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Effectiveness of Citric Content-Based Pocket Soap from Lemon (Citrus Limon) Peels in Maintaining Cleanliness in Batangas State University

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I. INTRODUCTION

The study aligns with the United Nations Sustainable Development Goal (UNSDGs), particularly (UNSDG) 3, which advocates Good Health and Well-Being good hygiene is essential to protecting health, especially in school environments where diseases can easily spread. However, many students find it difficult to practice regular handwashing due to the lack of accessible and convenient hygiene products. In addition, the use of commercial soaps containing synthetic chemicals and plastic packaging contributes to environmental waste and pollution. This growing problem highlights the need for a practical, affordable, and eco-friendly hygiene solution that supports both personal well-being and environmental sustainability. To address this concern, the study introduces pocket soaps made from citrus peels as a sustainable alternative to commercial soaps. These small, portable soaps encourage students of Batangas State University to maintain proper hand hygiene anywhere and anytime, reducing the risk of infection while promoting environmental responsibility.

A. Background Of The Study

In an era when maintaining good hygiene is essential to protecting health, even the simplest innovation can have a meaningful impact. Consider a small piece of soap that is portable enough to fit in a pocket as a useful tool to promote cleanliness among students. The introduction of pocket soaps provides a useful, environmentally responsible, and conveniently accessible way to promote sustainability, eco-friendly and regular hand hygiene among students of Batangas State University to maintain a safe and healthy learning environment.

Students at Batangas State University are investigating eco-friendly appropriate alternatives for commercial hygiene products in an effort to promote cleanliness and environmental sustainability. The development of pocket soaps from citrus peels, which are accessible, biodegradable, and extremely effective in cleaning is one innovative idea that shows promise.

Hand hygiene is a fundamental public health practice that significantly contributes to the prevention of infectious disease transmission. The effectiveness of handwashing largely depends on the type of soap used, particularly the distinction between antibacterial and plain soaps. According to “Comparative Analysis of Different Hotel Bar Soaps Against Staphylococcus aureus (n.d.),antibacterial soaps contain active chemical agents such as triclosan or triclocarban, which are formulated to inhibit bacterial growth and reduce microbial contamination on the skin. In contrast, plain soaps primarily function through mechanical action, effectively dislodging dirt, oils, and microorganisms from the skin’s surface when combined with proper rinsing, but they do not directly eliminate bacteria.

Citrus limon (L.) Burm. f. is a tree with evergreen leaves and yellow edible fruits from the family Rutaceae. Plant-based materials and botanical extracts are used to make herbal soaps, also referred to as natural soaps. As stated by Das et al. (2024), The herbal soap's physical and chemical characteristics were meticulously extracted. Herbal soap's pH was checked and found to be 9.04, which is within the optimal range. The ideal foam height that soap should create is between 1.3 and 22 cm, however the foam height of herbal soap was found to be 7 cm. Scientific studies indicate that lemon citrus soap offers several benefits beyond basic cleansing due to natural compounds in lemons like citric acid, limonene, and alpha-pinene. These components provide antioxidant, antimicrobial, and astringent properties, which help remove dirt, reduce excess oil, gently exfoliate dead skin cells, and may inhibit bacteria involved in acne. Lemon-based soap is often found to be gentler on the skin compared to synthetic soaps and can contribute to a brighter complexion, reduction of dark spots, and inflammation control.

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Studies also highlight its environmental benefits as a natural alternative to chemical ingredients, with favorable user satisfaction regarding cleansing effectiveness and moisturizing effects. Lemon peel extract in soap formulations has shown antimicrobial efficacy and may support skin clarity and bacterial resistance, making lemon soap a promising option for skin health and cleansing needs.

This research focuses on examining the effectiveness of using citrus peels as the primary component of pocket soaps to provide an efficient, eco-friendly, and cost-effective alternative to store-bought soaps for Batangas State University students. It aims to determine how well citrus peel-based soaps can maintain cleanliness and promote good hygiene while contributing to waste reduction and environmental awareness. Furthermore, the study highlights how sustainable and locally accessible materials can be transformed into effective cleaning agents that support public health and hygiene promotion. From a sustainability perspective, it also demonstrates how biodegradable materials can be recycled into useful and beneficial products, promoting responsible waste management practices within the community.

B. Statement Of The Problem

This research study, titled "Citric Content-Based Pocket Soap from Lemon Peels (Citrus limon) in Batangas State University," will seek to develop a sustainable hygiene solution using lemon peels (Citrus limon). The primary objectives will include evaluating the cleansing ability, smell and size. Additionally, the study will explore variations in properties by altering the proportion of the binder. By achieving these goals, the research will aim to contribute to the sustainable resolution of natural waste, mitigate environmental contamination, and promote a more eco-friendly approach.Specifically, it will intend to answer the following questions:

1) How effective is the citrus peel pocket soap in terms of:
- Cleansing ability;
- Smell; and
- Size.

2) How does the citrus peel pocket soap differ from the commercial pocket soap in maintaining cleanliness?

3) What is the effect of using citrus peel as an alternative in creating pocket soap?

C. Objectives OfThe Study

The main objective of this research is to determine the effectiveness of using citrus peels as an eco-friendly pocket soap in maintaining cleanliness among students in Batangas State University. Specifically, this study aims to achieve the following research objectives:

1) Evaluate the effectiveness of the citrus peel pocket soap in terms of:
- Cleansing ability;
- Smell; and
- Size.

