

# Lemongrass (*Cymbopogon Citratus*) Into Laundry Detergent Product

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## Abstract

This study was conducted to evaluate the experimented product Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent Product. Specifically, it sought answers to the following questions: What are the ingredients used in making laundry detergent product?, What are the methods and procedures used in making laundry detergent product as to liquid laundry detergent and fabric softener?, What is the level of acceptability of laundry detergent product in terms of appearance, scent, texture and usefulness?, Is there a significant difference between the evaluation of the acceptability of laundry detergent product using lemongrass and the level of acceptability of branded commercial detergent?, and What is the laboratory analysis of lemongrass (*cymbopogon citratus*) laundry detergent product? The study made use of experimental and descriptive method. Though in its entirety this research is experimental in design the evaluation is descriptive to determine the acceptability of Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product with a total of thirty (30) family members of Barangay Bagumbayan, Santa Cruz, Laguna and ten (10) business owners within the Municipality of Santa Cruz, Laguna were involved. Questionnaires was the main tool used to gather data about the developed laundry detergent product. The overall acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent as rated by business owners and family members was interpreted as in terms of appearance is 4.53, scent is 4.845, texture is 4.55 and usefulness is 4.655 respectively which implies as very strongly acceptable. While the overall acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener as rated by business owners and family members was interpreted as in terms of appearance is 4.88, scent is 4.75, texture is 4.585 and usefulness is 4.715 respectively which implies as very strongly acceptable.

Based on the findings of data presented the ratings of the group of respondents meant that there was no significant on the ratings given by them on the level of acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent in terms of appearance ( $t=-0.907$ ,  $p=0.376$ ), scent ( $t=1.116$ ,  $p=0.279$ ), texture ( $t=0.124$ ,  $p=0.903$ ), usefulness ( $t=-0.478$ ,  $p=0.639$ ) as reflected by the computed t-value and p-value which are almost the same as with the commercially branded laundry detergent. While the findings of the data presented the ratings of the group of respondents meant that there was no significant on the ratings given by them on the level of acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener and commercially branded fabric softener in terms of appearance ( $t=-1.464$ ,  $p=0.160$ ), scent ( $t=0.545$ ,  $p=0.593$ ), texture ( $t=0.361$ ,  $p=0.722$ ), and usefulness ( $t=-0.624$ ,  $p=0.541$ ) as reflected by the computed t-value and p-value which are almost the same as with the commercially branded laundry detergent as per evaluation of the respondents. Laboratory tests revealed significant information about the Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent Product with the following sample code test analysis respectively which states that the liquid laundry detergent, lemongrass oil, washing soda, fabric softener, sodium benzoate and washing soda have high percentage of antibacterial content on a certain bacterium as the *Staphylococcus Aureus*.

The analysis of data presented and the ratings of the group of respondents meant that there was no significant difference in the ratings of the acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent and Fabric Softener in terms of appearance, scent, texture and usefulness.

In view of the findings and conclusion of the study, the following recommendations are given:

- 1) Look for another ingredient/s for the liquid laundry detergents bubbler that will help produce more bubbles while washing so that the consumer will enjoy the washing,
- 2) Find some ingredient as liquid viscosity that will makes the liquid laundry detergent thicker than the usual,
- 3) Container of the liquid laundry detergent product should be uniform in shape and size with distinction of which is the liquid detergent and fabric softener,
- 4) Do bring the detergent for a test in a laboratory to find out its best before date or expiration and have it written on the label,
- 5) For future researchers who will conduct same study to try other coloring on the laundry detergent to become more appealing to the possible buyer.

Keywords: Lemongrass; *Cymbopogon Citratus*; Laundry Detergent Product

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## Introduction

Textiles are part of every individual's daily life. Making it clean and fresh gives the person feelings of relax and confident. One way is by using detergents as daily homecare. Such products are able to emulsify oils, hold dirt in suspension and act as wetting agents. It is an effective cleansing agent that people can use to experience the clean, stainless and good smell of textile or clothes they are using. This can be made through different procedures, substances or compositions to apply with the same purpose as soap for washing. Laundry fabric softener and washing mixtures are the products made in this study which considered as detergent by the Association Internationale for Soaps, Detergents and Maintenance Products (A.I.S.E.) Guidelines on the implementation of the Detergent Regulation v.2. In recent years during the process of purification and enhancing compositions of detergents have been regarded as with arousing chemicals which has susceptible effect to human and environment. However, considering the safeguarding of the environment and human safety with the use of these products studies were made and found out that "Essential Oil" has been proven to solve the problem. Finding ways to deal with it will give a hand to the consumers' versatile detergent for home care products, which, even adhering to the skin, does not chap it, which does not irritate the eye or any sensitive part by a scattered liquid, thus, safe and harmless. Recent studies have identified that lemongrass (*Cymbopogon Citratus*) as cultivated from yard of our homes has its substance that can be use as medicinal and pharmacological significance. Other than that its extracted essential oil has been extensively investigated for their chemical compositions and bioactivities. Its biocharacteristics, biological data and possible trade activities to pursue are the reasons to apply this substance in this study. Thus, the researcher thought to utilize the lemongrass into laundry detergent product.

## Background of the Study

The researcher pursues the study of Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product to support the increasing values on the biocharacteristics of lemongrass to home product that people can consume to experience the clean, fragrance of the textile they are using and to produce environmentfriendly laundry products that do support FDA's Health-Related Claims in making soaps and detergent. Since the Food Drug Administration (FDA) on its cosmetic claims that most "soaps" and other body cleansers sold today are synthetic product that come under the U.S. Food and Drug Administration jurisdiction. It is necessary to conduct this study to give heed to the Republic Act No. 8970 (Oct. 31, 2000), an act prohibiting the manufacture

importation, distribution and sale of laundry and industrial detergents containing hard surfactants and providing penalties for violation thereof. Section 1, on policy declaration of the state it shall protect, secure and safeguard the citizenry from the danger and harmful effects of pollution as seen from the influx of imported detergents containing hard surfactants, a substance found to be water pollutant. Provided for its complete prohibition and pursuing vigorous campaign against the manufacture, importation, distribution and sale of laundry and industrial detergents containing the harmful substance is for the total physical and mental well-being. This study supports the RA no. 8435 known as "Agriculture and Fisheries Modernization Act of 1997" on its policy declaration (s.2) that the goal of national economy is to have more equitable distribution of opportunities, income and wealth; a sustained increase in the amount of goods and services production the nation for the benefit of the people and an expanding productivity as the key to raising the quality of life for all, especially, the underprivileged. This study gives a hand in anyways according to the principles of the said Act as to Global Competitiveness to enhance the ability to compete in terms of price, quality and value of agricultural products as a "resource-based" in making detergent products relatively to those with other countries.

This study also upholds that same Act under chapter 1 of title 3 about Research and Development (s.8081) in giving priority of the Department to develop, innovate, and utilize indigenous and self-reliant scientific and technological capabilities and application to the country's productive system and national life. Furthermore, this study supports the Plant Product Safety Service Division (PPSSD) which is tasked with the characterization of agricultural crops and its by-products and ingredients in manufacturing any cosmetics on the ongoing procedure of the study.

### Statement of the Problem

This study aimed to determine the utilization of lemongrass in making laundry detergent product.

More specifically, this research sought to answer the following questions:

1. What are the ingredients used in making laundry detergent product?
2. What are the methods and procedures used in making laundry detergent product as to:
  - 2.1. Liquid Laundry Detergent;
  - 2.2. Fabric Softener?
3. What is the level of acceptability of lemongrass (*cymbopogon citratus*) laundry detergent product in terms of:
  - 3.1. Appearance;
  - 3.2. Scent;
  - 3.3. Texture; and
  - 3.4. Usefulness?
4. Is there a significant difference between the evaluation of the acceptability of laundry detergent product using lemongrass and the level of acceptability of branded commercial detergent evaluated by:
  - 4.1. Family Members
    - 4.1.1 Housewife;
    - 4.1.2 Father;
    - 4.1.3 Children; and
    - 4.1.4 House Helper.
  - 4.2. Business Owners?
5. What is the laboratory analysis of lemongrass (*cymbopogon citratus*) laundry detergent product?

### Significance of the Study

The result of the study is beneficial and help to the following group of individuals:

#### Laundrymen

They may be inspired to do more washing using the laundry product with special ingredient of

lemongrass because of the scent and biocharacteristics of it that also smoothen their hands and prevent chapping of skin. Giving them a good experience in washing clothes.

#### **Housewives**

This study helps housewives to use a costless and environment-friendly detergent product that do not cause pollution because of its substance. This will serve as another source of income for them as much as they learn the process of making the product.

#### **Family Members**

The result of the study helps family members use the product and do the laundry by themselves without any hesitation of danger, thus, harmless and safe to use. They can have the chance or have the eagerness to do the laundry on their own to experience washing with the use of a product which contain natural ingredient.

#### **Community**

This study provides the community an idea of putting a business with the use of indigenous special ingredients. It will serve as the best sample or give them an idea to make some related product or even produce the same thing using lemongrass extract. They will become aware of the use of organic substances in cleaning and sanitation which makes it easy for them find and safe to apply on.

#### **Future Researchers**

This study may give insights to the future researchers and serve as spring board for further development and assessment of work related studies. It will help them to do more studies on discovering the importance of plants and herbs more specifically lemongrass to produce products of either food, beverage, cosmetics, perfumery or another cleaning products using its extracted oil.

#### **Scope and Limitations of the Study**

This study is limited only in the production of Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product.

The effectiveness of the product was tested by applying it during the washing of clothes or in doing the laundry. The acceptability was tested in sensory terms such as appearance, scent, texture and usefulness while applying the product in laundry.

The respondents of the study who evaluated the product were (30) Family Members such as Housewife, Father, Children and House Help of Brgy. Bagumbayan, Sta. Cruz, Laguna; and (10) Business Owners in same Municipality.

#### **Definition of Terms**

To ensure better understanding of the research work, following terms are conceptually and operationally defined:

**Appearance.** This refers to the finished product presentation, an overall appeal that pleases the eye of the concerned individual that encourage him/her to use the product.

**Biocharacteristics.** This refers to the acting properties contain in lemongrass plant such as anti-bacterial, anti-fungal, etc. which makes the product more beneficial.

**Curing.** It is a process of fermentation that were done in a mixture of laundry detergent product that go through a chemical change and results in the production of alcohol. The process of leaving the mixtures within hours or days to prepare for a final laundry product.

