



# DEVELOPMENT OF HERBAL OIL WIPES FOR XEROSIS

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## ABSTRACT

Environmental pollution can lead to a variety of issues with facial skin. Xeroderma, also known as dry skin, xerosis cutis, or asteatosis, is a prevalent condition resulting from inadequate hydrolipids in the skin. Oil wipes can help prevent a number of skin issues related to Xerosis. Natural remedies and environmentally friendly practices are highly essential in today's world. The searching for novel ways to combine these natural materials in order to find a long-term replacement for commercial oil wipes being the objective of this study. The primary ingredient in the wipes is bamboo, which is known to be environmentally safe and biodegradable. This provides a long-lasting yet green solution. Guava seed oil is extracted using coconut oil as a carrier; this oil has skincare and moisturizing properties. The efficacy, environmental impact, and utility of the wipes are determined by the production process. It utilizes the potential of bamboo and guava seed oil to encourage the development of personal care products that are more ecologically friendly and sustainable in the future. Its quality standards were followed with FTIR analysis, antimicrobial testing and with Absorption test. The result pertained for the developed wet wipes were good to serve as personal care product.

**KEYWORDS:** Psidium guajava seed oil, bamboo wipes, non-woven fabric, extraction of guava seed oil, tissue

## 1. INTRODUCTION

Today's world is experiencing record levels of pollution, which has serious implications for human health, the environment, and personal well being. When oil and dead skin cells clog hair follicles, acne, a skin condition, results. Acne vulgaris is generally considered to be a disorder of adolescence, but environmental pollutants can result in a variant of acne called chloracne, a typical environmental skin disease that is characterized by the acne-like eruption of comedones (blackheads and whiteheads)<sup>[1]</sup>. Other than this Xerosis, or dry skin, is a highly prevalent condition among the general population. It can be caused by the combination of many factors, such as environmental triggers, genetic background, age, and concomitant diseases. Clinically, xerosis causes rough, scaly, and often itchy skin.<sup>[2]</sup> When your skin's natural moisturization process goes awry, it disrupts its barrier function. Your skin isn't able to produce or hold on to hydration effectively, and it becomes abnormally dry. Xerosis cutis happens when the skin loses more moisture than it retains.<sup>[3]</sup>

As a result, there is a greater need for practical and successful pollution-reduction strategies. Wet wipes, also referred to as moist towelettes, have grown in popularity as a useful and adaptable tool to handle some of the problems caused by pollution in this context. From skin protection and personal hygiene to environmental cleanup, wet wipes have many advantages. The global Wet Wipes market size was valued at USD 16893.86 million in 2022 and is expected to expand at a CAGR of 7.47% during the forecast period, reaching USD 26035.84 million by 2028.<sup>[4]</sup>

Wet wipes have been widely used in consumers' daily lives, especially confronted with the Covid-19 pandemic. Most wet wipes contain plastic components, which cause salient plastic consumption and environmental pollution after their usage.<sup>[5]</sup> Commercial wet wipe improper disposal threatens both the environment and public health. These wipes often contain chemicals and non-biodegradable materials. Marine environments are at risk from the lasting presence of plastic fibers and other toxic elements, and the ease of use of disposable wipes may encourage harm, which would worsen the world's plastic waste problem. Furthermore, wet wipes' chemicals have the potential to irritate skin and trigger allergic reactions, which highlights the necessity of appropriate disposal techniques and the promotion of ecologically friendly substitutes in order to lessen these risks.

Guava seed oil has numerous health advantages. Rich in vitamins, vital fatty acids, and antioxidants, guava seed oil moisturizes and prevents the aging process of the skin. It also has antibacterial qualities that can aid in the fight against skin infections.

Spunlace non-woven fabrics can be produced using a wide variety of fiber raw materials, which are primarily classified into two groups: chemical fibers and natural fibers from plants and animals. In particular, fibers made of cotton, lyocell, silk, bamboo, polyester, viscose, and polypropylene, among others. The most popular fibers on the market for face wipes include polyester, cotton, viscose, and polypropylene. Compared with chemical fibers, spunlace nonwoven fabrics made of cotton fibers are softer, have excellent water retention, and will not fall off fibers, which are popular with consumers. 100% cotton spunlace nonwoven fabric has always been the preferred raw material for high-end facial wipes brands around the world.<sup>[6]</sup>