2) Determine if the citrus peels pocket soap is more effective than commercial soap in terms of their ability to maintain cleanliness

3) Assess the potential usage of citrus peels as an alternative ingredient to make a pocket soap.

D. Significance OfThe Study

This research focuses on hygiene and development of eco-friendly pocket soap to the residence of Batangas State University. The findings of the research will be beneficial to the following industries:

1) PERSONAL CARE AND HYGIENE – They can get new ideas for making natural and biodegradable soap products that provide customers with sustainable alternatives for soaps purchased from stores. In order to reduce reliance on chemical-based substances, manufacturers may be encouraged by this research to create sustainable products using natural components like citrus peels.

2) WASTE MANAGEMENT AND ENVIRONMENTAL SECTOR –They may benefit from the study's citrus peel recycling method, which encourages waste reduction and resource efficiency. The study provides a demonstration of how biodegradable material can be recycled into useful products instead of being thrown away. Additionally, it could help organizations in developing programs that promote recycling, waste disposal, and waste segregation, therefore enhancing efforts to create cleaner and more sustainable communities.

3) AGRICULTURE AND FOOD PROCESSING – They could explore innovative uses for citrus products, transforming potential waste into useful raw materials. These industries could discover the financial benefits of recycling fruit waste instead of throwing it away. This research could result in the development of partnerships or small businesses focused on the production of natural skincare and hygiene products, promoting economic growth in environmental sustainability.
4) ACADEMIC AND COMMUNITY –Raising awareness of environmental responsibility and sustainable living can help Batangas State University's faculty and students. The study can be used as a guide to promote eco-friendly innovation by motivating students to create ideas that blend sustainability with scientific study. Additionally, the academic community may use the results to improve its environmental initiatives and advance sustainability, cleanliness, and appropriate waste management both on and off campus.
5) ENVIRONMENTAL – The study will benefit environmentalists by providing alternative and resourceful hygiene solutions. It may also help reduce the production of certain commercial soaps that can harm the environment. Through this research, the researchers can lend a helping hand in achieving a healthier and cleaner environment.
6) SOAP PRODUCTION FACILITY – The study will benefit soap production facilities by introducing a new, sustainable solution that promotes eco-friendly hygiene alternatives. This can encourage manufacturers to adopt more natural and environmentally conscious production methods.
7) COMMUNITY – The study will benefit the community through the use of biodegradable materials and waste reduction practices, supporting sustainability efforts and helping decrease pollution and landfill waste.
8) FUTURE RESEARCHERS – This study will benefit future researchers by opening opportunities to refine and expand studies related to the development of pocket soaps made from citrus peels. It can serve as a foundation for further innovation in sustainable hygiene products.

E. Scope And Delimitation

This study focuses on the evaluation of citrus peel-based pocket soaps to determine their effectiveness in maintaining proper hygiene among first-year students of Batangas State University. Specifically, it aims to assess the soap's cleaning capability, usability, and user acceptability compared to commercially available soaps. The study is limited to first-year students who preferably use hand sanitizers as their primary means of hand hygiene, in order to evaluate their perception and willingness to shift toward a more sustainable alternative. Surveys and user evaluations will be conducted to measure the soap's performance, effectiveness, and practicality in promoting hand hygiene.

F. Definition Of Terms

To further understand the study, the following terms were defined based on their
conceptual and operational uses:

1) CITRUS LIMON - Citrus limon is the scientific name for the lemon plant, a species from the family Rutaceae known for its yellow fruit rich in citric acid, vitamin C, and essential oils. In this study, lemon peels from Citrus limon are used as the main ingredient in producing eco-friendly pocket soap due to their cleansing, antibacterial, and antioxidant properties.
2) CLEANSING ABILITY - Cleansing Ability refers to a product's effectiveness at removing impurities In this study, it refers to the effectiveness of the citric content-based pocket soap in removing dirt, oil, and microbes from the skin's surface.
3) COMMERCIAL SOAP - Commercial soap typically refers to soap products that are mass-produced and may contain synthetic fragrances, artificial colors, preservatives, foam boosters, and detergents. In this study it refers to a mass-produced soap used as a standard for comparison. The goal is to evaluate whether the citric content-based pocket soap is more effective at maintaining cleanliness than this commercial soap.
4) ECO-FRIENDLY - According to the U.S. Environmental Protection Agency (2023), eco-friendly refers to products or practices that cause minimal harm to the environment by conserving resources and reducing pollution. In this study, it describes the lemon peel-based pocket soap, which uses natural and biodegradable materials to promote waste reduction and environmental sustainability within Batangas State University.
5) LEMON PEEL - Lemon peel is defined as the outer skin of the lemon fruit, rich in vitamin C, dietary pectin, and various volatile compounds, which possess nutritional, medicinal, and antibacterial properties. In this study, lemon peel refers to the key ingredient in the formulation of a pocket soap
6) SCENT - Scent is a distinctive smell, especially one that is pleasant. In this study it refers to the aroma or fragrance emitted by the citric content-based pocket soap made from lemon (Citrus limon) peels.

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II. REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents the necessary literature and studies related to the effectiveness of citric content-based pocket soap from lemon (Citrus limon) peels in maintaining cleanliness in Batangas State University. This part specifies the relevant resource gathered from the work of professional authors as well as research papers, which are concisely discussed to further reinforce the foundation of the study.