**Cutting.** It refers to a stem, leaf or root that is cut from a plant and used to grow a new plant. In this study it refers to the act of dividing the lemongrass leaves into pieces in preparation for extraction.

**Detergent.** This refers to the soap or cleansing agent use in washing clothes and other textiles with lemongrass oil. It refers to the finished product of this study which is intended for washing and scenting the fabric making it clean and fresh.

**Essential Oil.** Is any of a class of volatile oil that give plants their characteristic odor and are used especially in perfumes and flavorings, and for aromatherapy. This refers to an oil extracted from lemongrass plant that has an aromatic fragrance like a lemon used in making soap that provides long lasting smell to the fabric.

**Fabric Softener.** This refer to the finished product of the study which is intended to use as detergent that makes the textiles soft and smells good after washing.

**Laundry.** This refer to the soiled clothes, towels, sheets, and textiles that need to be washed or that have been washed.

**Lemongrass.** It refers to an aromatic grass belonging to the family Gramineae and genus cymbopogon plant serve as the special ingredient in making detergent product. Grown in tropical regions for its lemon-scented foliage used as a seasoning and that is the source of an aromatic essential oil. It is the natural ingredient used in this study in making laundry detergent product which possess citrus fragrance.

**Liquid Detergent.** This refer to the finished product in a liquid form with the use of some ingredients that is applicable in washing clothes or textiles to make it clean and fresh.

**Mix.** It refers to as the process of combining two or more substances to make one mixture product. In this study it is the act of adding or combining prepared ingredients to make one final product which is the laundry detergent.

**Texture.** It refers to the finished product's smoothness acceptability when it is touched and applied in washing clothes or textiles.

**Utilization.** It refers to the use of lemongrass as component in making laundry detergent product. It also refers to as using of something for a particular purpose.

**Usefulness.** It refers to the ability of the product to be used as laundry detergent that can be used daily without causing any skin or health problems or irritation to the user.

## Related Literature

The researcher identified important principles in accomplishing this study that provides ideas to succeed in making the product aligned with the following readings.

Stated from the Guidelines on the Implementation of the Detergents Regulation v.2 (2013) by the Association Internationale for Soaps, Detergents and Maintenance Products under Detergent Scope, that "detergent" are products applied which are intended for any washing and cleaning process such as products to clean hard surfaces or textiles, fabric softening function or claiming a cleaning. Detergent products considered in this guidelines are Auxiliary washing mixture which is intended for soaking (pre-washing), Laundry fabricsoftener used to modify the fabrics in feeling, cleaning mixture intended for all domestic purpose cleaners, other cleaning and washing mixture used for other washing and cleaning processes. This document provides an understanding to this research that the product would like to produce in this study is considered as detergent as to the purpose for cleaning and providing scent to fabric such as Laundry Detergent Liquid and Fabric Softener. In addition, Madsen, et. al (2007) reviewed a report regarding Environment and Health Assessment of Substance in Household Detergents and Cosmetic Detergent Products. As stated detergents were used in high volumes and total annual exceeded 70,000 tons in Denmark (in 1992) and 9,000,000 tons in Europe (in 1998). This review cited the groups of substances of surfactants, agents, acids and bases, etc. that were formerly used in products that do give environmental hazard and toxicity. Also included on his reviews the ranking of substances used to indicate cases with detailed risk assessment or potentially hazardous chemicals that may be considered for substitution. These were enumerately done for the purpose of awareness for all, about Environment and Health Assessment of substances found in household detergents and cosmetics products. It would be helpful to the recent research to make a detergent product that will avoid those listed substances that gives hazardous effect to the environment and to have some alternative ingredient that are safe and environment-friendly.

A book entitled, "Livelihood Made Simple" will provide recipes that most probably teach readers procedures on how to make simple products that will help them meet the basic household needs, even save money for the

family, learn productivity by utilizing inexpensive and locally available materials that would also provide fun time to the whole family written by Wijenayake (2007). Some of those cited on his book are the processes of making Liquid Soap with the use of coconut oil and other essence, Powder Soap and Quicksetting Homemade Soap. These light and easy recipes but productive one gives additional insights with the present study on how to make detergents that are less-expensive, easy to prepare and mostly using less or no harm indigenous ingredients.

Because of the demand of essential oil in industries due to its bioactive compound that shows various therapeutic effect, Scholarly studies do some ways on how to extract oil from plants, herbs and twigs, etc. In this regard, methodology of extraction cited by M. A. Suryawanshi, et. al (2016) lemongrass can be extracted through solvent extraction and steam distillation method wherein the solvent extraction method gave the highest yield because of the less exposure to air and heat yielded 1.85% compared to steam distillation with 0.86% oil respectively. Similar method was done by Eduardo Cassel and Ruben M. F. Vargas (2007) the steam distillation which was used in optimizing citronella essential oil extraction from twigs and leaves.

Another extraction of essential oil from lemongrass shared by A. R. Mohamed Hanaa, et. al (2012) were the three different drying methods: the sun-drying (36h), shade-drying (48h) and oven-drying at 48°C (7h). Among the methods used oven-drying produced the highest essential oil percentage of 2.45% compared to shade-drying with 2.12% and sun-drying method which has 2.10%. These methods had the marked effect on the proportion of various components identified. This would be helpful for the researcher to have a better idea that oven-drying method is best to apply among the three extraction methods shared by Hanaa to get the highest amount of essential oil percentage. The extraction process done and experimented by the mentioned individuals serve as an idea on applying it to the present study.

Furthermore, Ranitha M. et. al (2014) studied and tested two different ways of extracting essential oil the Microwave-Assisted Hydrodistillation (MAHD) and Conventional Hydrodistillation (HD) Method. MAHD is an advanced hydrodistillation (HD) technique, in which a microwave oven was utilized as the heating source with a power of 200W and 250W extracted within time duration of 30 min., 60 min., 90 min. and 120 min. the results were compared with those of conventional HD that was done with the use of 400 ml distilled water with the same time duration as with MAHD using a Clavenger type apparatus. Result from the tests and methods done the Microwave-Assisted Hydrodistillation (MAHD) produced the high amount of essential oil with remain substance as what is present on lemongrass plant.

Among the above-mentioned oil extraction procedures, it would be helpful for the present study to do either the Oven-drying method or Microwave-Assisted Hydrodistillation (MAHD) in obtaining and getting desirable amount of essential oil.

From the work of Cristiane de Bona da Silva, et. al (2007) there are common fungal diseases specifically *Candida* species experienced by human that has limited treatment which is part of the reason's due to limited spectrum of anti-fungal drugs and expensive treatment. It was demonstrated from their tests that the lemongrass oil and citral presents similar anti-fungal activity. Result from this, the potentiality uses of lemongrass oil instead of citral in pharmaceutical preparation was indicated since it has same antifungal activity, cost and toxicity other than induce sensitization of essential oils present in each material. It was observed with very good effectiveness and broad spectrum activity against *Candida* species. This would be a help to the present research to have an idea about the present activity that a lemongrass content.

From the compilation of Jayasinha (2007) a literature survey on lemongrass it has three species with similar aromatic grass that produces oil with many benefits and uses. It can be used as an oil in its own right or to the isolation of its derivative citral. Processing of chemicals produced from its citral makes possible manufactures of vitamins, notably vitamin A. Because of its oil's fragrance work many have some articles on its perfumery use that can be apply for aerol deodorants, household detergents, domestic and industrial products that need fresh, pleasant fragrance in masking unpleasant odours of some ingredients. She stated that in addition to its possessing odour 98-100% citral gives a lemon smell to soap after a month, and it fades within 6 months but with the help of a group of very important synthetic aromatic called ionones it possesses a strong and lasting

violet odour. On the last part of her compilation she stated that aside from the abovementioned benefits lemongrass also possessed an insect repellent properties, germicidal and bactericidal used in preparing disinfectant solution, a therapeutic and other uses that is said to be helpful in our lives.

It determined the possibility of using sanitizing detergents based on natural products for elimination and/or reduction of some microbial elements including the process of sanitation on some surfaces especially stainless steel by Alessandra Farias Millezi, et. al (2011). It was shown from here the reduction of *Aeromonas* using Thyme (*Thymus Vulgaris*) and lemongrass (*Cymbopogon Cytratus*).

Furtherly stated from the work of Deepak Ganjewala and Asish Kumar Gupto (2012) about the Overview and Biological Activities of Essential Oils from members of the genus *Cymbopogon* such as lemongrass (*Cymbopogon flexuosus*), wild lemongrass (*C. citratus*), palmarosa (*C. mantinii*) and citronella (*C. winterianus*) in economic and pharmacology. Accordingly, lemongrass oil and citral are mainly used in flavors, fragrances, cosmetics, perfumery, soaps, detergents, toiletry, tobacco products and pharmaceuticals. Cited from here also the biological activities of lemongrass including antimicrobial, anti-inflammatory and anti-oxidant; anti-cancer and chemo-preventive activity, allelopathic, insect repellent and anthelmintic activities; anti-protozoan and other useful bioactivities. In conclusion, this *Cymbopogon* (lemongrass) has lots of uses and biological activities that will be beneficial for a particular purpose.

After all the processes it has been described by A. R. Mohamed Hanaa, et. al (2012) and Jayasinha the color of an essential oil as to its appearance that can applied to soaps and other cosmetics is a pale and liable to slightly yellow. This was similarly almost the same as with other volatile oil. Therefore, its color is good when applied for the mixtures of some common purposive works without any change effect of the color of the other. It would be helpful to the recent research in making a laundry detergent product that uses oil extracted from plants, specifically, lemongrass which is said to be good on its perfumery use and biological content to determine its acceptability on the said product given the biological properties mentioned with natural benefits.

Shape, appearance and motion are the most important cues for analyzing human movements in visual surveillance said Lim (2009). Representation of these visual cues be rich, invariant and discriminative by presenting approaches to model and integrate them for human detection and segmentation, person identification and action recognition.

Moreover, stated by Khungum (2017) on modeling and rendering appearance of hair and textile fibers that hair is an important part of our appearance, and we wear and use clothes made from various type of fibers which are ubiquitous in our visual world. Three contributions were made- the light scattering model for human hair fibers that more accurately takes into account how light interacts with their elliptical cross sections, general powerful optimization framework for estimating parameters of a large class of appearance models from observations of real materials, which greatly simplifies development and testing of such models and a fast, precomputationsbased rendering fiber level textile models under environment illumination. In addition, facilitating the acquisition of realistic material appearance models by Lockerman (2016) stated that tools for acquiring realistic material appearance models are both have become available to anyone and have lagged behind. Demonstrated from here number tools that provide low cost methods to capture these models and particularly focusing on two different aspects of appearance: the spatial variance encoded in texture and the subsurface scattering of light within an object.