Bamboo fibre has been used in various applications such as building and construction, decoration, slope maintenance and high performance composites for the past many years. Regenerated bamboo fibre has characteristic mechanical properties of superior tensile strength, excellent UV protection, antibacterial and biodegradable characteristics, high moisture absorption, softness, brightness and high flexibility under flexible and compressive loads.<sup>[7]</sup>

Psidium guajava seeds are reservoirs of various primary and secondary metabolites and are a rich source of protein; fatty acids such as linoleic acid, palmitic acid, and oleic acid along with some uncommon lipids; minerals such as potassium, sodium, phosphorus, calcium, magnesium; and vitamin C. Guava seed also contains a broad spectrum of phenolic compounds, including vanillin and vanillic acid.<sup>[8]</sup> It has high moisturizing properties because it contains vitamin A, vitamin E, and essential fatty acids. These elements regulate cell growth and regenerate damaged skin cells. The main component of this oil is carotenoids, which protect skin from sun damage by producing cell-protecting antioxidants. These antioxidants are also effective in stopping free radicals from breaking down collagen, which is essential for maintaining strong, healthy skin.

Extracted from the meat of coconuts, coconut oil is well known for having a special combination of fatty acids, mostly medium-chain triglycerides (MCTs) including lauric acid. Its hydrating qualities make it popular in skincare and hair care. Coconut tree is referred to as the "tree of life" because of its many uses, coconut, *Cocos nucifera* L., is a fruit tree found in warm, humid climates with well-drained soil. Coconut oil has traditionally been used as a medicinal agent for cancer, diabetes, diarrhea, dry skin, and psoriasis and is used as an antibacterial, antifungal, and antiviral agent for the treatment of dermal infections.<sup>[9]</sup>

Using the dipping and padding technique, the guava oil is infused into the bamboo non-woven fabric. FTIR, antimicrobial test and absorbency test are the standard testings taken.

## 2. MATERIALS AND METHODS

### 2.1. Selection of Fabric

#### 2.1.1. Bamboo Non-Woven Fabric

Bamboo non-woven fabric is an eco-friendly and sustainable textile product derived from bamboo fibers. Its growing popularity can be explained by its number of unique qualities. Firstly, due to its rapid growth and little demand for water and pesticides, bamboo is a very environmentally friendly resource. The outcome results in a fabric that is widely prized for its remarkable silkiness and softness, which makes it a popular choice for apparel. Bamboo is ideal for active wear and bed linens that enhance comfort and temperature regulation, since it naturally breathes well and wicks away moisture. In addition, bamboo is suitable for hygiene items like diapers and feminine care products because of its inherent antibacterial and hypoallergenic qualities, which prevent bacterial growth and lessen skin irritation. It can decompose naturally identified as sustainable product. The bamboo Spunlace nonwoven fabric selected for this study were procured from South Indian Textile Research Association(SITRA), Coimbatore of meters in 40x25 inches.(Fig 1)



Fig:1 Bamboo non-woven Fabric

## 2.2. Selection of Herbs

### 2.2.1. Guava leaves

Guava leaves are increasingly recognized for their potential benefits in facial care. The guava leaves are rich in vitamins, minerals, and antioxidants. They contain essential nutrients like Vitamin C, A, and potassium, offering a wide range of health benefits.<sup>[10]</sup> The antioxidant content in guava leaves contributes to their anti-aging properties, combating free radicals and promoting a youthful complexion. For those seeking a brighter skin tone and reduced dark spots, incorporating guava leaves in facial masks or toners may be beneficial. Furthermore, the anti-inflammatory nature of guava leaves makes them suitable for soothing skin irritations and redness.

### 2.2.2. Guava seeds

Seeds are among byproduct of guava. Instead of discarding seeds as waste, seeds with high potential as antioxidants could be utilised for commercial purposes.<sup>[11]</sup> It has potential benefits for facial care due to their rich nutritional profile. Packed with antioxidants, these seeds may contribute to skin rejuvenation and protection against free radicals. The seeds also contain essential fatty acids, which can moisturize and nourish the skin, potentially addressing dryness and promoting a healthy glow. Additionally, the presence of vitamins and minerals in guava seeds may support collagen production, aiding in maintaining skin elasticity.