A. Related Studies

Previous studies have investigated the antimicrobial and cleansing potential of natural soap formulations derived from fruit and plant extracts. The Biosains Journal (2023) developed a paper soap made from natural lemon and pineapple peel extracts and demonstrated that it possessed antiseptic properties, with inhibition zones of 5.7 mm against Staphylococcus aureus and 20 mm against Escherichia coli. This shows the effectiveness of lemon-based extracts as natural antibacterial agents in soap formulations.

Similarly, the study by Saikia (2017) found that soaps formulated with plant extracts such as pomegranate flower, carrot seed, and lavender exhibited significant antibacterial activity against both gram-positive and gram-negative bacteria. These findings reinforce the idea that natural extracts rich in antioxidant compounds enhance the antimicrobial effectiveness of soap formulations.

Moreover, as stated by Sinaga, et al., 2022, Based on the findings of the research that has been done, the conclusion of this study is that the ethanol extract of lemon peel (Citrus limon(L.) Burm.f.) may be formed into an antibacterial solid soap preparation based on the SNI 06-4085-1996 standard. With inhibitory values of 10.22 mm, 11.65 mm, and 12.48 mm, respectively, antibacterial solid soap made from ethanol extract of lemon peel at concentrations of F1 (5%), F2 (10%), and F3 (15%) demonstrated antibacterial activity.

Research conducted on various antiseptic and herbal soaps (2016) compared commercial brands like Dettol, Lifebuoy, and herbal variants containing neem and aloe vera. Results showed that herbal soaps demonstrated comparable or higher efficacy against skin-surface bacteria such as Bacillus subtilis, S. aureus, E. coli, and Pseudomonas aeruginosa. This indicates that natural alternatives can perform effectively without relying on harsh chemical antiseptics.

In a related study, Growing Global Concern Over Synthetic Cleaning Agents (2022) evaluated eco-friendly cleaning formulations incorporating lemon peel extract, coconut shell, and eggshell powders. The lemon-based formulations exhibited high oil solubility, mild acidity, and excellent antimicrobial potential. These results further support the utilization of citrus peel extracts as sustainable and effective ingredients for natural soap and cleaning product development.

The study by Citrus Peel Toothpaste Formulation (2025) explored toothpaste derived from citrus peel extracts, revealing notable antibacterial activity against Staphylococcus aureus and Proteus vulgaris. This demonstrated the versatility of citrus peel bioactives in hygiene-related formulations beyond soap production. Similarly, Lemon Peel Nanoemulgel Formulation (2024) reported the successful use of lemon peel extract in alcohol-free hand sanitizers, showing strong antimicrobial and antiviral activity while remaining non-toxic to skin cells.

Moreover, Citrus Peel Waste Valorization and Sustainable Management (Springer, 2024) highlighted that lemon peel waste, which is often discarded, can be converted into valuable products like soaps, cleansers, and sanitizers through biotechnological and extraction techniques. The study further emphasized that transforming citrus peel waste into consumer products contributes to environmental sustainability and aligns with circular economy principles. This supports the feasibility and environmental benefit of using lemon peel as a soap ingredient.

Another study by Limonene-Based Soap Production from Waste Cooking Oil and Citrus Peel (2025) found that the inclusion of D-limonene extracted from citrus peel waste not only improved soap odor and antibacterial performance but also reduced carbon emissions by up to 89%. This demonstrated that citrus-derived components can significantly enhance both environmental and product quality outcomes.

Finally, Herbal Scrub Soap Formulation (2025) confirmed that herbal and fruit-based soap formulations remain effective against both gram-positive and gram-negative bacteria while maintaining user safety and product stability. These studies collectively establish that the incorporation of citrus fruit peels—particularly lemon—into cleansing formulations supports antimicrobial efficacy, eco-friendly waste utilization, and sustainable product innovation.

B. Related Literature

Cleansing ability refers to a soap's effectiveness in removing dirt, oil and microorganisms from the skin surface without causing irritation or dryness. It is primarily influenced by the composition of surfactants, pH balance and the presence of natural compounds such as citric acid and essential oils. Lemon peel, in particular, contains limonene, citral, and flavonoids that contribute to its degreasing and antimicrobial properties, improving the soap's cleansing performance (Biosains Journal, 2023).

Moreover, as stated by Dhanavade, et al., 2011. Lemon peel has antibacterial properties in addition to being an astringent. This is a significant finding since certain skin flora, such as Micrococcus and Pseudomonas, may develop in sebum, particularly when it is released excessively (in certain people), and cause acute skin diseases. It may occasionally operate as a risk factor for other skin conditions, such as acne. A simple application of lemon juice can assist to maintain healthy skin and avoid these kinds of illnesses. It goes without saying that maintaining proper personal cleanliness, getting regular exercise, and maintaining a healthy diet are all equally essential. In the context of sanitary product formulation, the cleansing ability of lemon-based soaps offers a natural alternative to synthetic detergents, aligning with eco-friendly and sustainable product development goals.