However, a framework for realistic modeling and display of object surface appearance according to Darling (2013) states that with advance in screen and video hardware technology, the type of content presented on computer has progressed from text and simple shapes to high-resolution photographs, photorealistic renderings and high definition video. She added, that a chromatic adaptation experiment was performed to evaluate color appearance in the framework and explore the factors that contribute to differences when viewing self-luminous displays as opposed to reflective objects.

It would be helpful to the recent research in making detergent product that is eye catching through the help of technologies mentioned above like in labeling and searching for designs to make it more appealing in the eyes of the target consumers.

Fisher (2017) on his commentary of Create Your Own Scent Blends for soaps and candles stated that the scent is the most compelling aspect of their handmade candles and soaps. Experiencing aromatherapies or new scent blending can create a good smell in making soaps. This would be helpful in recent research to give some idea to create a product with scent that compels a good smell.

Moreover, Sugiyama, et. al. (2015) states that fragrances also potentiate a variety of psychological states from moods to motivated behavior. Shown from the consumer research that pleasant, product-congruent scents enhance product appeal with greater emotional and cognitive involvement which perceived more positive and increase recall.

The Philippine orange taxonomy, description and agricultural aspects of sweet orange (*C. sinensi*) particularly dalandan or Philippine orange variety, stated that its scent are among the most delightful fragrance which is the citrus scent are among the most popular soap in bathing, dishwashing and in laundry.

Likewise, Jayasinha (2007) stated from her compilation about lemongrass that it has three species with similar aromatic grass that produces oil with many benefits and uses which can be used as an oil in its own right or to the isolation of its derivative citral. She said that because of its oil fragrance work on its perfumery use that can be apply for aeorol deodorants, household detergents, domestic and industrial products that need fresh, pleasant fragrance in masking unpleasant odours of some ingredients. She added, that in addition to its possessing odour 98-100% citral gives a lemon smell to soap after a month and it fades within 6 months but with the help of a group of very important synthetic aromatic called ionones it possesses a strong and lasting violet odour.

These are helpful to the recent study to have an idea about a possible natural ingredient, specifically, lemongrass to be applied in making laundry detergent product that it would have a citrus smell.

According to Hove (2010), texture is the quality of a substance in terms of how it looks or feel. It is the measure of variation of the intensity of a quantifying properties of surface such as smoothness, coarseness and regularity. In addition, stated by Bensmaia (2009), that texture is represented at the somatosensory periphery in the spatiotemporal pattern of activity in population of receptor embedded in the skin.

Most particularly, texture is derived from Latin word *textura* means “to weave” and it was first applied to certain tactile in fabrics stated by Amudhan, P.S., et. al. (2015). By analog it came to have more general meanings and was applied to other sectors including foods and other products.

However, Bourne (2015) defined texture as a group of physical characteristics that arise from the structural elements of the food that sensed primarily by the feeling of touch. It is measured objectively by functions of mass, tone, and length. According to him texture emphasizes multidimensional property comprising a number of sensory characteristics interest in what it comprises and measured.

Collins dictionary (2012) states that usefulness is defined as being able to be used advantageously, beneficially, or for several purposes and are helpful or serviceable. Moreover, according to applied psychology usefulness refers to whether a theory or a piece of research is useful, practical or applicable which describe to be one that can be accurately generalized to a wide population or the target population and benefit a number of people or causes. Cited from the book “Herbal and Bath Soap Making”, Recaforte (2011) stated the usefulness of natural ingredients available around us in making herbal soap. He also stated that “natural” refers to organic material originating, or derived from plants and animals. He added, that botanicals have been valued for medicinal purposes.

More importantly, according to Michael (2015), that there are 10 unexpected uses for both the liquid and powdered laundry detergent that can do more than cleaning clothes aside from using them wisely, here are the following: Whiten yellowed pillows, Clean up oil spills, Make your own “goop” like hand cleaners designed to remove grease while leaving hands soft without irritation, Degrease your stove, Make a good allpurpose cleaner, Kill moss and weeds, Clear a blocked drain, Clean toys safely, Spruce up the deck, and Banish soap scum.

Likewise, Cannor (2014), shared 10 Amazing Beauty Tricks stated the usefulness of coconut oil and the discovered natural beauty benefits of it for hair, skin and face. It can be used in many beauty products because of its natural antibacterial and antifungal, which is best as moisturizer described as cookie-like smell.

These literatures would be helpful in this study that gives an important input of knowledge on creating a product like liquid laundry detergent so that it will give more advantages to the target consumers in terms of its appeal, scent, texture and usefulness.

### Related Studies

A repellent Bar Soap for mosquitoes from Oregano extract was the study of Uy (2017) that sought to answer the level of acceptability in terms of texture, scent/aroma, color and efficacy. Her study is related with the present manuscript in regards to cleansing or washing product which is soap made from oregano plant extract. However, the study of Tope (2016), "By Products of Herbal Plant Bayabas-bayabasan (Akapulco) Cassia Alata" was made and produced bar soap, bath powder soap and liquid soap. The study measures the level of acceptability in terms of odor, appearance and usefulness. This is connected with the present study in regards to the utilization of plants in making cleansing product such as bar soap, bath powder and liquid soap.

Similarly, bath soap was made out of Persian Lime (*Citrusx latifolia*) studied by Lucena (2015). His work entitled, "Persian Lime (*Citrus latifolia*) Bath Soap" was conducted and evaluated to accept its level of acceptability in terms of odor, texture, appearance and microbial test, using different solutions. Zest end product appeared was described as transparent soap and looks to be neon in color.

Palmero (2011) the study of Aloe Vera Hand Sanitizer determined how aloe vera plant can be used as a hand sanitizer. The product was made with the following ingredients the aloe vera gel, grain alcohol, distilled water and different essential oils scented with lavender, peppermint, sampaguita, ylang-ylang and rose. It was done by extracting the aloe vera through peeling the leaves, slicing, straining and measuring, mixing of ingredients and dropping of essential oil. The result of the study was interpreted as very good in terms of odor, texture and soothing effect. The present study is related in terms of procedure from "Extracted organic (Madre De Cacao and Ipil-Ipil) Insecticide for Household Insects", which was developed in order to determine the effectiveness of extracted organic Madre de cacao and Ipil-ipil insecticide in eliminating household insects within the elapsed time using different solutions. The study undergone the process of washing, pounding/grinding, extracting, straining, measuring, mixing, packaging and testing. Lucena (2015) mentioned that extracted organic insecticide is effective in eliminating insects and it can be used as a substitute for commercial and expensive insecticide. Extraction method done in this study gives an idea to the present on how to extract a plant. Extraction of natural stains from plant parts of Pandan leaves, avocado seeds and red rose petals as studied by Tobias (2012) was tested and evaluated to be used as a source of dye for biological stain.

Process in preparing Graviola leaf was indicated from the study of Cana (2014) in making 3-in-1 tea powder. It was done from producing the selected graviola leaves, washing, drying, roasting, rinding, mixing of ingredients, packing and labeling of the product. This study is related with the present research considering the fact that natural material used which is the graviola leaves was made to a certain product applying the processes mentioned can also be apply in making the product of the present.

Felicita (2016) with her study entitled, "Natural Indicator" obtained the findings that the banana bract, mayana leaves, and purple camote can be a natural indicator. Among the indigenous materials she used the banana bract showed as the best indicator in terms of color stability, while mayana leaves is the most effective in terms of accuracy of color change. These materials were undergone through the process of collecting, washing, chopping, weighing, boiling or steam distillation and labeling.

Plants extracted from the leaves of atis, lemongrass and eucalyptus with the used of some oil such as lemon oil, virgin coconut oil and peppermint oil developed the study of Robale (2013) as mosquito patch repellent. This study shows the effectiveness of plants extract as mosquito patch repellent in terms of odor and time effectivity.

The process shown in this study includes extraction process and mixtures of some ingredients to form a product which related to the present.

Herbal Chalk Insect Repellent was the title of the study conducted by Palis (2016). This study investigated the effectiveness of oregano and sambong leaves extract as herbal chalk repellent. Its effectivity was tested based on the number of repelled ants within the time lapsed. Generally, the result of the study showed that plants such as oregano (*Origanum Vulgare*) and sambong (*Blumea balsamifera*) leaves can be used as good insect repellent and concluded that oregano scented chalk repelled more ants as compared to sambong and combined extract of both plants.

The study of Leonardo (2016) about Patchouli (*Pogostemon Cablin Blanco*) determined the acceptability of Patchouli oil-based products as Housefly Repellent in terms of the number of housefly repelled at a given reaction time, duration of efficiency, odor and functionality. Based from the findings showed the repellency of housefly through spatial devices using source of heat and concentrated substance which made it diffuse using source of heat and concentrated substance which made it diffuse faster and resulted to repel more houseflies.

Buensalida (2016) on her study, "Insecticidal Activities of Turmeric (*Luyang Dilaw*), *Curcuma Longa L.* (Zingiberaceae) and Holy Basil (*Sulasi*), *Ocimum Sanctum L.* (Lamiaceae) Extracts" that the turmeric extract is effective in killing larvae of ACB and TAW and was found out high as 100% concentrate. Findings from her study that turmeric and holy basil plants extracts are said to be effective organic pesticide.

Furtherly stated from the study Gamboa (2015), on the Efficacy of *Anona Squamosa* (atis) and *Gliricidia Seprum* (Madre cacao) Larvicide was conducted and determined that the product made is effective that shows high mortality rate.

Organic substance such as garlic (*Allium Sativum*) into mosquito repellent by Delos Reyes (2015), determined its effectiveness in repelling insects. This was done through experimental approach in producing a product from organic/herbal substance in terms of odor and appearance

The relation of these studies with the present study is the effectivity of plants extract in application to be a substance of the product to be produce or made other than the possibility to kill insects.

The above-mentioned studies were classified according to product, process and materials, hence, they are interrelated as to gather information to be use in developing the present study.

Gaceta (2014), studied about "Calamansi Peel as Mosquito Repellent" which revealed accepted in terms of its appearances, odor, shelf-life and repelling ability after it was evaluated and tested by the respondents. Likewise, Dela Cruz (2014), in his study "Pizza Crust Ala Ampalaya" which shows the level of acceptability in terms of appearance and aroma which was rated as highly accepted.