## 2.3. Selection of Plant based oil

### 2.3.1. Coconut Oil

A typical and all-natural method of skincare that has a number of potential advantages is the application of coconut oil to the face. Its high fatty acid content makes it a potent moisturizer, which can be especially beneficial for people with dry or dehydrated skin. Lauric acid, another component of coconut oil, has antimicrobial and anti-inflammatory properties that can help reduce minor skin irritation and redness. Coconut oil has attracted attention due to its hypocholesterolemic, anticancer, antihepatosteatotic, antidiabetic, antioxidant, anti-inflammatory, antimicrobial and skin moisturizing properties.<sup>[12]</sup> Knowing your skin type is crucial because, due to its potential comedogenicity, coconut oil may not be appropriate for people with oily or acne-prone skin. Coconut oil can be a useful addition to a skincare regimen, but it's best to take into account your particular skin's needs and sensitivities and, if necessary, seek the advice of a dermatologist.(Fig 2)



Fig 2: Selection of Plant based (Coconut) Oil

## 2.4. Preparation of Composite Herbal oil

### 2.4.1. Guava leaf and Seed Oil

Guava seed oil is derived from the seeds of the guava fruit (*Psidium guajava*) and has gained popularity for its potential benefits for the skin. The potential skincare advantages of guava seed oil have garnered attention when applied to the face. This guava seed-based organic oil can be used in a variety of skincare routines. Due to its high level of essential fatty acids, it is especially beneficial for those with dry or dehydrated skin, as it helps to provide good hydration. Furthermore, anti-oxidants is found in the oil, such as vitamins A and C, help protect the skin from oxidative damage and potentially lessen the appearance of fine

lines and wrinkles. Guava seed oil may improve overall complexion, reduce imperfections, and balance skin tone. Guava seed oil may have anti-inflammatory properties, which can be beneficial for soothing irritated skin and reducing redness.(Fig 3,4,5)



Fig:3 Guava Seed



Fig:4 Guava Leaf



Fig:5 Guava leaf and Seed Oil

## 2.5. Finishing on Fabric

Dip coating method is done to infuse the oil into the wipes. The process of coating wet wipes with a liquid or chemical formulation is known as the "wet coating method." This liquid may be a cleanser, antiseptic, skincare item, or any other concoction designed specifically for the function of the wipes.

The wet coating method for wet wipes entails coating a base material, usually non-woven fabric, with a liquid formulation. The preparation of the formulation, which might include different ingredients like water, active ingredients, fragrances, and preservatives, is the first step in the process. The sheet material of choice is unrolled and run through a machine to evenly coat it with the liquid mixture. It's essential to complete this impregnation step to ensure that the wipes are evenly saturated. Depending on the formulation, a drying or curing step may be necessary to get rid of extra moisture. The coated material is then divided into small pieces for individual wipes and folded as required. The finished wipes are then labeled with usage guidance and batch coding, and they are packaged to preserve their freshness and efficacy. With consideration for elements like sustainability and regulatory compliance, this approach guarantees that customers receive wet wipes that are safe, high-quality, and effective and are tailored to their needs.(Fig 6)



Fig:6 Herbal Finish Oil Wipes

## 3. TESTING

### 3.1. FTIR Analysis

An infrared spectrum of a solid, liquid, or gas's absorption or emission can be obtained using the Fourier-transform infrared spectroscopy (FTIR) technique. A broad spectrum of high-resolution spectral data is concurrently collected by an FTIR spectrometer. This offers a substantial benefit over a dispersive spectrometer, which gauges intensity throughout a limited range of wavelengths simultaneously.

### 3.2. Antimicrobial Test

#### 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 24hours 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 stroke 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 10-50

µl 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 mullerhintonagar 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 % for 18 hours. The agar plates of the above media were prepared. Each plates was inoculated with 18 hours old cultures the bacteria were swab in the sterile plates. Placed the extract treated cloth and untreated cloths were placed. All the plates were incubated at 37°C for 24 hours and the diameter of inhibition zone was noted in Cm.

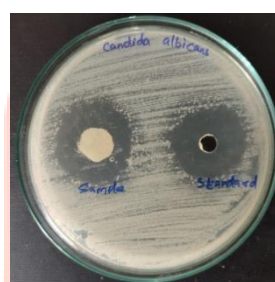
Agar well diffusion method has been used to determine the antimicrobial activities and minimum inhibitory concentrations or plant extracts against Gram positive, Gram negative bacteria. The extracts exhibited antibacterial activities against tested microorganisms.