The fragrance of soap significantly affects consumer preference and satisfaction. Lemon peel contains volatile oils such as limonene and citral, which provide a fresh citrus aroma known for its energizing and refreshing qualities (Ibrahim,et al,2024). As stated by Pinky Kharata, 2024. Lemon soap's antibacterial qualities make it ideal for eliminating body odour. It will leave you odor-free and fresh. Lemon essential oil's scent eliminates out the undesirable smell of sweats and other odours, and its antibacterial qualities eliminate microorganisms on your skin, which decreases body odour.Unlike artificial fragrances, natural citrus scents also possess mild antibacterial activity and contribute to an overall clean sensory experience. The incorporation of lemon peel extract in soap enhances the product's natural fragrance, making it more appealing to consumers while avoiding synthetic additives that can cause skin sensitivity.

The physical characteristics of a pocket bar soap, including its size, texture, and firmness, play a crucial role in usability and consumer convenience. A compact soap designed for portability requires a formulation that balances hardness and solubility to prevent quick melting during use. Incorporating lemon peel powder and citric extracts not only improves hardness through natural acids but also adds exfoliating properties, enhancing soap texture and stability (Nadaroglu and Baran 2020). Optimizing these factors ensures that the soap maintains quality, durability, and effectiveness even in smaller, portable forms.

The use of lemon peel in soap formulation also aligns with sustainable waste management practices. Lemon peel, often discarded as waste, contains high concentrations of bioactive compounds like citric acid, vitamin C, and polyphenols. Utilizing these by-products helps reduce environmental waste while creating value-added products (Mwamba,2025). As stated by De Garcia, et al., 2024. The lemon-based soap obtained excellent scores for all studied characteristics, indicating its promise as a sustainable and effective alternative to traditional soaps. The study demonstrated the need of investigating natural alternatives to synthetic components in soap manufacture, citing customer preferences and environmental concerns. Participants demonstrated a high degree of environmental consciousness, showing that there is an increasing market need for environmentally friendly and organically made products. Lemon-based soap was regarded to have distinct cleaning and skin-nourishing effects when compared to ordinary soap, possibly due to the natural capabilities of lemons and its absence of harsh synthetic chemicals. Through bioconversion and extraction processes, citrus peels can be repurposed as raw materials in hygiene products, promoting circular economy initiatives and reducing dependence on synthetic ingredients.

C. Conceptual Framework

Lemon peel (Citrus limon) serves as the main natural ingredient that connects the different aspects of this research. It contains essential bioactive compounds such as citric acid, limonene, and flavonoids, which are known for their cleansing, antimicrobial, and aromatic properties. In this study, the lemon peel extract is utilized as the active component in the formulation of the Citric Content-Based Pocket Soap, an eco-friendly and portable hygiene product designed for students of Batangas State University. The framework highlights how the chemical composition of lemon peel, the concentration of extract used, and the formulation process affect the soap's overall cleansing ability, fragrance, and size. These factors interact to determine the soap's effectiveness in removing dirt and oil, its appealing natural scent, and its durability during use. The study also compares the performance of the lemon peel pocket soap to that of a commercial pocket soap to assess whether the natural formulation can serve as a viable alternative. Furthermore, this framework assumes that utilizing citrus peel waste contributes to environmental sustainability by reducing biodegradable waste and promoting resource efficiency. By transforming what is usually discarded into a useful hygiene product, the study aims to support sustainable waste management and encourage innovation through environmentally conscious practices. Overall, this conceptual framework illustrates the relationship between the natural composition of lemon peel, the soap-making process, and the resulting product performance. It supports the idea that natural and sustainable ingredients can produce effective and eco-friendly hygiene products that align with modern environmental goals.

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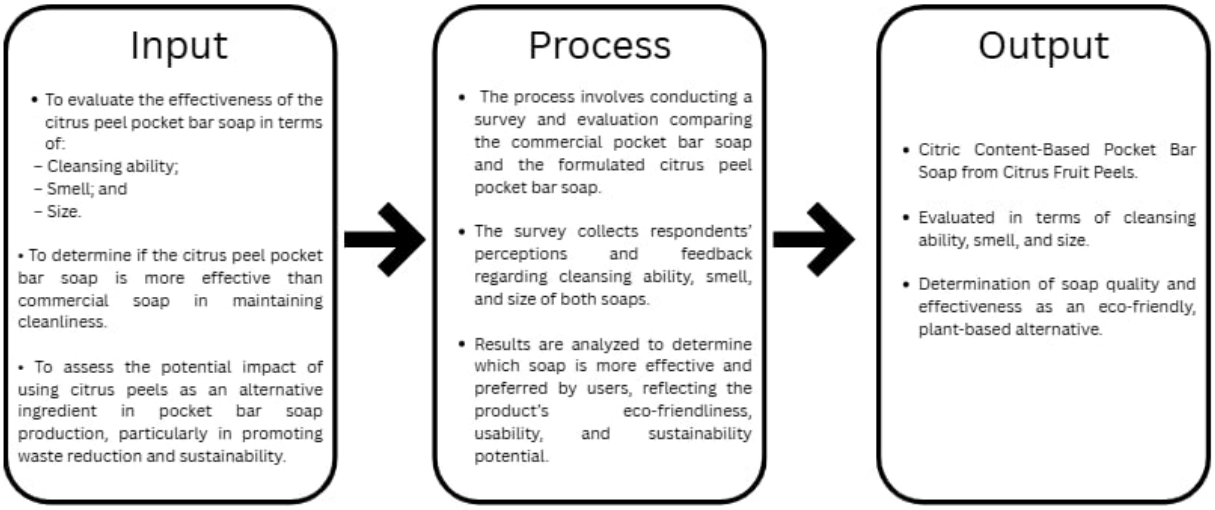

FIGURE 1. Conceptual Framework IPO.

