifungal susceptibility testing in *Candida albicans* isolates from patients who have failed conventional therapy, before the selection of an empirical therapy. The well diffusion test is simple, easy to reproduce, inexpensive, easy both to read and interpret, and has a good correlation to the reference NCCLS micro dilution test and may represent an alternative method for antifungal drug susceptibility testing of *Candida* spp., mainly in laboratories with few resources.

Various conventional methods are routinely employed for determining the antimicrobial activity of floral extracts and essential oils. Generally, *in vitro* assays are employed. The agar diffusion method (paper disc or well) and dilution method (agar or broth) are the 2 most common techniques used.

#### Agar diffusion method

The agar diffusion method is one of the most widely employed techniques for evaluating antimicrobial activity. In this technique, agar plates are inoculated with test microorganisms (usually pathogenic microbes). Floral extracts or essential oils are applied directly onto paper discs, which are then placed on the agar medium or into wells made in the agar. The agar plates are incubated to allow the components of floral extracts or essential oils to diffuse into the agar medium. The diameter of growth inhibition zones around the discs or wells is then considered to be an indication of the effectiveness of the material being tested.

#### Preparation of the Bacterial Inoculum

Stock cultures were maintained at 4°C on slopes of nutrient agar and potato dextrose agar. Active culture for experiments were prepared by transferring a loop full of cells from stock cultures to test tubes of 50ml nutrient broth bacterial cultures were incubated with agitation for 24 hours and at 37°C on shaking

incubator and fungal cultures were incubated at 27°C for 3-5 days. Each suspension of test organism was subsequently streaked out on nutrient agar media and potato dextrose agar. Bacterial cultures then incubated at 37°C for 24 hours and fungal incubated at 27°C for 3-5 days. A single colony was transferred to nutrient agar media slants were incubated at 37°C for 24 hours and potato dextrose slant were incubated at 27°C for 3-5 days. These stock cultures were kept at 4°C. For use in experiments, a loop of each test organism was transferred into 50ml nutrient broth and incubated separately at 37°C for 18-20 hours for bacterial culture.

### Well Diffusion method

The antibacterial activity and antifungal activity of crude extract extracts was determined by Well Diffusion method (Bauer *et al.*, 1996). MHA plates were prepared by pouring 20ml of molten media into sterile petriplates. After solidification of media, 20-25µl suspension of bacterial inoculums was swabbed uniformly. The sterile paper discs were dipped into required solvents then placed in agar plates. Then 10-50µl of plant extract was poured into the wells. After that, the plates were incubated at 37°C for 24 hours. Assay was carried into triplicates and control plates were also maintained. Zone of inhibition was measured from the edge of the well to the zone in mm. The tested cell suspension was spread on mullerhinton agar plate and potato dextrose agar. Well were put into the agar medium using sterile forceps. Plant extract were poured on to wells. Then plates were incubated at 37°C for about 24 hours and control was also maintained. Zone of inhibition was measured from the clear zone in mm.

Antibacterial activity was performed by agar diffusion method. Van der Watt *et al.*, 2001. The stock culture of bacteria *E.coli* and *Candida albicans* were received by inoculating in nutrient broth media and grown at 37 °C for 18 hours. The agar plates of the above media were prepared. Each plate was inoculated with 18 hours old cultures the bacteria were swab in the sterile plates. Cut the 5 wells pour the extract in ratio 1 %, 0.1%, 0.01%, 0.001%. All the plates were incubated at 37°C for 24 hours and the diameter of inhibition zone was noted in Cm.

Agar well diffusion method has been used to determine the antimicrobial activities and minimum inhibitory concentrations of plant extracts against Gram positive, Gram negative bacteria. The extracts exhibited antibacterial activities against tested microorganisms.

### QUANTITATIVE ANALYSIS


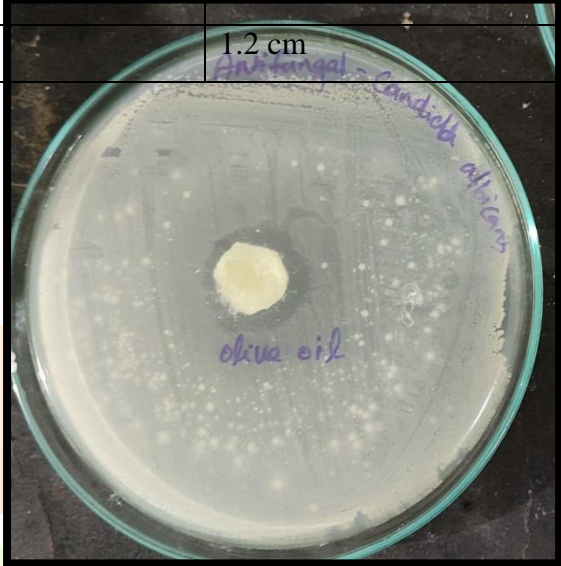
The developed eye mask was physically evaluated using a group of 10 people with different occupation and age groups. A questionnaire was prepared based on the usage of the eye mask by them for a night. General characteristics of developed eye mask and its effects were taken as the major aspects. And other details of their eye health were also questioned.