Plate1: *E. Coil*



Plate 2: *S.Aureus*



Plant3: *Candida albicans*

### 3.3. Oil Absorption Test

The measurement of static oil absorption of spunlace fabrics were carried out. The samples were conditioned and cut in to 10 cm x 10 cm and their mass evaluated. The samples were kept in oil for five minutes at room temperature. After that the samples were padded and hanged for three minutes to remove excess oil. Then, mass of the wet samples were measured. The amount of water absorbed by the spunlace fabric samples were calculated by taking the difference between the wet and dry mass.

## 4. RESULTS AND DISCUSSION

### 4.1. FTIR Analysis of prepared Herbal Oil

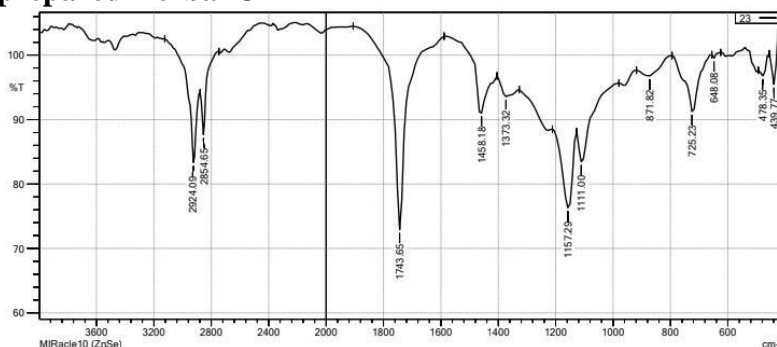


Fig:7 FTIR Report of Guava Seed Oil

Table :1 FTIR activities of Guava Seed Oil

S.NO	PEAK READING	CHEMICAL COMPONENTS
1	2924.09	CH and CH2 stretching aliphatic group
2	1743.65	C=O ester fatty acid group
3	1157.29	C-O-C stretching cellulose

In the above shown table 1 Peak readings shows 3332.99, 1635.64, 686.66 and the Chemical components are CH, CH2, C=O and C-O-C. The FTIR test report shows twelve different active peaks shows. The active peaks are 2924.09, 2854.65, 1743.65, 1458.14, 1373.32, 1157.29, 1111.00, 871.82, 725.23, 648.08, 478.35 and 439.77.

### 4.2. FTIR Analysis of Herbal Oil Finished Fabric

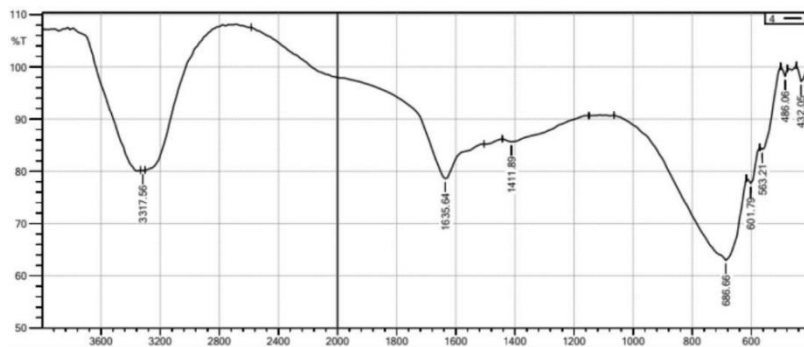


Fig:8 FTIR Report of herbal finished oil Wipes

Table :2 FTIR activities of Herbal Finished Oil Wipes

S.NO	PEAK READING	CHEMICAL COMPONENTS
1	3317.56	NH <sub>2</sub> amino acid group
2	1635.64	C=O Amide I band
3	686.66	CH out of plane aromatic band

In the above shown table 2 Peak readings shows 3317.56, 1635.64, 686.66 and the Chemical components are NH<sub>2</sub>, C=O and CH. The FTIR test report shows eight different active peaks shows. The active peaks are 3317.56, 1635.64, 1411.89, 686.66, 601.79, 563.21, 486.06 and 432.05.