III. METHODOLOGY

This chapter represents the different methods and procedures that were used in the design and study of the effectiveness of citric content-based pocket soap from lemon (Citrus limon) peels in maintaining cleanliness in Batangas State University.

A. Research Design

The researchers aimed to determine the properties of pocket soap made from lemon peels as a potential component of a hygiene solution. Therefore, the type of quantitative research design used in this study was the experimental design. By using this method, the researchers were able to effectively address the existing issue through a scientific approach.

B. Participants and Setting

A total of fifteen (15) first-year college students from Batangas State University, Alangilan Campus, participated in this study. The respondents were not classified by age or gender. They provided answers to the questions prepared by the researchers.

C. Data Gathering Procedure

During the data-gathering procedure, both a survey questionnaire and a face-to-face interview were administered to each participant in the study. Initially, the researchers obtained informed consent from all respondents. Prior to distributing the survey questionnaires, the researchers formally sought the participants' permission to provide information relevant to the documentation of the pocket soap. The researchers also ensured that the participants had a clear understanding of the purpose and scope of the study and assured them of the confidentiality of their identities.The interview commenced only after the participants had granted their full permission and approval. Upon receiving their consent, the researchers presented the set of questions and proceeded with the interviews to obtain the necessary data. Finally, the researchers analyzed the gathered responses to systematically compile and interpret the information required for the study.

D. Research Instruments

In this quantitative study, the information needed for a study of the citric content-based pocket soap from lemon peels will be gathered through survey questionnaires. Survey questionnaires will be used by the researchers to collect data and information from a population in a systematic and effective manner. They will be employed to comprehend viewpoints, actions, opinions, and experiences pertaining to a particular subject. Surveys will allow the researchers to get quantifiable information that can be statistically examined to determine trends or patterns.

Survey research is defined as "the collection of information from a sample of individuals through their responses to questions. This type of research allows for a variety of methods to recruit participants, collect data, and utilize various methods of instrumentation (Check & Schutt, 2011). Survey questionnaires will be crucial for evaluating ideas and offering reliable evidence for conclusions in research. The researchers will construct five interview questions.

Table 1
Response Scale and Verbal Interpretation

OPTION	SCALE RANGE	VERBAL INTERPRETATION
4	3.50 – 4.00	Strongly Agree
3	2.50 – 3.49	Agree
2	1.50 – 2.49	Disagree
1	1.00 – 1.49	Strongly Disagree

E. Data Analysis

Descriptive analysis was employed to summarize and present the collected data, primarily through the use of the mean and standard deviation to interpret the respondents' evaluations. Inferential analysis was also used to further interpret the data and derive meaningful conclusions. To determine whether there were significant differences in the effectiveness of commercial soap and citrus peel pocket soap, hypothesis testing was conducted. Appropriate inferential tests, such as t-tests, were utilized to assess whether the observed differences in cleaning performance and user perception were statistically significant, depending on the data distribution and sample size. This approach ensured that the findings were supported by reliable statistical evidence rather than relying solely on raw data.

F. Ethical Considerations

In this study, the researchers make sure everything is done fairly, safely, and honestly. Before collecting any data, the researchers asked permission from the school and got the consent of all participants. This means that everyone who takes part will know what the study is about and will join voluntarily, not because they're forced.

All the information gathered will be kept private and confidential, no names or personal details will be shown in the report. The answers from 1st year students will only be used for research and will be shared as group data, not individually.

When testing the citrus peel pocket soap, the researchers will make sure it's safe to use and doesn't cause any skin problems. Only natural and non-toxic ingredients will be used, and every participant involved will be informed about what's in the soap.

Finally, the researchers will ensure that all data is managed properly, that their findings are legitimate, and that they avoid copying the findings of others. Additionally, by recycling waste materials like lemon peels, they will ensure that the study benefits the environment.

IV. PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter presents the results and discussion of the study. It includes the presentation of data, analysis and interpretation of the results.

A. STATEMENT OF THE PROBLEM 1:

Citrus peel pocket soap offers moderate cleansing ability, the natural oils and acids in citrus peels that help remove dirt and oil from the skin. Research indicates that soap formulated with citrus peel extract, such as lemon or orange peel, is gentle and safe for regular use, with participants reporting no adverse skin reactions after several days of application. However, its cleansing power is generally less potent than commercial soaps with added surfactants, making it suitable for basic hygiene and light cleaning rather than deep or oily skin needs. The soap is typically small and portable, fitting easily in a pocket or purse, though its compact size means it may not last as long as larger commercial bars.

The scent of citrus peel pocket soap is fresh and invigorating, derived from the essential oils in the peels, which are known for their uplifting fragrance. Product evaluations show that users generally prefer the natural scent of citrus peel soap over synthetic fragrances, finding it pleasant and skin-friendly. The soap's texture may be slightly rough due to visible pieces of dried peel, and its natural, biodegradable composition appeals to those seeking eco-friendly alternatives (Ochate et al., 2023). Commercial bar soaps, while effective at deep cleaning, often contain synthetic chemicals and harsh detergents that can strip the skin of natural oils and cause dryness or irritation; in contrast, citrus peel pocket soap is gentler and retains more natural moisturizing properties, making it a milder option for daily use.

