

# Design and Development of Ecofriendly Herbal Oil Infused Nail Polish Remover Tissues

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## ABSTRACT

Natural nail polish removers have gained popularity as a safer and more environmentally friendly alternative to traditional acetone-based removers. This abstract provides a research work of the key features and benefits of natural nail polish removers, which are made from natural and non-toxic ingredients like plant-based solvents, essential oils, finished on natural and regenerated fibred nonwoven spun lace fabrics. These environment friendly techniques remove nail polish effectively without emitting foul chemical odors or harming cuticles and nails. The study introduces a nail polish remover solution featuring lemongrass oil as its primary active ingredient enriched with vitamin E oil. In response to the growing desire for natural cosmetic products, this study examines the efficiency and safety of composites made of lemongrass oil and vitamin E oil treated on fabric as a nail polish remover through antimicrobial testing and subjective analysis. The findings suggest that the proposed approach may be more effective than conventional nail polish removers in terms of user experience and environmental impact. Thus, in response to the growing demand for natural and non-toxic beauty products, this natural nail polish removers were developed and embraced, which has assisted the beauty industry in becoming more environmentally and health conscious.

**Key words:** Nail polish remover, acetone, viscose fabric, lemongrass oil, vitamin E, and eco-friendly

## 1. INTRODUCTION

Nail polish, sometimes called nail enamel or nail varnish in British English, is a lacquer that is applied to the nail plates of the human fingernail or toenail to coat and protect them. Nail polish gets its distinct colors and textures from a variety of different chemicals, including an organic polymer. [1] A fatty material, like lanolin or castor oil, is combined with an acetone solvent to create conventional nail polish removers. In order to remove polish, acetone quickly dissolves nail varnish and lifts the polish from the nail plate's surface. [2] Nail polish remover's primary ingredient is acetone, a ketone. This reaction, as well as additional negative consequences and risks associated with polish removers, are examined. Nail paint removers with acetone as an ingredient are loaded with strong chemicals that can cause damage to your nails and surrounding skin. [3,4] Onycholysis, paronychia, brittleness, and irritating and allergic contact dermatitis are all side effects of removal. To remove nail polish from our nails, we need nail polish remover, which is an organic solvent or a blend of organic solvents with additional oils, perfumes, and minor colors. [5]

One of the segments of the global textile market with the quickest rate of growth is

nonwoven fabrics. Recycling resources can be used to make nonwoven fabric. For functional textiles, especially those that are electrically conductive, nonwoven fabric can be a perfect supporting material. [6,7] Water jets are used to entangle loose fiber webs in order to create spun-lace, nonwoven fabrics. In order to manufacture fabrics, high-velocity water jets are directed via a nozzle that is closely spaced apart. This causes the fibers to mechanically interlock by displacement, twisting, rearrangement, or reorientation. [8]

Cotton Spun Lace, also known as water jet, interlaced nonwoven fabric, is a type of nonwoven fabric made by firmly tying cotton fibers in water jets. The sheets can be strengthened while retaining their texture as the fibers get more tightly interwoven. The sheets can be strengthened even further by blending synthetic fibers. Viscose is a textile made synthetically from cellulose found in nature. The softness, breathability, and drape of viscose fabric are well known. Viscose can regulate moisture and breathe. Moreover, the fabric is perfect for making clothes because the synthetic fibers are allergy friendly. [9]

An entirely natural component that can be used as a home treatment for health issues is lemongrass essential oil. It is removed from the peel of fresh lemons using steam extraction or, less frequently, by "cold pressing," which rotates and pricks the peel to release the oil. You can diffuse lemongrass essential oil into the air and breathe it in, or you can dilute it and apply it physically to your skin. Some claim that lemon essential oil is a miracle worker that clears the skin, fights fatigue, eases depression, eliminates dangerous bacteria and viruses, and lowers inflammation. [10,11]