Appearance, aroma, taste and texture was determined highly acceptable stated from the study of Mercado (2015), entitled "Spicy Kundol (*benicasia hispida*) Marmalade and was also determined the methods and proximate analysis making the product. Similarly, Fernandez (2014) aimed to determine the acceptability of lemongrass oil as air disinfectant. Analysis furtherly revealed that there were no significant differences between the ratings given by the two groups of respondents on the acceptability of the product in relation to its appearance and odor.

Furthermore, a thesis studied by Gu (2010), stated that time-varying appearance lot a variety of natural phenomena- opaque surfaces, transparent surfaces and participating media- using captured data. This is by many natural phenomena evolve over time- often coupled with a change in their reflectance and geometry and give rise to dramatic effects in their visual appearance. Derived a physically-based analytic reflectance model for recreating the weathered appearance in real time and developed single-image based methods to measure contaminant texture patterns from real examples.

An experimental method of research which determined the acceptability of the finished product in terms of scent was conducted by Uy (2017) entitled, "Oregano Extract as Repellant Bar Soap for Mosquitoes". This study was related to the present in relating to its finished product's acceptability in terms of scent/aroma on how it smelled as evaluated by the respondents.

Likewise, effectivity in terms of odor/scent was showed in the study of Robale (2013) which was came from extracted leaves of atis, lemongrass and eucalyptus using some oil such as lemon oil, virgin coconut oil and peppermint oil. In addition, Ludden, et. al. (2014) showed from their experiment the attempt to influence how a product is experienced that can manipulate all aspects including odor. From the 2 experiments made it shows the differences in people's reactions to congruent and incongruent odors of products that has a normal odor (e.g. lemons) and those that do not have an odor (e.g. kitchen paper holder) which were found surprising and evaluated as moderately positive. Participants' comments suggest that odors do play a role in their evaluations.

Texture plays a major role in the human visual system for image understanding and object recognition and its found, to some degree, in all natural images stated from the study of Shafer (2012). His study explores texture representation in general and texture feature extraction methods for image retrieval. Three texture representation in the spatial-frequency and sparse domains were discussed and implemented to extract feature vectors from texture images. The results show that the spare image retrieval method performed favorably but has room for improvement in both performance and complexity.

In addition, Griffin (2016) on his study, "Quality Guided Variable Bit Rate Texture Compression", states that there is a rendering use of texture mapping to meet both quality and time constraints which maps 2D textures compression optimization made that minimizes the bitrate of compressed textures while maximizing the quality of final rendered images. Guided texture compression will help with the scalability problem for optimizing texture compression in real-world scenarios. However, Lucena (2015) on his study was conducted and evaluated the level of acceptability of Persian lime (*Citrus latifolia*) in terms of texture, odor and appearance using different solutions and found to be acceptable. Its zest has been described as transparent and looks to be neon in color.

On that regard, Malinawan (2009) states that there is another herbal soap that can be made through guava leaves and it is accepted in terms of odor, texture and effectiveness and can be substituted to another branded soap.

Malinawan (2009) states that there is another herbal soap that can be made through guava leaves and it is accepted in terms of odor, texture and effectiveness and can be substituted to another branded soap.

Develop a classifier that can reliably and accurately discriminate among a large number of different natural-surfaces in color images using only general-purpose color and texture features is the objective of the study of Ko (2008). He stated that the general-purpose color and texture features are those which exhibit the least sensitivity to illumination and viewpoint variation in a broad range of applications for which color and textures are a reasonable basis for classification.

Originality and usefulness was determined its level of acceptability as pineapple peel bar and liquid soap was studied by Kalacas (2010). Stated from her that there was a significant difference on the ratings of given teenagers, housewives and faculty on the level of acceptability of pineapple peel bar soap and there was no significant difference on the ratings given by the same respondents on the pineapple peel liquid soap.

Furthermore, Gafour, et. al. (2015) studied about soap production using a mixture of moringa leaves and olive oil. Stated in this study that we can prepare soap using moringa leaves by ourselves which also revealed in here the results that the leaves of moringa is rich in potassium while olive oil and soda on the other hand is good in foaming, emulsifying, wetting and has detergent properties.

Lastly, revealed from the study on the effectiveness of oregano and sambong leaves extract as herbal chalk repellent was tested based on the number of repelled ants within the time lapsed. Generally, the result of the study showed that plants such as oregano (*Origanum vulgare*) and sambong (*Blumea balsamifera*) leaves can be used as good insect repellent as stated by Palis (2016).

The above-mentioned studies are related to the present study with regard to the natural ingredients used in making the output product together with the acceptability tested in terms of appearance, scent, texture and usefulness similar with the output product made in this study and the sensory qualities tested.

### Research Hypothesis

There is no significant difference on the acceptability of laundry detergent product using lemongrass and the acceptability of branded commercial detergent product as evaluated by Family members such as Housewife, Father, Children, and House helper and Business Owners.

### Conceptual Framework

The conceptual paradigm of this study illustrates the finished product made, and its acceptability. Frame 1- This frame represents the independent variable that shows the product made in the study which is the lemongrass (*cymbopogon citratus*) laundry detergent such as the liquid laundry detergent and the fabric softener. The biocharacteristics of it and the shared knowledge and experience gained from others by the researcher creates on her mind to utilize lemongrass into a product.

The product was made for the purpose of washing the laundry and as a softener that gives lasting lemongrass smell to textiles. The methods and process includes preparing, measuring, boiling, stirring/soaking, mixing, curing, packing, labeling, laboratory testing, main product revision and evaluation. Frame 2- This shows the dependent variable that states the acceptability of the Laundry Detergent Product in terms of appearance, scent, texture and usefulness.

### LEMONGRASS (CYMBOPOGON CITRATUS) INTO LAUNDRY DETERGENT PRODUCT

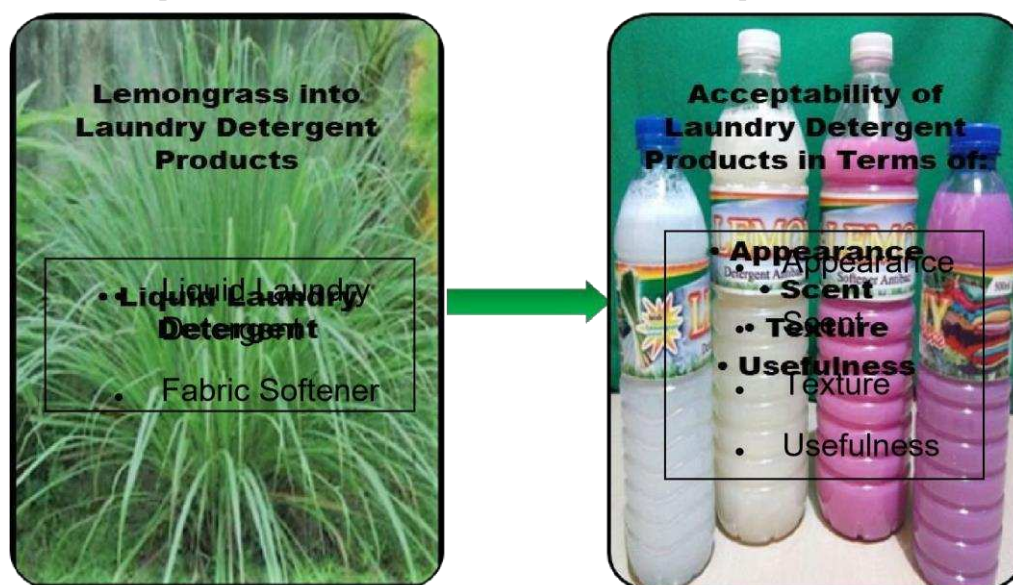


Figure 1. Research Paradigm of the Study

**Research Design** Chaplin states that experimental method is “the technique of discovering information by means of experimentation”. It is to reveal expectedly the causal relations dealing with dynamics, interaction, forces and simply not intended to give descriptive picture of states or change.

Descriptive research is defined by Best as “concerned with conditions of relationships that exists, practices that prevail, beliefs and processes that are going on, effects that are being felt, or trends that are developing. It goes beyond mere gathering and tabulation of what is described. Thus, it often combines with comparison and contrast involving measurements, classifications, interpretation and evaluation.

Though in its entirety this research is experimental in design, the evaluation is descriptive to determine the acceptability of Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product with 5 Likert scale of alternative ratings, such as: Very Strongly Acceptable, Strongly Acceptable, Acceptable, Moderately Acceptable and Less Acceptable interpreted as Very high, High, Moderate High and very Low respectively so valid and accurate conclusion that was drawn based on the findings get.

### Respondents of the Study

The researcher tested Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product. The products were evaluated by 30 family members (Housewife, Father, Children, Househelp) of Brgy. Bagumbayan, Sta. Cruz, Laguna and 10 Business Owners of the said municipality.

The finished product produced from the adapted method are subject for acceptability test and analysis on sensory qualities such as appearance, scent, texture and usefulness.

### Sampling Technique

The parameter of the study is forty (40) as the basis for the sampling procedure wherein subjects were taken as the actual respondents which consists of (30) family members in Barangay Bagumbayan Santa Cruz, Laguna and 10 business owners of the said municipality to determine the acceptability of the Laundry Detergent Product that was made from lemongrass in terms of the following sensory qualities such as appearance, scent, texture and usefulness.

### Data Gathering Procedure

The researcher looked first for the problem and made the preliminary research. The introduction of the problem was gathered, the location involved and the respondents of the study were determined. The related literatures and studies gave the baseline information for the study. Preparing of supplies and materials, tools and equipment needed for the preparation of the product. Developing the preliminary form of the product. The laboratory testing was done and analyzed. Next, the evaluation of product was done by the respondents. Gathering of the ratings to be tabulated and treated with the appropriate statistical formulae.

**Table 1. The Materials and their Functions in making Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent**

Materials	Functions
Lemongrass (essential oi)	Main ingredient (antibacterial and scenter)
Borax	Cleansing agent
Super Washing soda	Bubbling agent
Distilled Water	Solvent

Castile Shreds	Thickener
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The table shows that as per material used in making Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent their functions serve as an important part for its purpose as a detergent such as the following: Lemongrass essential oil as the main ingredient that serve as the natural antibacterial and scenter of the product, Borax as cleansing agent, Super Washing Soda as the bubbling agent, Distilled Water as solvent, Castile Shreds as the thickener, Ethyl Alcohol as surfactant, Softener Beads as the softening agent, Sodium Benzoate as the preservative and Scent Retainer to retain the smells of lemongrass into the product.