B. STATEMENT OF THE PROBLEM 2:

How does the citrus peel pocket soap differ from the commercial pocket soap in maintaining cleanliness?

Significant Difference of Citrus Limon Soap and
Commercial Soap in Maintaining Cleanliness
Table 2.1

SOURCES	MEAN AVERAGE	STANDARD DEVIATION
CITRUS PEEL SOAP	0.5333	0.4989
COMMERCIAL SOAP	0.4667	0.4989

The table presents a comparison between Citrus Peel Soap and Commercial Soap using two statistical measures: the mean average and the standard deviation. Based on the data, the Citrus Peel Soap obtained a mean average of 0.5333, while the Commercial Soap received a slightly lower mean of 0.4667. This indicates that, on average, the respondents rated the Citrus Peel Soap more positively than the commercial alternative. Although the difference between the two means is not large, it still shows that the citrus-based soap was generally more favored or perceived as more effective by the participants.

In terms of consistency of responses, both products have the same standard deviation, recorded at 0.4989. This value suggests that the variability in the respondents' ratings for both soaps is almost identical. A standard deviation close to 0.5 reflects a moderate spread of responses, meaning the participants had mixed opinions, but the range of these opinions was similar for both soaps. Because the standard deviation values are equal, it can be inferred that the level of agreement or disagreement among the respondents regarding the performance of each soap does not differ.

Overall, the table shows that while the Citrus Peel Soap received slightly higher average feedback, both soaps exhibited the same degree of variability in ratings. This implies that although the citrus-based soap was generally preferred, respondents expressed diverse opinions toward both products with similar consistency.

C. STATEMENT OF THE PROBLEM 3:

What is the effect of using citrus peel as an alternative in creating pocket soap?

Table 2.2
Effectiveness of Citrus Peel as an Alternative Pocket Soap

QUESTIONNAIRES	WM	VI
1.The soap effectively removed dirt and grime from my skin	3.33	Agree
2.My skin felt thoroughly clean after using the soap.	3.27	Agree
3.The soap rinsed off easily without leaving a residue	3.6	Strongly Agree
4.The soap has a pleasant and refreshing scent.	3.4	Agree

5.The citrus scent of the soap is noticeable during use	3.27	Agree
6.The scent of the soap lingers on my skin after washing.	3.13	Agree
7.The size and shape of the soap were comfortable to hold and use.	3.8	Strongly Agree
8.The pocket size of the makes it convenient for travel or carrying	3.6	Strongly Agree
9.The citrus peel pocket soap cleans as effectively as commercial pocket soaps.	3.13	Agree
10. The citrus peel pocket soap maintains cleanliness longer after washing compared to commercial soaps.	3.33	Agree
11.. The citrus peel pocket soap performs equally or better overall than commercial soaps.	3.33	Agree
12. Using citrus peel as a main ingredient makes the soap environmentally friendly.	3.67	Strongly Agree
13.I would choose the Citrus Peel Pocket Soap over a commercial pocket soap as a sustainable alternative.	3.33	Agree
14. I am more likely to use environmentally friendly soaps like the citrus peel pocket soap.	3.13	Agree
15. Overall, the Citrus Peel Pocket Soap is a highly acceptable product for maintaining cleanliness.	3.33	Agree
Composite mean	3.38	Agree

LEGEND: WM - Weighted Mean VI - Verbal Interpretation

The table 2.2 presents that citrus peel is a highly effective ingredient for formulating pocket bar soap, demonstrated by an overall composite mean of 3.38 (Agree), indicating excellent user acceptability. Respondents agreed that the soap efficiently removed dirt (WM = 3.33) and thoroughly cleansed the skin (WM = 3.27). These findings correspond with research studies that citrus peels contain antimicrobial and antioxidant compounds that can enhance cleansing effectiveness (Kanmani & Rhim, 2014). The soap's ability to rinse cleanly without leaving residue (WM = 3.6) correlates with research indicating that citrus extracts enhance washability and cleansing efficiency in personal-care products (Maqbool et al., 2023).

Participants also rated the product positively in terms of user experience, particularly smell and convenience. The soap's natural citrus aroma was deemed to be pleasant and refreshing (WM = 3.27-3.40), supporting research indicating that citrus waste products include essential oils that contribute to appealing odors in cosmetic applications (Andrade et al., 2022). Respondents highly agreed that the soap's size and form were convenient for travel (WM = 3.80; 3.60). Furthermore, the soap worked comparably to commercial pocket soaps (WM = 3.13), supporting previous study revealing that fruit peel compositions can equal or outperform commercial washing solutions (Kamil et al., 2011).

Overall, respondents significantly recognized the environmental benefits of citrus peel, rating the product as environmentally friendly (WM = 3.67) and expressing a willingness to choose sustainable products such as this soap (WM = 3.13). These opinions have been reinforced by worldwide sustainability research, which shows that reusing citrus wastes minimizes waste and contributes to eco-friendly manufacture (Food and Agriculture Organization, 2019).