Vitamin E oil for the skin, particularly for those with eczema, psoriasis, and dry or itchy skin. Additionally, it might promote wound healing, reduce the appearance of scars, and prevent wrinkles. hydrating the skin. Many moisturizers contain vitamin E, and the oil can be used as a moisturizer to prevent or treat dry, flaky skin. Wound Recovery Vitamin E supplements may speed up the

healing of wounds, according to some research (Trusted Source). The ability of our skin to sense our surroundings, preserve thermal, physicochemical, and nutritional equilibrium, provide both passive and active defense, and react to shock and injury is crucial to our survival. [12,13]

One natural method of removing nail polish through nonwoven viscose and cotton blend tissues is to use a combination of lemongrass and vitamin E oil. Together, vitamin E, well-known for its skin-nourishing qualities, and lemongrass, recognized for its cleansing qualities, provide a mild yet potent ecofriendly remedy.

## 2. MATERIALS AND METHODS

### 2.1 Selection and Procurement of Fabric

Viscose textiles are susceptible to strong chemicals, such as those in nail paint removers. To reduce the possibility of damaging the fabric, use a mild nail polish remover without acetone. To make sure it works with the viscose fabric, always test a small, discrete area first. It is important to choose a mild, acetone-free nail paint remover for viscose fabric to minimize any potential damage. Since Viscose can be sensitive to strong chemicals, it is best to use a gentle remover to protect the integrity of the fabric. To verify compatibility and avoid any negative effects on the viscose material, do a patch test in a discrete area before applying. By taking these safety measures, nail polish can be removed efficiently without affecting the fabric's quality.

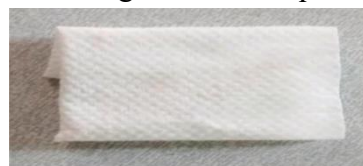


Fig:01 Viscose Fabric

### 2.2 Selection and Collection of Herbal oil

#### 2.2.1 Lemongrass oil

Lemongrass oil has a lot of perks and benefits. Because of its aromatic properties, which aid in promoting serenity and lowering stress levels, it is frequently used in aromatherapy. The natural antibacterial qualities of the oil can prevent the growth of

bacteria and fungi. Lemongrass oil is useful in skincare because of its astringent properties, which aid in cleansing and toning the skin. In addition, lemongrass oil may help with headaches and muscle pains due to its analgesic qualities. Its anti-inflammatory properties may be beneficial for several medical conditions. This extracted lemongrass oil is procured from the tribal community of Annamalai forest region, near Pollachi.



Fig:02 (a) Lemon grass [15] (b) Lemongrass Oil

### 2.2.2 Vitamin-E oil

It is rare to remove nail polish using a vitamin E tube. Vitamin E is commonly used in skincare products because of its reputation for being hydrating and antioxidant rich. For a more thorough removal of nail polish, use specific remover products that contain acetone or other solvents. products for successfully dissolving and removing nail polish. If a vitamin E tube is used for this, the results might not be what you were hoping for. It is highly renowned for its antioxidant properties and serving as a barrier to protect the skin from free radical damage while maintaining a youthful appearance. Beyond skin care, vitamin E reduces scarring and encourages cell regeneration to speed up wound healing. This vitamin is known for its ability to reduce the appearance of wrinkles and fine lines in relation to anti-aging. When taken as part of a balanced diet, vitamin E helps support heart health and the immune system. While vitamin E can offer additional antioxidant defense against UV rays, sunscreen should never be substituted for it. This wood press Vitamin E oil is extracted from sunflower seeds which was procured from Agriculture University, Coimbatore.