### 4.3. Antimicrobial Test

Table:3 Antimicrobial activity of Guava Seed Oil

Organisms	<i>E.Coli</i>	<i>Candida albicans</i>
Oil	0.9 cm	0.7 cm
Standard (Bacteria-Chloramphenicol) Fugues- Fluconazole	1.0 cm	1.0 cm

Fig:9 Evaluation of Antimicrobial activity of Guava Seed Oil

In the above shown table 3, It can be observed that *E. Coli* showed a smaller growth inhibition zone in the presence of Oil (0.9 cm) compared to the Standard (1.0 cm). *Candida albicans* also showed a smaller growth inhibition zone in the presence of Oil (0.7 cm) compared to the Standard (1.0 cm).

Table:4 Antimicrobial activity of Herbal Finished Wet Wipes

Organisms	<i>E.Coli</i>	<i>S.aureus</i>	<i>Candida albicans</i>
Plant extract	1.0 cm	1.0 cm	1.0 cm
Standard (Bacteria-Chloramphenicol) Fugues- Fluconazole	1.0 cm	1.2 cm	1.5 cm

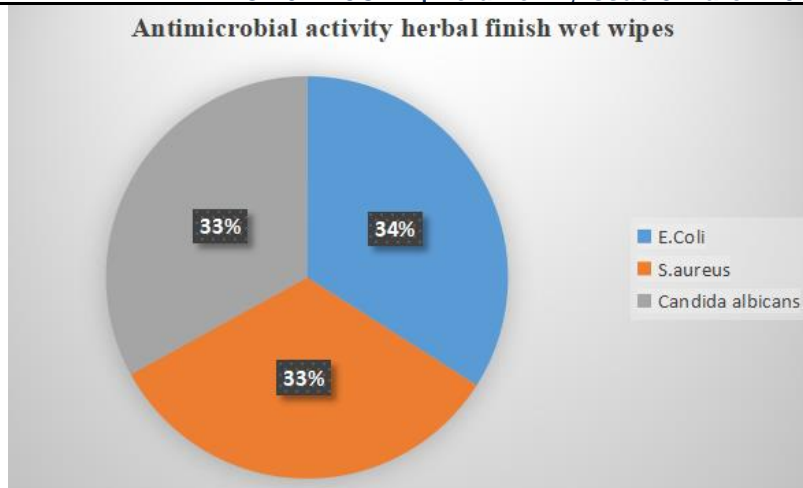


Fig:10 Antimicrobial activity herbal finish wet wipes

The result find give specimen having antimicrobial activity against the *E.Coli*, *S.aureus* and *Candida albicans*. For *E. Coli*, the "Plant extract" and "Standard (Bacteria-Chloramphenicol)" both showed the same level of growth inhibition (1.0 cm). For *S. aureus*, the "Standard (Bacteria-Chloramphenicol)" was more effective at inhibiting growth (1.2 cm) compared to the "Plant extract" (1.0 cm). For *Candida albicans*, the "Standard (Bacteria-Chloramphenicol)" was the most effective at inhibiting growth (1.5 cm), and the "Plant extract" had the same level of inhibition (1.0 cm) as "*E. Coli*."

#### 4.4. Weight of the Fabric

Table:5 (Weight of the Fabric)

S.No.	Dry Wipe Weight	Oil Wipe Weight
1.	12.45 grams	19.23 grams

The above table demonstrates the weight of the dry spunlace bamboo wipes as 12.45gms and herbal finished spunlace bamboo wipes as 19.23gms due to the phenolic components present in the oil engaged in fibres of nonwoven fabric.

#### 4.5. Oil Absorbency Test

An experiment or examination used to gauge a material's capacity to absorb liquids usually water is known as an absorbency test. This test is frequently used to evaluate the absorbent qualities of materials in a variety of industries, such as textiles, materials science, and manufacturing. Tests for absorbency are used to quantify and contrast the various materials' capacities to absorb and hold onto liquids. The wipes in the product have an absorption capacity of about 60%.

Table:6 (Absorbency test of Herbal finished Wet Wipes)

S.No	Sample Code	Size of the Material	% of Absorption
1	Product	(100X100cm)	60%

#### 4.6. Subject Evaluation for Final Herbal Oil Wipe product

##### Questionnaire with subjective analysis chart

1. How familiar are you with non-woven wipes?

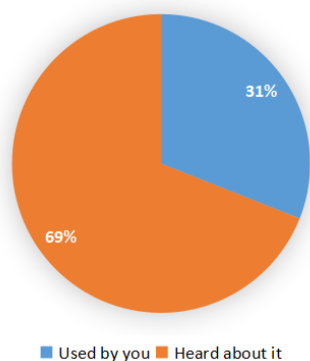


Fig:11

The above figure 11 exhibits among 30 peoples, 69% of them are aware of nonwoven wipes and 31% are not aware of the wipe product.