**Table 2. The Tools, Equipment and their Functions in Making Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent**

Tools and Equipment	Functions
Basin (Stainless Steel)	Container where the materials are mix
5 gal. Empty Container	Container to be used after the products are mixed
Small Bowl	A round dish that will be used for serving
Weighing Scale	Use for weighing the desired amount of the ingredients
Mixing Bowl	Use for mixing ingredient
Wooden Spoon	Use for blending
Funnel	Use for transferring mixture in the container
Empty Bottle container	As container for the finish liquid detergent product
Measuring Cups	For measuring of materials

The table shows that as per tools and equipment used in making Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent their functions serve as an important part to made a detergent such as the following: Basin used as a container for mixing dry ingredients, a 5-galon empty container used for mixing all the ingredients needed and curing process, Small bowls used as a dish where to set aside the prepared ingredients, Weighing Scale used for weighing dry ingredients on its set amount, Wooden Spoon used for blending and mixing the ingredients, Funnel used for transferring the finished product to empty bottle containers, Empty Bottle Containers used as a container where the liquid detergent set aside, Measuring Cups used for measuring dry and liquid ingredients accurately.

**Table 3. The Materials and their Functions in making Lemongrass (Cymbopogon Citratus) Fabric Softener**

Materials	Functions
Lemongrass (essential oi)	Main ingredient (antibacterial and scenter)
Purified Water	Solvent
Ethyl Alcohol	Surfactant
Softener Beads	Softening Agent
Sodium Benzoate	Preservative
Scent Retainer	Scent Retainer
Anti-foam	Prevent Foaming Activity

The table shows that as per material used in making Lemongrass (Cymbopogon Citratus) Fabric Softener their functions serve as an important part for its purpose as a detergent such as the following: Lemongrass essential oil as the main ingredient that serve as the natural antibacterial and scenter of the product, Purified Water as solvent, Ethyl Alcohol as surfactant, Softener Beads as the softening agent, Sodium Benzoate as the preservative and Scent Retainer to retain the smells of lemongrass into the product and Anti-foam used to prevent any foaming activity in the softener.

**Table 4. Tools, Equipment and their Functions in making Lemongrass (Cymbopogon Citratus) Fabric Softener**

Tools and Equipment	Functions
Basin (Stainless Steel)	Container where the materials are mix
Small Bowl	A round dish that will be used for serving
Weighing Scale	Use for weighing the desired amount of the ingredients
Mixing Bowl	Use for mixing ingredient
Wooden Spoon	Use for blending
Funnel	Use for transferring mixture in the container
Empty Plastic Bottle container	As container for the finish liquid detergent product

Measuring Cups	For measuring of materials
Pale	Container used to put the finished product while in curing process

The table shows that as per tools and equipment used in making Lemongrass (*Cymbopogon Citratus*) Softener their functions serve as an important part to made a detergent such as the following: Basin used as a container for mixing dry ingredients, Small bowls used as a dish where to set aside the prepared ingredients, Weighing Scale used for weighing dry ingredients on its set amount, Mixing Bowl used for mixing the ingredients, Wooden Spoon used for blending and mixing the ingredients, Funnel used for transferring the finished product to empty bottle containers, Empty Bottle Containers used as a container where the liquid detergent set aside, Measuring Cups used for measuring dry and liquid ingredients accurately and Pale used as a container where to put mixed ingredients and do the curing process.

#### **Production Procedure A. Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent**

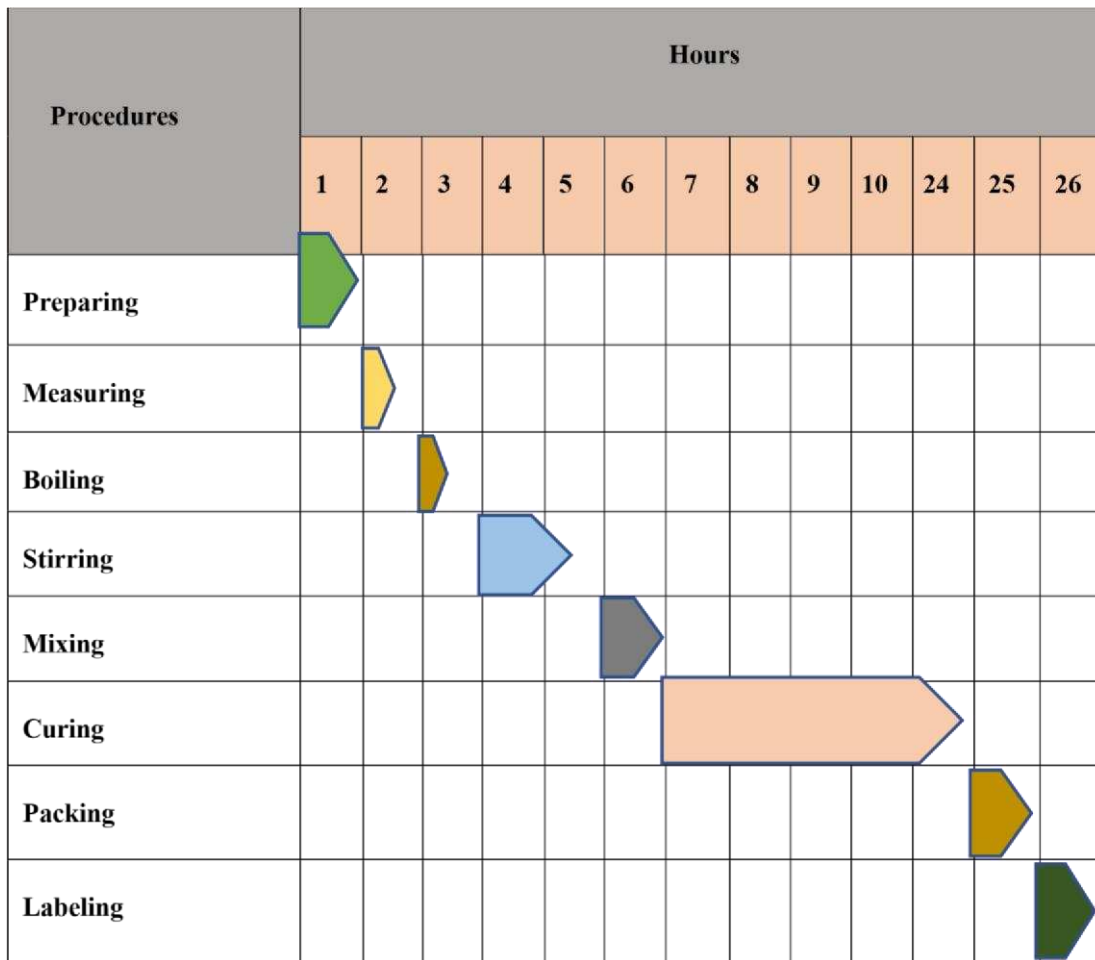
Procedure in making liquid laundry detergent are: The collection of lemongrass, washing, cutting into pieces and do the distillation process for oil extraction. Next, preparation of tools and materials or ingredients needed. Measure the ingredients and check the quality of the materials. After the preparations of ingredients and tools to be used procedure in making Liquid Laundry Detergent are followed accordingly: 1. Add the castile shreds to a pot with four (4) cups of hot water. Put the heat on medium-high and stir until completely melted-about 10 minutes.

2. Fill up a 5-gallon bucket halfway with hot water.
3. Pour in the melted soap mixture and give it a quick stir.
4. Stir in the borax and washing soda.
5. Then, add essential oil in ½ oz. to 1 oz. depending on how it scented.
6. Fill up the bucket with warm water, all the way to the top- and stir again.
7. Snap on the lid and let it sit for 24 hours to gel it up.
8. After curing process mix it well and transfer the mixture to the empty bottle containers through the use of funnel for ease of transferring.
9. Label the detergent product.

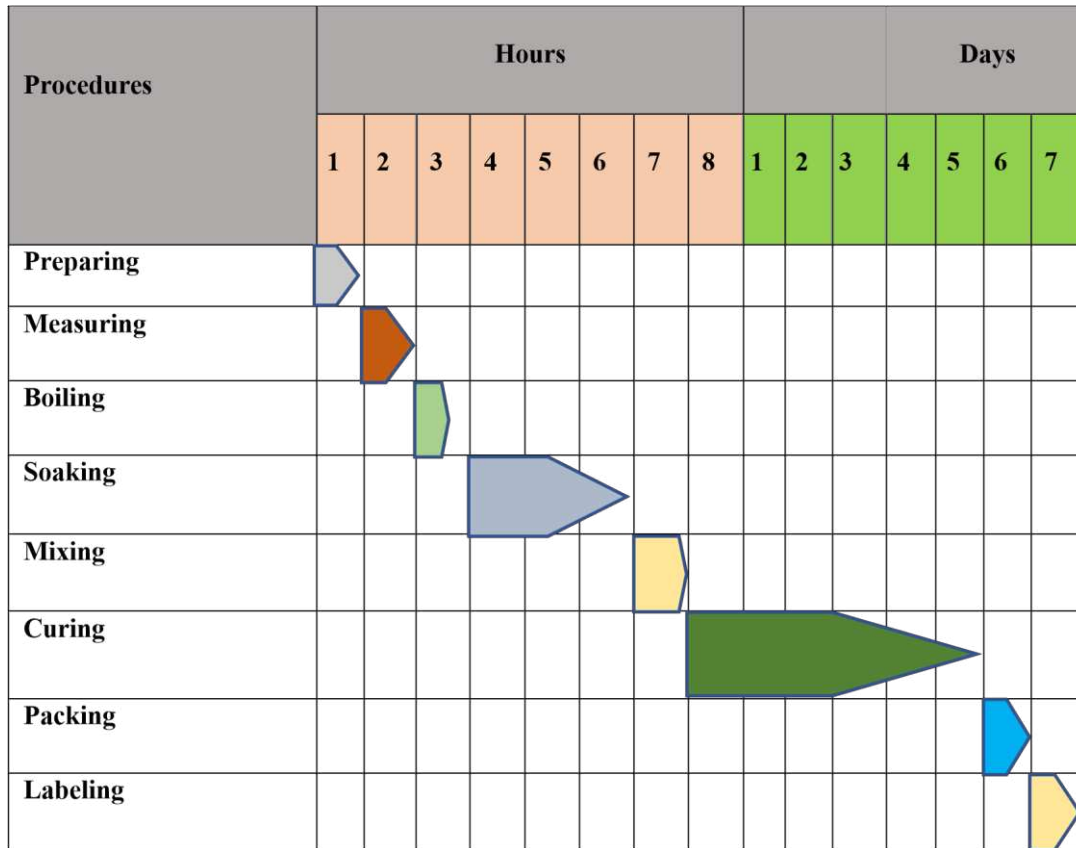
#### **B. Lemongrass (*Cymbopogon Citratus*) Fabric Softener**

After tools needed were prepared and ingredients measured, procedure in making Lemongrass (*Cymbopogon Citratus*) Fabric Softener are to be followed accordingly:

1. Dissolve or soak softener beads and sodium benzoate in 500 ml purified water.
2. Mix it well until softener beads is fully dissolved.
3. Add the colorant, stir then add the remaining water.
4. Set aside the mixture and let it cool before adding the lemongrass as fragrance.
5. Lastly, add the scent retainer but not required. Let it cure 3 to 5 days. After curing time stir the mixture then repack.