Fig:3 Vitamin-E oil

### 2.3 Pattern Making

Making a DIY on selected viscose fabric for easy usage with the desired trendy shapes is one of the customer attractions. In order to create a viscose fabric pattern with a 1.5-inch cut and shaped design, first draft the desired arrangement onto pattern paper or straight onto the fabric, making sure that the proportions and contours are accurate. Using fabric markers or chalk, transfer this pattern onto the cloth, being sure to precisely trace the cutting lines and any intricate contouring. Then, apply two drops of water-diluted lemongrass oil evenly over the fabric's surface. Finally, apply one drop of vitamin E oil for extra nutrition and suppleness. Depending on the material and the dropper's design, a volume measurement may contain less or more drops. Generally, though, one drop is about equal to 0.05 milliliters (ml) or 0.05 cubic centimeters (cm<sup>3</sup>). The volume of two drops would thus be about equal to 0.1 milliliters (ml) or 0.1 cubic centimeters (cm<sup>3</sup>). Importantly, this estimate might differ somewhat depending on dropper size, liquid viscosity, and drop formation technique. Using sharp fabric scissors, cut precisely along the marked lines, paying close attention to the desired pattern and subtle contouring. Incorporating the cut fabric into the intended product, a garment or other textile creation, is the last step.

### 2.4 Traditional Finishing Process

Making a fabric Die nail polish remover using lemongrass oil and vitamin E is a straightforward process. Gather the necessary ingredients first: lemongrass oil, vitamin E oil, and acetone or rubbing alcohol as a base liquid. Mix the lemongrass and vitamin E oils with the chosen base liquid in equal amounts. It is made as, to start with smaller quantities and adjust the ratios based

on how smoothly the nail polish comes off. The container will be able to sealed in order to prevent evaporation and maintain the mixture's effectiveness over time. The remover should be kept out of direct sunlight in a cold, dry environment to maintain its efficacy.

Developing a balanced composite essence, which is necessary to ensure that a nail polish remover with lemongrass oil and vitamin E is effective without being harmful when used along viscose fabric and its blends. It is critical to conduct preliminary testing on discrete fabric sections to evaluate suitability and the remover's capacity to remove nail polish. To achieve even dispersion and give lemongrass oil and vitamin E time to penetrate the polish, gently rub the product on. Wiping or rinsing eliminates the dissolved polish and residues after a predetermined absorption period. Adopting certain quality control procedures guarantees reliable and successful outcomes.



Fig: 4 Infusion of composite herbal essence and oil

## 2.5 Evaluation of Finished Fabric

### 2.5.1 Anti- Microbial Analysis

Anti-microbial testing for nail polish remover incorporating lemongrass oil and vitamin E oil, in combination with viscose fabric and its blends, has shown excellent results. Lemongrass oil is known for its natural antibacterial properties, which can effectively combat potentially harmful microbes. Vitamin E oil, with its antioxidant qualities, not only nourishes the nails but also aids in preserving the product. When integrated with viscose fabric, these ingredients create a robust and effective solution that not only removes nail polish but also ensures a hygienic and safe experience. This innovative approach combines the benefits of natural ingredients and fabric

technology to produce an outstanding anti-microbial nail polish remover.

### Antimicrobial Test Preparation of The Bacterial Inoculum for Finishing Product Testing

Stock cultures were kept at 4 °C on slopes of potato dextrose agar and nutritional agar. A loop of cells from stock cultures were transferred to test tubes filled with 50 ml (about 1.69 oz) of nutrient broth to create an active culture for studies. Bacterial cultures were incubated with agitation for 24 hours at 37 °C in a shaking incubator, and fungal cultures were cultured at 27 °C for 3–5 days. On nutritional agar media and potato dextrose agar, each test organism solution was subsequently stroked out. Following that, fungal and bacterial cultures were cultured for 3-days at 27°C and 37°C, respectively. Potato dextrose slants were incubated at 27°C for 3–5 days after a single colony was transferred to nutritional agar medium slants and incubated at 37°C for 24 hours. The temperature for these stock cultures was 4 °C. For use in investigations, a loop of each test organism was put into 50 ml (about 1.69 oz) of nutrient broth and incubated separately for 18 to 20 hours at 37 °C for bacterial culture.