2. What do you think about bamboo wipes infused with guava seed oil? (Select all that apply)

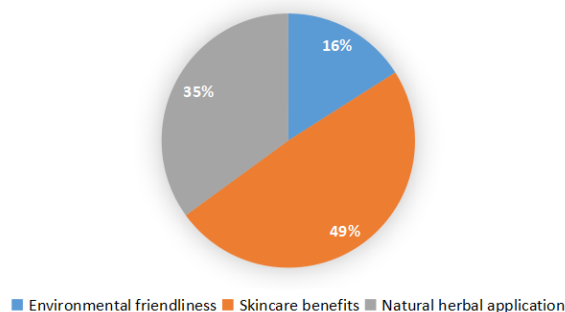


Fig:12

The above figure 12 shows among 30 peoples, 49% of them feels that they can use this product for skin care benefits, 35% of them knowing for natural herbal application and 16% of them are concerning for environmental friendly.

3. How would you rate the effectiveness of the product in moisturizing and nourishing your skin?

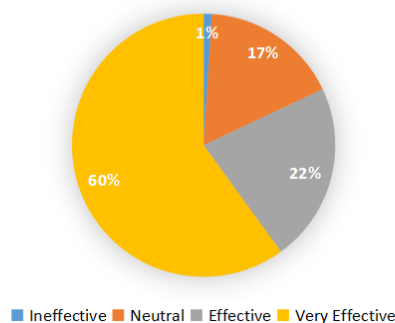


Fig:13

The above figure 13 possess among 30 peoples, 60% of them find it very effective in moisturizing and nourishing their skin, while 22% deem it effective, 17% find it neutral and only 1% find it ineffective in moisturizing and nourishing the skin.

4. What scent or fragrance level do you prefer in your skincare wipes?

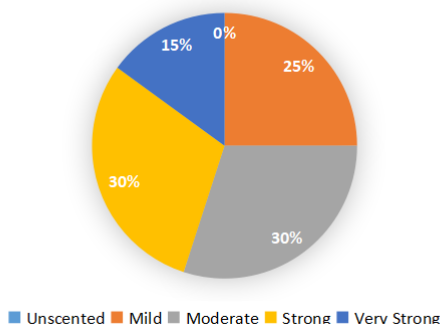


Fig:14

The above figure 14 shows among 30 peoples, 30% favoring both moderate and strong scent in skincare wipes, while 25% prefer mild fragrance, 15% prefer very strong scent and 0% prefer unscented options.



5. How likely are you to recommend this oil wipes?

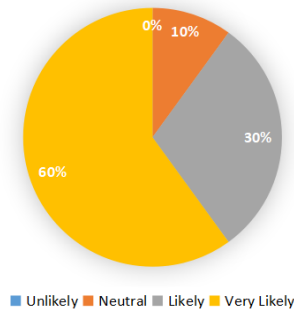


Fig:15

The above figure 15 indicates among 30 peoples,an overwhelming 60% claimed that they would very likely suggest the oil wipes, while 30% claimed that they would likely do so, 10% of people are neutral and 0% consider it unlikely.

6. How often do you use wipes in your skincare routine?

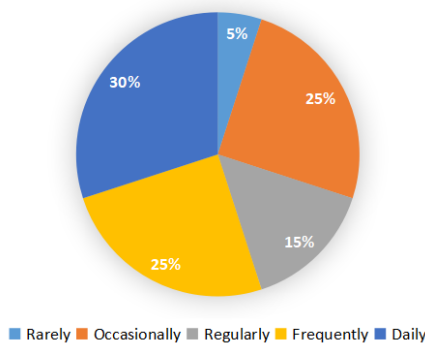


Fig:16

The above figure 16 shows among 30 individuals, a notable 30% of them includes wipes in their daily skincare routine, while 25% use them frequently and occasionally. About 15% of people use wipes regularly and 5% of people use them rarely as part of their skincare routine.