**Production Time Frame****Table 5. The projected Time Bar Graph in Preparing Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent**

The table shows the activities done in order to make Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent. The activities consist of preparation of raw materials and utensils, measuring, boiling, stirring, mixing, curing, packing and labeling. It took approximately 2 to 3 days to achieve the Lemongrass (Cymbopogon Citratus) Laundry Liquid Detergent.

**Table 6. Projected Time Bar Graph in Preparing Lemongrass (Cymbopogon Citratus) Fabric Softener**

The table shows the activities done in order to make Lemongrass (Cymbopogon Citratus) Fabric Softener. It also consists of the time consumed while making the product with the following activities which were consisted of the following such as preparation of raw materials and utensils, measuring, boiling, soaking/dissolving, mixing, curing, packing and labeling that were applied to go on with the finished product. It took approximately 6 to 7 days to achieve the Lemongrass (Cymbopogon Citratus) Fabric Softener.

#### Cost of Production

The following are the cost analysis made to find out if the experiment product would meet the economic minimum cost..

**Table 7. Cost Analysis of Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent**

Qty	Unit	Description	Unit Cost	Total Cost
1	Cup	Borax	P9	P9

1	Cup	Super Washing Soda	P12	P12
5.5	Oz.	Castile Shreds	P10	P10
10	ml	Lemongrass (essential oil)	P20	P20
4	Cups	Hot Water	Free	Free
5	Gal.	Warm Water	P25	P25

**P76****Yields: 19L****Price/Liter: P106.4**

The table presents the total expense in making the liquid laundry detergent, the products yield and price per Liter including the less expense ingredients and material used. It shows that the products yield was 19 liters with the total expense of 76 pesos and the price per liter would be 106 pesos and 4 centavos given from the sum of the total expense and its 40% as labor.

**Table 8. Cost Analysis of Lemongrass (Cymbopogon Citratus) Fabric Softener**

Qty	Unit	Description	Unit Cost	Total Cost
100	Grams	Softener Beads	P28	P28
1	Liter	Purified/De-ionized Water	P5	P5
1/4	Cup	Sodium Benzoate	P3	P3
Desired Amount		Colorant	P5	P5
5	ml	Lemongrass (essential oil)	P20	P20
10	ml	Ethyl Alcohol	.28centavo	.28centavo
5	ml	Scent Retainer	P24	P24

**P85.28****Yield/s: 1L****Price/Liter: P119.4**

Table reveals the itemized quantity, unit, item description and cost of the materials used in preparation of Lemongrass (Cymbopogon Citratus) Fabric Softener. It also displays the total expense and yield of each product. It shows that the products yield was 1 liter with the total expense of 85 pesos and 28 centavos and the price per liter would be 119 pesos and 4 centavos given from the sum of the total expense and its 40% as labor.

## Research Instrument

The researcher used a survey questionnaire in a printed form to gather information distributed to and filled out by the respondents.

A research-made questionnaire was employed as part of the instrument in gathering the data. It consists of two parts: 1) the personal data sheet which includes the Profile of the Respondents (optional) and the type of respondent being as Family Member (housewife, father, children, househelp) and Business Owner; 2) the evaluation data sheet wherein the respondents evaluate the liquid laundry detergent and fabric softener with regards to its acceptability in terms of appearance, scent, texture and usefulness from the given response categories as follows: 5 – Very Strongly Acceptable, 4 – Strongly Acceptable, 3 – Acceptable, 2 – Moderately Acceptable, and 1 – less Acceptable.

On the last part a space provided for any comments and recommendations to be given by the respondents for the enhancement of the laundry detergent product for the benefits of the target consumers itself.

A review of literature and studies on structural materials, preparation from various books, theses, dissertations and consultations from experts were done. These served as references on the construction of questionnaire used in the evaluation of the experimented lemongrass liquid laundry detergent product. Based from the gathered information an initial draft of research tool was prepared and presented to the experts and coteachers for comments and recommendations.

Revision of the instruments was considered in order to incorporate the suggestions provided by the mentioned individuals. The evaluation tool underwent face and content validated.

## Statistical Treatment

In order to establish the level of acceptability of Lemongrass into Laundry Detergent Product in terms of appearance, scent, texture and usefulness the weighted mean statistic were used. This was obtained by dividing the sum of the responses by the total number of items under each criterion. A range were set up to determine the level of acceptability of the product.

F-ratio was employed to determine the significant difference in the rating given by the group of respondents perceive by the Family Members fo Brgy. Bagumbayan, Sta Cruz, Laguna and Business Owners of the same Municipality.

## The Ingredients Used in Making Laundry Detergent Product

Figure 2 reveals the ingredients used in making lemongrass (*cymbopogon citratus*) laundry detergent product (the liquid laundry detergent and fabric softener).



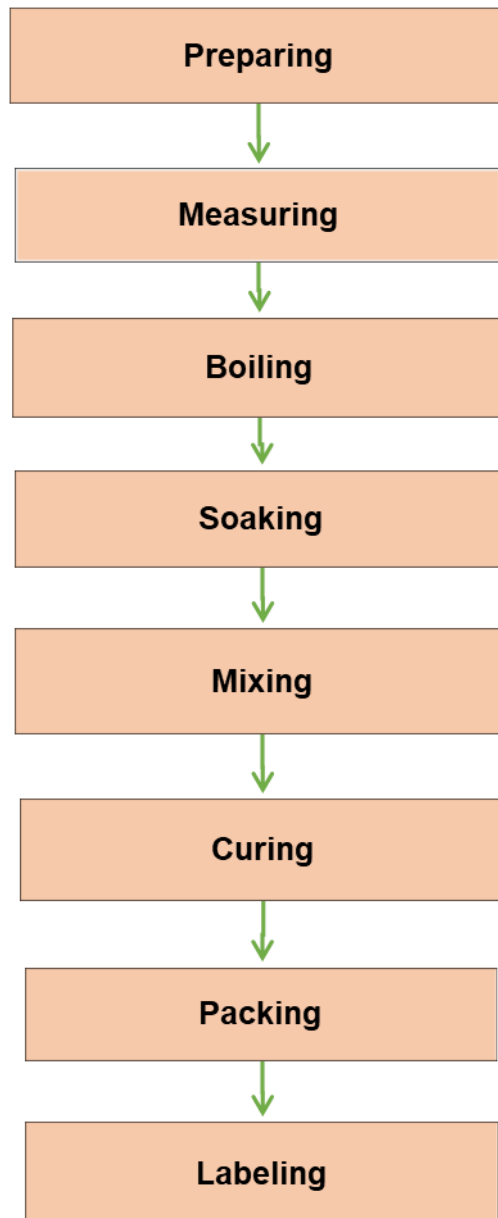
**Figure 2. List of Ingredients in Making Laundry Detergent Product Process of Preparation of Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent**

Figure 3 reveals the step by step procedure in making lemongrass (cymbopogon citratus) liquid laundry detergent such as preparing, measuring, boiling, stirring, mixing, curing, packing and labeling.



**Figure 3. Flow Chart in the Preparation of Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent Process of Preparation of Lemongrass (Cymbopogon Citratus) Fabric Softener**

Figure 4 reveals the step by step procedure in making lemongrass (*cymbopogon citratus*) fabric softener such as preparing, measuring, boiling, soaking, mixing, curing, packing and labeling.



**Figure 4. Flow Chart in the Preparation of Lemongrass (*Cymbopogon Citratus*) Fabric Softener.**

## Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent in Terms of Sensory Qualities

**Table 9. The Level of acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent in Terms of Appearance.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. product is appealing to the eye.	4.30	0.675	VSA	4.23	0.504	VSA
2. product general look good.	4.60	0.516	VSA	4.77	0.430	VSA
3. color, shape and size direct thoughts towards buying the product	4.70	0.483	VSA	4.73	0.450	VSA
4. give off a stronger expression that attract more consumers	4.30	0.949	VSA	4.60	0.675	VSA
<b>Total weighted mean</b>	<b>4.48</b>	<b>VSA</b>		<b>4.58</b>	<b>VSA</b>	
<b>Overall mean</b>	<b>4.53</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of the lemongrass liquid laundry detergent in terms of appearance is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	- Very Low

The table reveals that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of its appeal to the eye as rated by business owners (M=4.30, SD=0.675) and family members (M=4.23, SD=0.504). It was rated very strongly acceptable in terms of general looks rated by business owners (M=4.60, SD=0.516) and family members (M=4.77, SD=0.430); color, shape and size direct thought towards

buying the product rated by business owners ( $M=4.70$ ,  $SD=0.483$ ) and family members ( $M=4.73$ ,  $SD=0.450$ ) and its stronger expression that attract more consumers rated by business owners ( $M=4.30$ ,  $SD=0.949$ ) and family members ( $M=4.60$ ,  $SD=0.675$ ). The result of the table indicates that the level of acceptability of lemongrass (*cymbopogon citratus*) liquid laundry detergent as to appearance is very high to the business owners and family members as shown by the total weighted mean of 4.48 and 4.58 respectively with an overall mean of 4.53. Appearance, aroma, taste and texture was determined as highly acceptable stated from the study of Mercado (2015), which was determined through the methods and proximate analysis done **Liquid Laundry Detergent Table 10. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) in Terms of Scent.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. has pleasant odor.	4.80	0.422	VSA	4.73	0.450	VSA
2. the aroma is very appealing.	5.00	0.000	VSA	4.73	0.521	VSA
3. the smell is refreshing and stimulating.	5.00	0.000	VSA	4.87	0.346	VSA
4. the aroma increase intension to buy the product.	4.90	0.316	VSA	4.70	0.466	VSA
<b>Total weighted mean</b>	<b>4.93</b>	<b>VSA</b>		<b>4.76</b>	<b>VSA</b>	
<b>Overall mean</b>	<b>4.845</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of the lemongrass liquid laundry detergent in terms of scent is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	- Very Low

The table shows that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of its pleasant odor as rated by business owners ( $M=4.80$ ,  $SD=0.422$ ) and family members ( $M=4.73$ ,  $SD=0.450$ ). It was rated very strongly acceptable in terms of aroma as rated by business owners ( $M=5.00$ ,  $SD=0.00$ ) and family members ( $M=4.73$ ,  $SD=0.521$ ); so as the smell is refreshing and stimulating and the aroma that increase intention to buy the product. The result of the table indicates that the level of acceptability of the lemongrass (*cymbopogon citratus*) liquid laundry detergent as to its scent is very high to the business owners and family members as shown by the total weighted means of 4.93 and 4.76 respectively with an overall mean of 4.845. Odors do play a role on the evaluations of the participants from the experiments made by Ludden, et.al (2014) on how odor attempts to influence how a product is experienced that can manipulate all aspects which were found surprising.