### Diffusion Technique

By using the Well Diffusion method, it was possible to assess the antibacterial and anti-fungal effects of crude extract extracts (Bauer et al., 1996). Pouring 20ml (about 0.68 oz) of molten media into sterile petri plates created MHA plates. A homogeneous 20–25 l suspension of bacterial inoculum was swabbed after the media had solidified. The sterile paper discs were inserted in agar plates after being soaked in the necessary solvents. Following that, 10–50 l (about 13.21 gal) of plant extract were added to the wells. The plates were then incubated for 24 hours at 37°C. Triplicates of the assay were performed, and control plates were kept as well. The zone of inhibition was measured in millimeters from the well's edge to the zone.



Using sterile forceps, wells were placed into the agar medium, and the tested cell suspension was spread out on mullerhintonagar plate and potato dextrose agar. Wells received a pouring of plant extract. Plates were then incubated for 24 hours at 37°C while the control was likewise kept constant. The zone of inhibition was calculated.

The agar diffusion method was used to perform antibacterial activity. 2001, Vender Watt et al. E. coli and Candida Albans, the stock culture of bacteria, were obtained by inoculating in nutrient broth media and grew at 37°C for 18 hours. The above media's agar plates were made. Each plate was swabbed with germs from 18-hour-old cultures before being injected. Placed both the extract-treated and untreated cloths. The diameter of the inhibitory zone on each plate was measured in cm after 24 hours of incubation at 37 °C. The agar well diffusion method has been used to test the antibacterial activity and minimum inhibitory concentrations of plant extracts against Gram-negative bacteria.

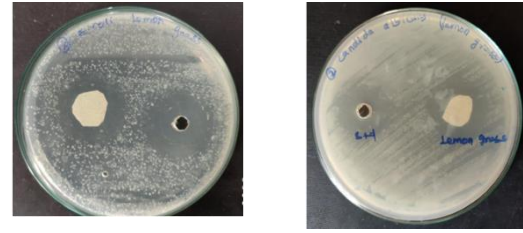


Fig: 5 Analysis of Antimicrobial efficacies (a. *E. coli* & b. *Candida albicans*) on Viscose fabric



Fig: 6 Analysis of Antimicrobial efficacy (a. *E. coli* & b. *Candida albicans*) on Viscose and cotton blend fabric

## 2.6 Subjective Analysis

A population of thirty people participated in physical evaluation of herbal nail polish remover infused in regenerated fiber tissues. Based on use of eco –friendly products as questionnaire were created. Review from customer is considered to be the most important factors, and additional information such as the developed product’s positive and negative aspects are also questioned.

## 3. RESULT AND DISCUSSION

### 3.1 Analysis of Antimicrobial efficacy

Table 1: Analysis of anti-microbial efficacy of herbal oil finished Viscose & Viscose Cotton blend fabric

Components	Organism ( <i>E. coli</i> )	Organism ( <i>Candida albicans</i> )
Lemon grass treated cloth I (Viscose)	1.0 cm	1.1 cm
Lemon grass treated cloth-II (Viscose & cotton blend)	1.3 cm	1.2 cm
Standard (Bacteria-Chloramphenicol) Fungues- Fluconazole	1.5 cm	1.5 cm

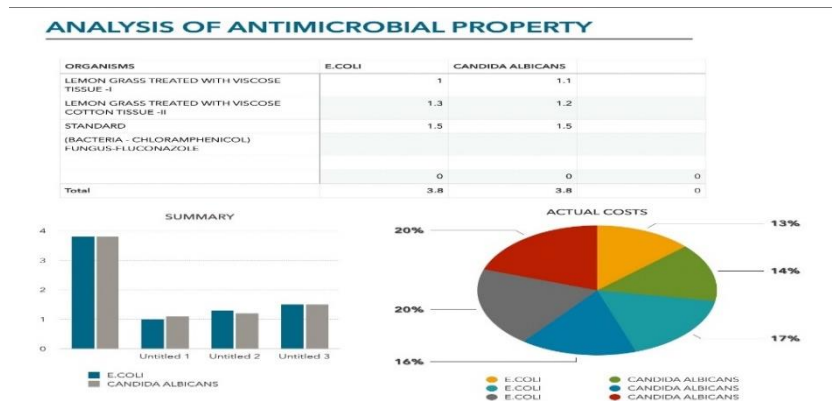


Fig:7 Analysis of anti-microbial efficacy of herbal oil finished Viscose & Viscose Cotton blend fabric

According to the findings, both lemon grass-treated cloths have antibacterial action against fungus *Candida Albicans* and bacteria *E. coli*. When compared to Lemon grass treated cloths-I, it is discovered that the offered Lemon grass treated cloths-II have excellent microbiological activity.