7. How satisfied are you with the level of moisture provided by guava seed oil wipes?

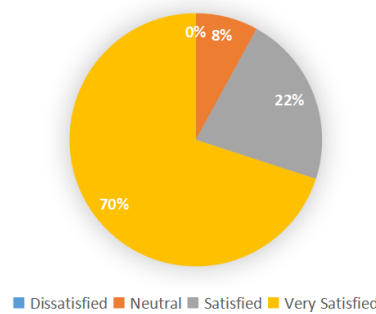


Fig:17

The above figure 17 display among 30 peoples, 70% express high satisfaction with the moisture level provided by guava seed oil wipes, 22% are satisfied, 8% remains neutral and 0% report dissatisfied with the moisture level.

8. Do you find bamboo wipes with guava seed oil to be a convenient alternative to commercial skincare products?

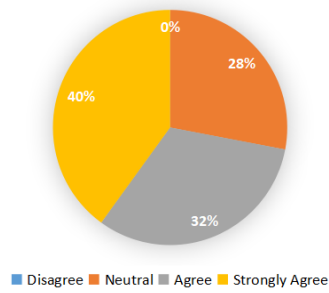


Fig:18

The above figure 18 display among 30 peoples, 40% strongly agrees that bamboo wipes with guava seed oil offer a convenient alternative to commercial skincare products. An additional 32% agree, while 28% maintain a neutral position, and 0% finds in disagree.

9. Would you be interested in trying different scents or formulations of oil wipes, if available?

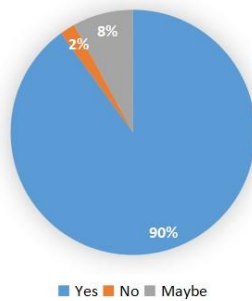


Fig:19

The above figure 19 thought among 30 peoples, 90% of them expressed interest in trying different scent or formulation of oil wipes, while 8% are undecided and 2% are opposed.

10. How do you typically dispose of used skincare wipes, including bamboo wipes with guava seed oil?

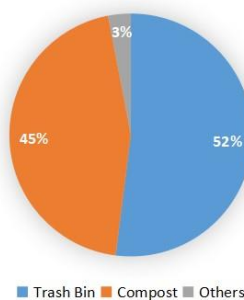


Fig:20

The above figure 20 indicates among 30 peoples, 52% dispose the used skincare wipes in the trash bin, while 45% opt for compost and 3% utilize other disposal methods.

11. How important is the eco-friendliness of the product to you?

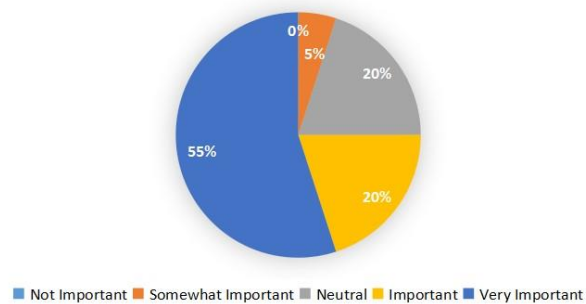


Fig:21

The above figure 21 suggestion among 30 peoples, 55% consider the eco-friendliness of the product is very important, while 20% consider it and important and neutral, 5% find it somewhat important and 0% consider it not important.

The overall satisfaction level of the people finds very good in result for the developed personal hygiene herbal oil wipes product.

## 5. CONCLUSION

Personal hygiene can be environmentally friendly and sustainable when bamboo tissue is combined with wet tissues that have been infused with coconut oil. These products are useful and eco-friendly options for people who want to lessen their environmental impact while still meeting their hygiene needs thanks to the moisturizing and antibacterial qualities of coconut oil. Oil tissues with coconut oil infusions and bamboo tissue products offer a creative and environmentally friendly approach to personal hygiene. Because coconut oil has natural moisturizing and antibacterial properties as well as the fact that bamboo is a sustainable material for tissue, this product is not only environmentally friendly but also advantageous for people looking for efficient and environmentally friendly hygiene options. For those who want to maintain their personal cleanliness while reducing their environmental impact, this fusion of nature-inspired elements offers a compelling option.

### Future Scope

As consumer preferences shift towards eco-friendly and natural products, the incorporation of guava seed oil, known for its skin-nourishing properties, enhances the appeal of wet wipes. Bamboo, being a sustainable and rapidly renewable resource, aligns with the growing demand for environmentally conscious alternatives. The future development of guava seed oil-infused bamboo wipes could focus on refining formulations to optimize skin benefits, exploring biodegradable and compostable packaging options, and expanding the range of wipes to cater to specific skincare needs.

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