### Liquid Laundry Detergent

**Table 11. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) in Terms of Texture.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. is smooth in hands.	4.90	0.316	VSA	4.70	0.466	VSA
2. achieve its desire as liquid laundry detergent in texture.	4.50	0.527	VSA	4.37	0.490	VSA
3. is even.	4.60	0.516	VSA	4.53	0.507	VSA
4. has commonly the same texture of the branded commercial liquid laundry detergent.	4.40	0.516	VSA	4.40	0.675	VSA
<b>Total weighted mean</b>	<b>4.60</b>	<b>VSA</b>		<b>4.50</b>	<b>VSA</b>	
<b>Overall mean</b>	<b>4.55</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of the lemongrass liquid laundry detergent in terms of texture is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	- Very Low

The table reveals that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of its smoothness in the hands as rated by business owners ( $M=4.90$ ,  $SD=0.316$ ) and family members ( $M=4.70$ ,  $SD=0.466$ ). It was rated very strongly acceptable in achieving its desire as liquid laundry detergent in texture as rated by business owners ( $M=4.50$ ,  $SD=0.527$ ) and family members ( $M=4.37$ ,  $SD=0.490$ ); its being even rated by business owners ( $M=4.60$ ,  $SD=0.516$ ) and family members ( $M=4.53$ , **Liquid Laundry Detergent**  $SD=0.507$ ); and has commonly the same texture of the branded commercial liquid laundry detergent rated by business owners ( $M=4.40$ ,  $SD=0.516$ ) and family members ( $M=4.40$ ,  $SD=0.675$ ). The result of the table indicates that the level of acceptability of lemongrass (*cymbopogon citratus*) liquid laundry detergent as to texture is very high to the business owners and family members as shown by the total weighted mean of 4.60 and 4.50 respectively with an overall mean of 4.55. The study of Malinawan (2009) herbal soap made from guava leaves determined its acceptability which was interpreted as very strongly acceptable in terms of odor, texture and effectiveness

**Table 12. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) in Terms of Usefulness.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. use advantageously for laundry purposes.	4.60	0.516	VSA	4.80	0.407	VSA
2. useful to wash-up blemish and dirt in clothing.	4.70	0.483	VSA	4.70	0.466	VSA
3. is suitable as laundry detergent product.	4.80	0.422	VSA	4.83	0.379	VSA
4. makes the textile clean and fresh.	4.40	0.843	VSA	4.37	0.718	VSA
<b>Total weighted mean</b>	<b>4.63</b>	<b>VSA</b>		<b>4.68</b>	<b>VSA</b>	
<b>Overall mean</b>	<b>4.655</b>					

<b>Overall Interpretation</b>	<b>The level of acceptability of the lemongrass liquid laundry detergent in terms of usefulness very high</b>
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**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	- Very Low

The table states that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of usefulness for laundry purposes as rated by business owners ( $M=4.60$ ,  $SD=0.516$ ) and **Liquid Laundry Detergent** family members ( $M=4.80$ ,  $SD=0.407$ ). It was rated very strongly acceptable in terms of usefulness to wash-up blemish and dirt in clothing as rated by business owners ( $M=4.70$ ,  $SD=0.483$ ) and family members ( $M=4.70$ ,  $SD=0.466$ ); its being suitable as laundry detergent product as rated by business owners ( $M=4.80$ ,  $SD=0.422$ ) and family members ( $M=4.83$ ,  $SD=0.379$ ); and makes the textile clean and fresh as rated by business owners ( $M=4.40$ ,  $SD=0.843$ ) and family members ( $M=4.37$ ,  $SD=0.718$ ). The total weighted means suggest that the level of acceptability of lemongrass (*cymbopogon citratus*) liquid laundry detergent in terms of usefulness is very high to the business owners and family members as shown by the overall mean of 4.63 and 4.68, respectively with an overall mean of 4.655. Likewise, the study of Kalacas (2010), Pineapple Peel Bar and Liquid Soap was determined its level of acceptability which was interpreted as very high in terms of originality and usefulness. **Composite Table of Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent**

**Table 13. The Difference on the Ratings of the Business Owners and Family Members on the Acceptability of the Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent**

Indicators	Mean		t-value	p-value	Analysis
	Business owners	Family members			
Appearance	4.48	4.58	-0.820	0.417	Not significant
Scent	4.93	4.76	1.489	0.145	Not significant

Texture	4.60	4.50	0.661	0.513	Not significant
Usefulness	4.63	4.68	-0.324	0.748	Not significant

Table shows that there were no significant differences on the ratings given by the business owners and family members on the acceptability of the liquid laundry detergent product in terms of appearance ( $t=-0.820$ ,  $p=0.417$ ), scent ( $t=1.489$ ,  $p=0.145$ ), texture ( $t=0.661$ ,  $p=0.513$ ), and usefulness ( $t=-0.324$ ,  $p=0.748$ ). Two groups of respondents the business owners and family members respectively find the appearance, scent, texture, and usefulness almost the same for the reason that its lemongrass content determined the possibility to use it as sanitizing detergent based on natural products for elimination of some microbial elements as from the study of Millezi, et.al (2011) on which it is best for its use as to washing. The color of the extracted lemongrass oil is pale and slightly yellow similarly characterized with other types of oil therefore is good for the mixtures to apply on without any change effect of the color of the other as described it by Hanaa, et. al (2012).

**Table 14. Difference on the Ratings of the Business Owners on the Acceptability of the Lemongrass (Cymbopogon Citratus) Liquid Laundry Detergent Product and Commercially Branded Laundry Detergent**

Indicators	Mean		t-value	p-value	Analysis
	Laundry detergent	Commercial brand			
Appearance	4.48	4.63	-0.907	0.376	Not significant
Scent	4.93	4.85	1.116	0.279	Not significant
Texture	4.60	4.58	0.124	0.903	Not significant
Usefulness	4.63	4.73	-0.478	0.639	Not significant

The table shows that there were no significant differences on the ratings given by the business owners on the acceptability of the lemongrass (*cymbopogon citratus*) liquid laundry detergent product and commercially branded laundry detergent in terms of appearance ( $t=-0.907$ ,  $p=0.376$ ), scent ( $t=1.116$ ,  $p=0.279$ ), texture ( $t=0.124$ ,  $p=0.903$ ), and usefulness ( $t=-0.478$ ,  $p=0.639$ ). It shows that the liquid laundry detergent made from lemongrass is almost similar in terms of its sensory qualities compared to the commercially branded laundry detergent.

#### Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener in Terms of Sensory Qualities

**Table 15. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener in Terms of Appearance.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. product is appealing to the eye.	5.00	0.000	VSA	4.90	0.305	VSA
5. product general look good.	4.80	0.422	VSA	4.83	0.379	VSA
6. color, shape and size direct thoughts towards buying the product	4.90	0.316	VSA	4.87	0.346	VSA
7. give off a stronger expression that attract more consumers	4.80	0.422	VSA	4.93	0.254	VSA
<b>Total weighted mean</b>	<b>4.88</b>		<b>VSA</b>	<b>4.88</b>		<b>VSA</b>
<b>Overall mean</b>	<b>4.88</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of lemongrass fabric softener in terms of appearance is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	- Very Low

The table reveals that the lemongrass (*cymbopogon citratus*) fabric softener was very strongly acceptable in terms of its appeal to the eye as rated by business owners ( $M=5.00$ ,  $SD=0.000$ ) and family members ( $M=4.90$ ,  $SD=0.305$ ). It was rated very strongly acceptable in terms of general looks rated by business owners ( $M=4.80$ ,  $SD=0.422$ ) and family members ( $M=4.83$ ,  $SD=0.379$ ); color, shape and size direct thought towards buying the product rated by business owners ( $M=4.90$ ,  $SD=0.316$ ) and family members ( $M=4.87$ ,  $SD=0.346$ ) and its stronger expression that attract more consumers rated by business owners ( $M=4.80$ ,  $SD=0.422$ ) and family members ( $M=4.93$ ,  $SD=0.254$ )

The total weighted means suggest that the appearance of the lemongrass (*cymbopogon citratus*) liquid laundry detergent is very strongly acceptable to the business owners and family members as shown by the overall mean of 4.88 and 4.88 respectively which was interpreted to as very high with an overall mean of 4.88.

**Table 16. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener in Terms of Scent.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. has pleasant odor.	4.70	0.483	VSA	4.50	0.509	VSA
2. the aroma is very appealing.	4.90	0.316	VSA	4.67	0.661	VSA
3. the smell is refreshing and stimulating.	4.90	0.316	VSA	4.67	0.661	VSA
3. the aroma increase intension to buy the product.	4.90	0.316	VSA	4.77	0.430	VSA
<b>Total weighted mean</b>	<b>4.85</b>		<b>VSA</b>	<b>4.65</b>		<b>VSA</b>
<b>Overall mean</b>	<b>4.75</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of lemongrass fabric softener in terms of scent is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High

1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	-Very Low

The total weighted means suggest that the appearance of the lemongrass (*cymbopogon citratus*) liquid laundry detergent is very strongly acceptable to the business owners and family members as shown by the overall mean of 4.88 and 4.88 respectively which was interpreted to as very high with an overall mean of 4.88. rated by business owners (M=4.70, SD=0.483) and family members (M=4.50, SD=0.509). It was rated very strongly acceptable in terms of aroma as rated by business owners (M=4.90, SD=0.316) and family members (M=4.67, SD=0.661); so as the smell is refreshing and stimulating and the aroma that increase intention to buy the product. The total weighted means suggest that the scent of the lemongrass (*cymbopogon citratus*) liquid laundry detergent is very strongly acceptable to the business owners and family members as shown by the overall mean of 4.85 and 4.65, respectively which was interpreted as very high with an overall mean of 4.75.