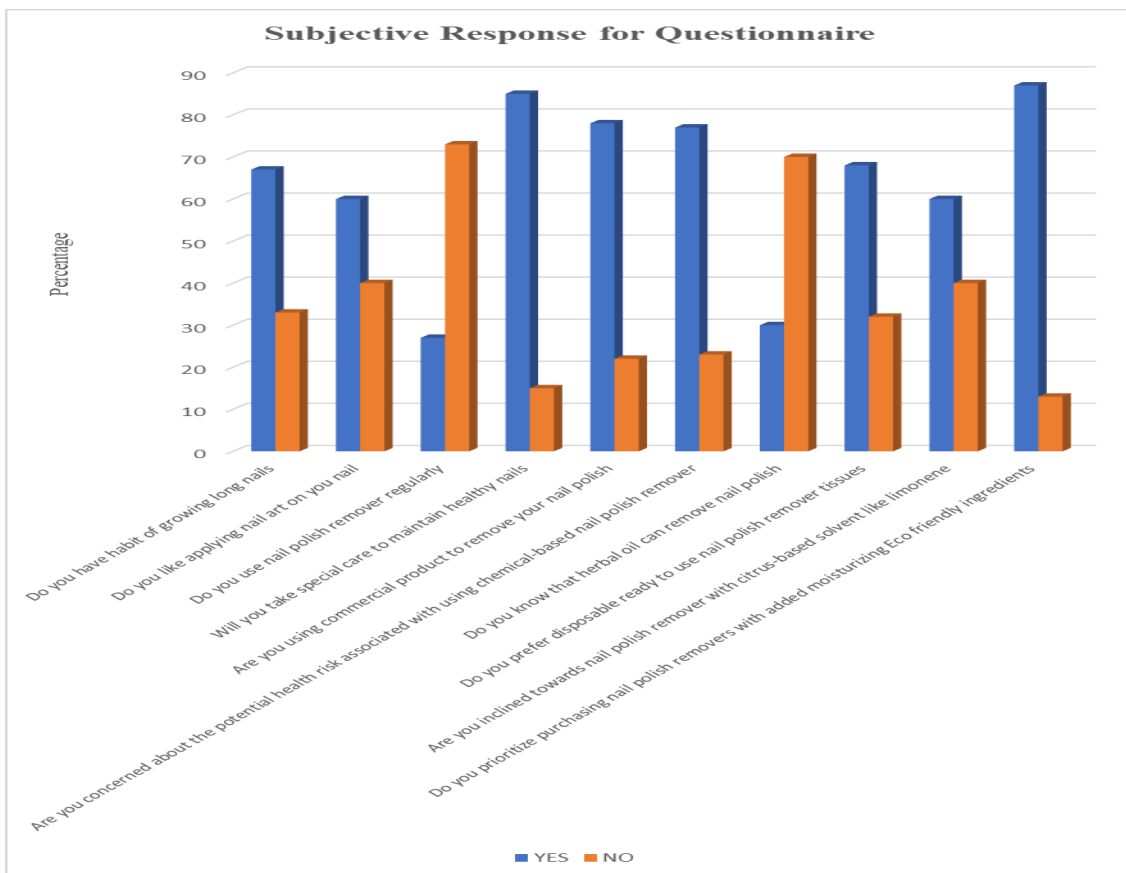
### 3.2. Subjective Analysis

Natural substitutes for nail polish removal include vitamin E and lemongrass oil.