With respondents agreeing that citrus peel pocket bar soap maintains its cleanliness and effectiveness over time (WM = 3.33), the study shows that citrus peel is not only an effective cleaning agent, but also a sustainable and acceptable alternative to commercial pocket bar soaps.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. *Summary*

The effectiveness of citric content-based pocket soap from lemon (citrus limon) peels in maintaining cleanliness in Batangas State University, examines the effectiveness and functionality of pocket soap formulated from discarded natural citrus sources, specifically lemon peels. Previous research indicates that soaps incorporating citrus peel extracts are generally mild and safe for daily use, with users reporting no adverse skin reactions after several days of application. Although the cleansing capability of citrus-based soap is comparatively lower than that of commercial soaps containing additional surfactants, it remains suitable for basic hygiene practices and the removal of light dirt. However, it may not be ideal for deep cleansing or for individuals with oily skin. The soap's compact size enhances portability, allowing it to be conveniently carried in a pocket or small bag. This feature, however, also contributes to a shorter product lifespan relative to standard commercial soap bars. Additionally, the natural citrus fragrance provides a bright, refreshing, and energizing scent, which contributes positively to user satisfaction. The study evaluates three key parameters of the citrus peel pocket soap—cleansing ability, fragrance, and size. Based on the findings, the soap demonstrates satisfactory performance in these parameters, supporting its overall efficiency and usability. Product testing was conducted among first-year students of Batangas State University to assess its practical performance and user acceptance.

B. *Conclusion*

The following were the conclusions of the researchers drawn from the findings of the study:

1) Citrus peel pocket soap provides gentle cleansing because of the natural oils and acids found in citrus peels. Studies show it's safe for daily use and doesn't usually cause skin irritation. However, it isn't as strong as commercial soaps, which contain powerful surfactants for deep cleaning. The soap is small, portable, and has a refreshing natural citrus scent that many users prefer over synthetic fragrances. Its texture can feel slightly rough due to pieces of dried peel, but its biodegradable and eco-friendly ingredients make it appealing to environmentally conscious users. Compared to commercial soaps which can dry or irritate the skin,citrus peel soap is milder and helps maintain natural moisture.

2) The table compares Citrus Peel Soap and Commercial Soap using the mean average and standard deviation. Citrus Peel Soap has a higher mean (0.5333) than Commercial Soap (0.4667), meaning respondents rated it slightly better overall. Both soaps have the same standard deviation (0.4989), showing that the spread of responses or how much people agreed or disagreed was basically the same for both products. In short, Citrus Peel Soap was rated a bit more positively, but the level of consistency in opinions was identical for both soaps.

3) Table 3.2 shows that citrus peel is a highly effective ingredient for making pocket bar soap, with a strong overall rating of 3.38 (Agree). Respondents confirmed that the soap removes dirt well, cleans the skin thoroughly, and rinses off without residue—findings supported by studies showing that citrus peels contain antimicrobial and antioxidant compounds. Users also liked the soap's smell and convenience, noting its refreshing natural citrus scent and travel-friendly size. The soap performed similarly to commercial pocket soaps, aligning with research showing that fruit peel formulations can match or even outperform commercial products. Respondents also appreciated its environmental benefits, agreeing that citrus peel makes the soap eco-friendly and sustainable. Overall, the results show that citrus peel pocket bar soap is effective, pleasant to use, environmentally friendly, and a strong alternative to commercial soaps.

C. *Recommendations*

Based on the study's findings, the researchers recommend further research in this Set offering the following suggestions:

1) Expanding test parameters - Future studies should investigate additional mechanical and environmental properties of the soap, including biodegradability, antimicrobial activity, and pH level, to thoroughly evaluate its overall performance and effectiveness.

2) Enhancing soap composition -Researchers should consider improving the soap's formulation by adjusting scent levels, reducing slipperiness, and modifying the bar size to enhance usability, consumer satisfaction, and overall functionality

3) Exploring alternative raw materials – Further research should focus on identifying and utilizing sustainable and abundant natural sources, such as agricultural waste and natural waste for soap production.

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4) Assessing large-scale production feasibility – Studies should evaluate the economic viability and environmental impact of large-scale soap manufacturing, considering factors such as cost-effectiveness, resource availability, and energy consumption.

APPENDICES

PROCESS OF MAKING THE CITRUS PEEL SOAP

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SAMPLE QUESTIONNAIRE

SURVEY QUESTIONNAIRE

NAME OF THE ACTION RESEARCH PROJECT: Effectiveness Of Citric Content-Based Pocket Soap From Lemon (Citrus Limon) Peels In Maintaining Cleanliness In Batangas State University

GENERAL OBJECTIVE: To analyze the effectiveness of using citrus peels, specifically lemon peels as a pocket of soap.

Table 1

Distribution of Questionnaires

Indicators	4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree
1.The soap effectively removed dirt and grime from my skin				
2.My skin felt thoroughly clean after using the soap.				
3.The soap rinsed off easily without leaving a residue				
4.The soap has a pleasant and refreshing scent.				
5.The citrus scent of the soap is noticeable during use				
6.The scent of the soap lingers on my skin after washing.				
7.The size and shape of the soap were comfortable to hold and use.				
8.The pocket size of the makes it convenient for travel or carrying				
9.The citrus peel pocket soap cleans as effectively as commercial pocket soaps.				
10. The citrus peel pocket soap maintains cleanliness longer after washing compared to commercial soaps.				
11.. The citrus peel pocket soap performs equally or better overall than commercial soaps.				
12. Using citrus peel as a main ingredient makes the soap environmentally friendly.				
13.I would choose the Citrus Peel Pocket Soap over a commercial pocket soap as a sustainable alternative.				
14. I am more likely to use environmentally friendly soaps like the citrus peel pocket soap.				
15. Overall, the Citrus Peel Pocket Soap is a highly acceptable product for maintaining cleanliness.				