## RESULTS AND DISCUSSION

### 4.1. QUALITATIVE ANALYSIS

Agar well diffusion method has been used to determine the antimicrobial activities and minimum inhibitory concentrations or plant extracts against Gram positive, Gram negative bacteria. The extracts exhibited antibacterial activities against tested microorganisms.

**Table -1**

Anti-	Concentration	<i>E.Coli</i>	<i>Candida albicans</i>
	Oil coated cotton	1.0 cm	

**microbial activity of oil- coated cotton**

**PLATE-VIII**

**Anti-bacterial activity against *E.Coli***

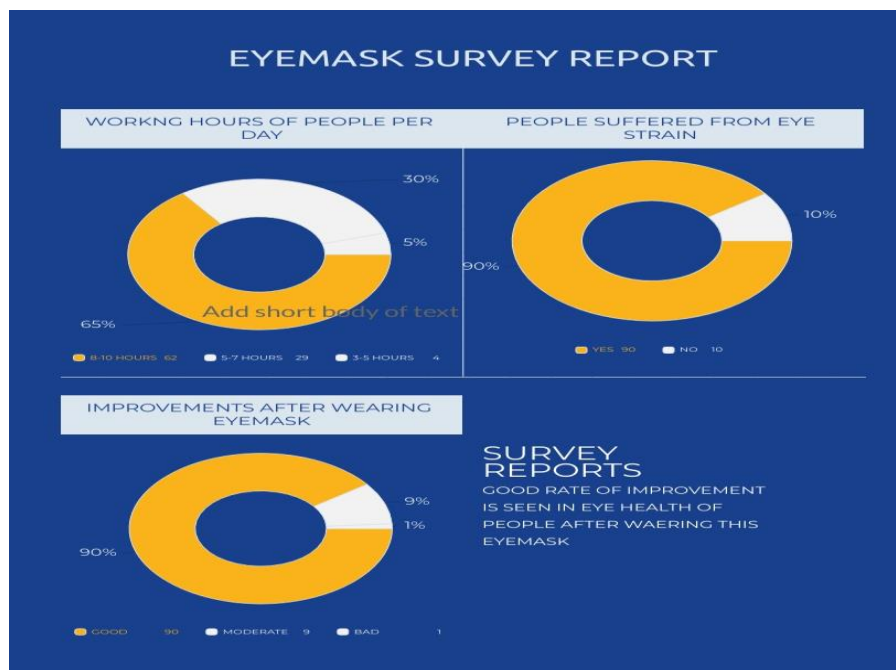
**PLATE-IX**

**Anti-fungal activity against *Candida albicans***

The Given olive coated cotton having both antibacterial activity against *E. Coli* (Gram negative) and antifungal like *Candida albicans* against to the pathogens.



# QUANTITATIVE ANALYSIS



## COST OF THE DEVELOPED EYEMASK

**Fabric:** Rs. 2 /mask

**Essential Oil:** Rs. 5/mask

**Cotton pad:** Rs. 2/mask

**Elastic band:** Rs.1/mask

**Total cost: Rs. 10 / mask**

According to the calculated amount for raw materials used for developing an eye mask, the cost per mask is Rs.10. It is less expensive as compared to the ones available in the market. When produced on a large scale, still the cost can be reduced and the mask can be produced at a cheaper rate.

## SUMMARY AND CONCLUSION

Eyestrain is a condition that occurs when your eyes get tired from intense use, such as while driving long distances or staring at computer screens and other digital devices .It is becoming a more common condition in this digital age among all age group of people. Mainly two sectors of people are affected due to this eyestrain more frequently; drivers and software engineers. Being continuously exposed to bright light or glare, they suffer from eyestrain and sleep disturbances and sleep deprivation adds to many health problems. To reduce these symptoms and to give relaxation to eyes, a cool eye mask using *Tabernaemontana divaricata*, is developed. The developed eye mask helps in relaxing the veins around the eyes, and thus giving a soothing

feel. This flower is used to treat sore eyes due to extreme heat in eyes in Ayurvedic treatment. The spunlace non –woven cotton materials used in the eye mask will be comfortable for wearing.

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### DEVELOPED EYEMASK