Lemongrass oil possesses antibacterial qualities, while vitamin E offers moisturizing advantages. When used in tandem, they may help remove lacquer and strengthen and nourish nails. To make sure it works well with the skin and nails, test on a few women population as 30nos were selected according to their frequency of Nail polish usage. The questioners and obtained results are as follows.

**Table 2: Subjective Analysis-Responses for Questionnaire on developed herbal Product**

S. No.	QUESTIONS	YES	NO
		Population responses among 30nos.	
1.	Do you have habit of growing long nails	20	10
2.	Do you like applying nail art on you nail	18	12
3.	Do you use nail polish remover regularly	8	22
4.	Will you take special care to maintain healthy nails	26	04
5.	Are you using commercial product to remove your nail polish	24	06
6.	Are you concerned about the potential health risk associated with using chemical-based nail polish remover	23	07
7.	Do you know that herbal oil can remove nail polish	09	21
8.	Do you prefer disposable ready to use nail polish remover tissues	20	10
9.	Are you inclined towards nail polish remover with citrus-based solvent like limonene	19	11
10.	Do you prioritize purchasing nail polish removers with added moisturizing Eco friendly ingredients	26	04



**Fig:8 Results of Subjective analysis on final product**

From the above graphical model, the subjective analysis was resulted as nearly 67% of women are passion to grow long nails and 33% with normal growth. In second question 60% of female frequently do nail arts while other 40% are not. Third question reveals that 73% of women use nail polish remover frequently while 27% are using rarely. 4<sup>th</sup> question reveals that 85% of female take special care for nails and other 15% are not. 5<sup>th</sup> question shows that 78% of women are using synthetic nail polish remover which are not good for skin and nail health and 22% go for home made products. According to 6<sup>th</sup> question 77% of population are concerning about health risk due to chemical-based products while 23% are not. The 7<sup>th</sup> question obtains 70% of people are not aware of herbal polish remover while 30% are known. 8<sup>th</sup> question validates that 68% of people are ready to prefer disposable nail polish remover tissues while 32% prefer the liquid forms. The 9<sup>th</sup> question reveals that 60% of population are inclined towards nail polish remover with citrus-based solvent like limonene while 40% are not. 10<sup>th</sup> question demonstrates that 87% of people prioritize purchasing nail polish removers with added moisturizing Eco friendly ingredients while 13% are with commercial ones.

#### 4. CONCLUSION

In conclusion, nail polish remover is a crucial beauty tool that removes nail polish effectively, resulting in clean, attractive nails. To ensure a pleasant and secure nail care routine, apply nail polish remover in a well-ventilated environment and follow safety precautions whether you prefer acetone-based or acetone-free solutions. A safer and greener alternative to conventional chemical-based removers are natural nail polish removers produced with components like vitamin E oil and lemongrass oil. These organic remedies efficiently remove nail paint while offering hydration and a pleasing scent. For environmentally aware customers wishing to keep beautiful nails without harsh chemicals, they are a viable option. In place of conventional chemical removers,

lemongrass oil and vitamin E oil can be a safe and efficient option. Vitamin E oil strengthens and nourishes the nails, while lemongrass oil has a pleasant scent and antimicrobial characteristics. This approach to nail care is kinder on the nails and cuticles, making it a great option for people seeking a more all-natural and holistic manner. The oils must be appropriate for your unique needs after conducting a patch test because individual results may differ. In addition to efficiently removing nail polish, it also offers benefits for cuticle and nail maintenance. The process is more comfortable and hygienic because of lemongrass oil's active components and antibacterial characteristics. Vitamin E oil promotes the health and vitality of the nails by strengthening and nourishing them. The risk of damage and dryness is lower with this natural method than with conventional chemical removers because it is kinder to the nails and cuticles. For those looking for a more holistic and healthy way to keep beautiful nails, utilizing lemongrass oil and vitamin E oil as a nail paint remover is a desirable choice.

#### *Declaration by Authors*

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