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MEAN OF CRITRUS PEEL SOAP

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	RESPONDENTS	QUESTIONNAIRES															MEAN	
2	NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
3	1	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
4	2	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
5	3	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
6	4	3	3	3	3	3	3	4	4	3	3	3	4	3	3	3	3.2	
7	5	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
8	6	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
9	7	3	3	4	4	3	3	4	4	3	3	3	4	3	3	3	3.333333333	
10	8	3	3	4	3	3	3	4	4	3	3	3	4	3	4	3	3.333333333	
11	9	3	3	4	3	3	3	4	4	3	3	3	4	3	4	3	3.333333333	
12	10	3	3	4	3	4	4	4	3	3	3	3	4	3	4	3	3.4	
13	11	4	3	3	3	4	4	4	3	3	4	4	3	4	4	4	3.6	
14	12	4	4	3	3	4	4	4	3	3	4	4	3	4	4	4	3.666666667	
15	13	4	4	3	3	4	4	3	3	3	4	4	3	4	2	4	3.466666667	
16	14	4	4	3	3	4	2	3	3	4	4	4	3	4	2	4	3.4	
17	15	4	4	3	3	2	2	3	3	4	4	4	3	4	2	4	3.266666667	
18	MEAN	3.333333	3.266667	3.6	3.4	3.266667	3.133333	3.8	3.6	3.133333	3.333333	3.333333	3.666667	3.333333	3.133333	3.333333	3.377777778	
19																	OVERALL	
20																		
21																		

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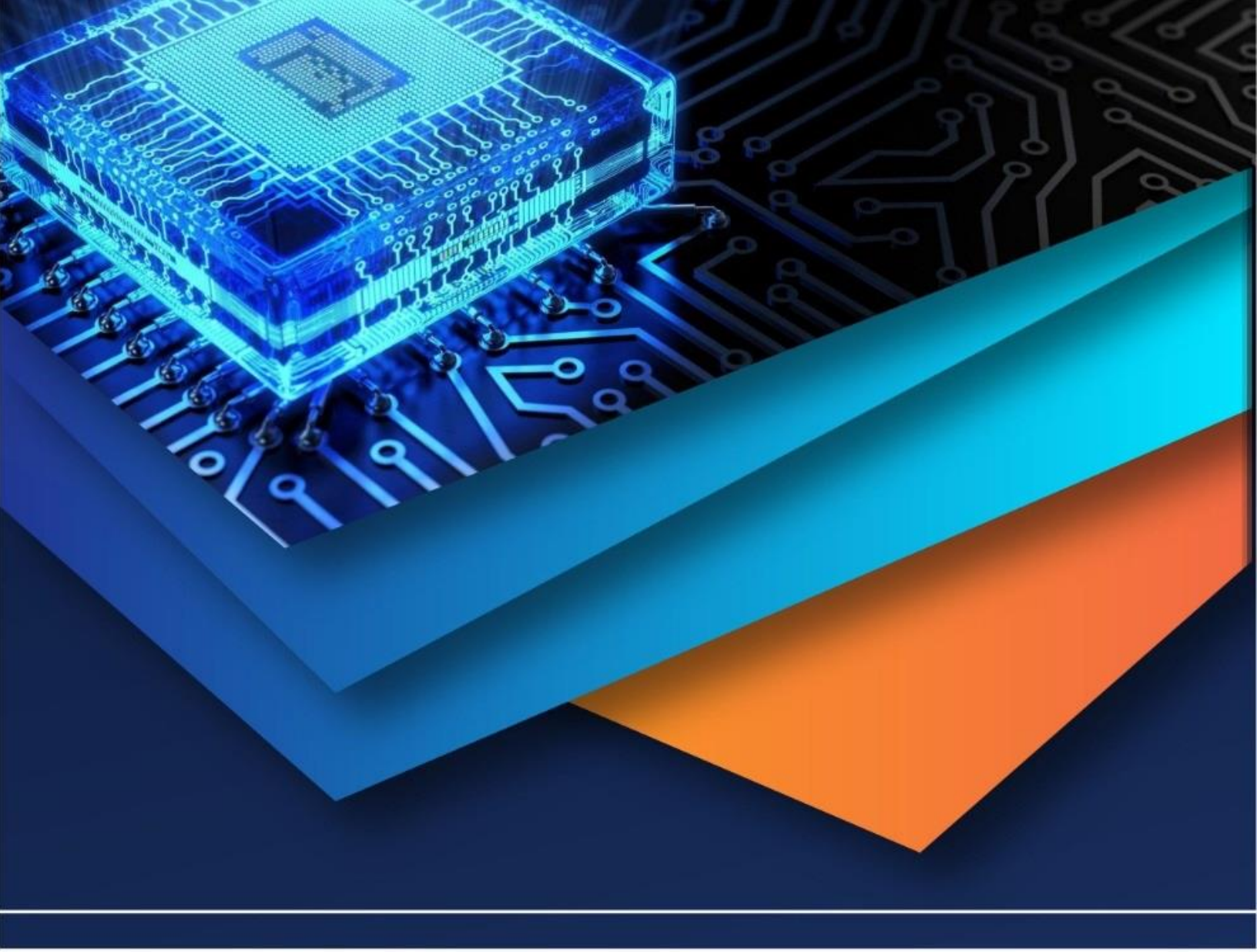

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