**Table 17. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener in Terms of Texture.**

The fabric softener ...	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1. is smooth in hands.	4.90	0.316	VSA	4.40	0.814	VSA
2. achieve its desire as fabric softener in texture.	4.60	0.516	VSA	4.60	0.498	VSA
3. is even.	4.60	0.516	VSA	4.37	0.669	VSA
4. has commonly the same texture	4.70	0.483	VSA	4.50	0.682	VSA
of the branded commercial fabric softener						
<b>Total weighted mean</b>	<b>4.70</b>	<b>VSA</b>		<b>4.47</b>	<b>VSA</b>	
<b>Overall mean</b>	<b>4.585</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of lemongrass fabric softener in terms of texture is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High
3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	-Very Low

The table reveals that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of its smoothness in the hands as rated by business owners (M=4.90, SD=0.316) and family members (M=4.40, SD=0.814). It was rated very strongly acceptable in achieving its desire as liquid laundry detergent in texture as rated by business owners (M=4.60, SD=0.516) and family members (M=4.60, SD=0.498); its being even rated by business owners (M=4.60, SD=0.516) and family members (M=4.37,

SD=0.669); and has commonly the same texture of the branded commercial liquid laundry detergent rated by business owners (M=4.70, SD=0.483 and family members (M=4.50, SD=0.682).

The total weighted means suggest that the texture of the lemongrass (*cymbopogon citratus*) liquid laundry detergent is very strongly acceptable to the business owners and family members as shown by the overall mean of 4.70 and 4.47 respectively which was interpreted as very high with an overall mean of 4.585.

**Table 18. The Level of Acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener in Terms of Usefulness.**

Indicative Statement	Business owners			Family members		
	Wt. Mean	S.D.	V. I.	Wt. Mean	S.D.	V. I.
1.use advantageously for laundry purposes.	4.70	0.483	VSA	4.63	0.490	VSA
2.useful to wash-up blemish and dirt in clothing.	4.70	0.483	VSA	4.63	0.490	VSA
3.is suitable as laundry detergent product.	4.80	0.422	VSA	4.83	0.379	VSA
4.makes the textile clean and fresh.	4.70	0.483	VSA	4.70	0.466	VSA
<b>Total weighted mean</b>	<b>4.73</b>		<b>VSA</b>	<b>4.70</b>		<b>VSA</b>
<b>Overall mean</b>	<b>4.715</b>					
<b>Overall Interpretation</b>	<b>The level of acceptability of lemongrass fabric softener in terms of usefulness is very high</b>					

**Legend:**

Range	Remark	Interpretation
4.20 – 5.00	Very Strongly Acceptable (VSA)	- Very High

3.40 – 4.19	Strongly Acceptable (SA)	- High
2.40 – 3.39	Acceptable (A)	- Moderate High
1.80 – 2.39	Moderately Acceptable (MA)	- Low
1.00 – 1.79	Less Acceptable (LA)	-Very Low

The table reveals that the lemongrass (*cymbopogon citratus*) liquid laundry detergent was very strongly acceptable in terms of usefulness for laundry purposes as rated by business owners (M=4.70, SD=0.483) and family members (M=4.63, SD=0.490). It was rated very strongly acceptable in terms of usefulness to wash-up blemish and dirt in clothing as rated by business owners (M=4.70, SD=0.483) and family members (M=4.63, SD=0.490); its being suitable as laundry detergent product as rated by business owners (M=4.80, SD=0.422) and family members (M=4.83, SD=0.379); and makes the textile clean and fresh as rated by business owners (M=4.70, SD=0.483 and family members (M=4.70, SD=0.466).

The total weighted means suggest that the usefulness of the lemongrass (*cymbopogon citratus*) liquid laundry detergent is very strongly acceptable to the business owners and family members as shown by the overall mean of 4.73 and 4.70 respectively which was interpreted as very high with an overall mean of 4.715.

### Composite Table of Lemongrass (*Cymbopogon Citratus*) Fabric Softener

**Table 19. The Difference on the Ratings of the Business Owners and Family Members on the Acceptability of the Lemongrass (*Cymbopogon Citratus*) Fabric Softener**

Indicators	Mean		t-value	p-value	Analysis
	Business owners	Family members			
Appearance	4.88	4.88	-0.085	0.933	Not significant
Scent	4.85	4.65	1.160	0.253	Not significant
Texture	4.70	4.47	1.134	0.264	Not significant
Usefulness	4.73	4.70	0.167	0.868	Not significant

The table reveals that there were no significant differences on the ratings given by the business owners and family members on the acceptability of the fabric softener in terms of appearance ( $t=-0.085$ ,  $p=0.933$ ), scent ( $t=1.160$ ,  $p=0.253$ ), texture ( $t=1.134$ ,  $p=0.264$ ), and usefulness ( $t=-0.167$ ,  $p=0.868$ ).

Two groups of respondents the business owners and family members respectively find the appearance, scent, texture, and usefulness almost the same since these characteristics were seen as a combination in-one detergent considering its function. According to a literature survey compiled by Purina Jayasinha (2007) on lemongrass its oil's fragrance can be used as aerol deodorants, household detergents, etc. that gives fresh, pleasant fragrance that produced citral lemon smell to soap after a month and it fades within 6 months which is good to mix such a product like fabric softener. Same with the liquid laundry detergent, fabric softener also considered as detergent with a purpose of fabric softening function that used to modify the fabrics in feeling according to the Detergent Regulation v.2 (2013) by the Association Internationale for Soaps, Detergent Scope.

**Table 20. Difference on the Ratings of the Business Owners on the Acceptability of the Lemongrass (*Cymbopogon Citratus*) Fabric Softener and Commercially Branded Fabric Softener**

Indicators	Mean	t-value	p-value	Analysis

	Laundry detergent	Commercial brand			
Appearance	4.88	5.00	-1.464	0.160	Not significant
Scent	4.85	4.78	0.545	0.593	Not significant
Texture	4.70	4.63	0.361	0.722	Not significant
Usefulness	4.73	4.83	-0.624	0.541	Not significant

The table reveals that there were no significant differences on the ratings given by the business owners on the acceptability of the lemongrass (*cymbopogon citratus*) fabric softener and commercially branded fabric softener in terms of appearance ( $t=-1.464$ ,  $p=0.160$ ), scent ( $t=0.545$ ,  $p=0.593$ ), texture ( $t=0.361$ ,  $p=0.722$ ), and usefulness ( $t=-0.624$ ,  $p=0.541$ ).

#### Laboratory Analysis (Antibacterial Assay) of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent Product

**Table 21. Laboratory Analysis (Antibacterial Assay) of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent Product by Sample Code.**

Sample Code	Test organism/ Zone of inhibition (dia. in mm.)					
	Staphylococcus aureus					
	R1	R2	R3	R4	R5	Ave

1. Liquid Laundry Detergent	8.3	0.0	13.7	11.7	15.5	9.84
2. Lemon Grass Oil	9.9	15.9	0.0	0.0	17.5	8.66
3. Fabric Softener	7.6	9.4	9.7	12.7	8.9	9.66
4. Sodium Benzoate	0.0	0.0	0.0	9.2	11.0	4.04
5. Washing Soda	30.3	28.8	30.0	29.0	36.6	30.94
6. Vancomycin (Positive Control)	24.5	24.5	24.2	25.8	27.9	25.38

Table reveals the laboratory analysis (antibacterial assay) of lemongrass (*Cymbopogon citratus*) liquid laundry detergent product namely: the liquid laundry detergent and fabric softener together with other sample code such as lemongrass oil, sodium benzoate, washing soda and vancomycin (positive control).

The table shows that based from the antibacterial assay of lemongrass (*Cymbopogon citratus*) by sample code reveals the following test organism or zone of inhibition (dia. in mm.) on a certain bacterium the *Staphylococcus aureus* with the following results: liquid laundry detergent has an average of 9.84, lemongrass oil has 8.66, fabric softener has 9.66, sodium benzoate has 4.04, washing soda has 30.94 and vancomycin (positive control) has 25.38. This means that all the analyzed and tested sample code have had a high presence of antibacterial content characterized as good for laundry detergent such as the product made in this study which is positively against a certain bacterium *Staphylococcus Aureus*.

### Summary of Findings

The study employed the experimental method of research to determine the acceptability of Lemongrass (*Cymbopogon Citratus*) into Laundry Detergent Product such as liquid laundry detergent and fabric softener in terms of sensory qualities such as appearance, scent, texture and usefulness.

The respondents of the study were composed of (30) family members of Barangay Bagumbayan, Santa Cruz, Laguna and (10) business owners in the municipality of Santa Cruz, Laguna. It sought to answer the following objectives: Identify the ingredients used in making liquid laundry detergent product., Determine the methods and procedures used in making liquid laundry detergent product in terms of appearance, scent, texture and usefulness., Relate the significant difference between the evaluation of the acceptability of liquid laundry detergent product using lemongrass and the level of acceptability of branded commercial detergent evaluated by the group of respondents.

Based on the statistical measurements and laboratory tests contemplated in this study, the following summary was manifested.

The ingredients used in making lemongrass (*Cymbopogon citratus*) laundry detergent product are the following: liquid laundry detergent- lemongrass oil, borax, super washing soda, distilled water, castile shreds, distilled water; fabric softener- lemongrass oil (fragrance), softener beads, purified water, sodium benzoate, colorant, ethyl alcohol, retainer scent, anti-foam/defoamer.

The process of preparing Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent was in order of preparing, measuring, boiling, stirring/soaking, mixing, curing, packing and labeling.

The overall level of acceptability of Lemongrass (*Cymbopogon Citratus*) Laundry Detergent Product; liquid laundry detergent in terms of appearance is 4.53, scent is 4.845, texture is 4.55 and usefulness is 4.655; fabric softener in terms of appearance is 4.88, scent is 4.75, texture is 4.585 and usefulness is 4.715 respectively which interpreted as very high.

Based on the findings of data presented the ratings of the group of respondents meant that there was no significant difference on the ratings given by them on the level of acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent in terms of appearance ( $t=-0.907$ ,  $p=0.376$ ), scent ( $t=1.116$ ,  $p=0.279$ ), texture ( $t=0.124$ ,  $p=0.903$ ), usefulness ( $t=-0.478$ ,  $p=0.639$ ) as reflected by the computed t-value and p-value which are almost the same as with the commercially branded laundry detergent.

Likewise, on the findings of data presented the ratings of the group of respondents meant that there was no significant difference on the ratings given by them on the level of acceptability of Lemongrass (*Cymbopogon Citratus*) Fabric Softener and commercially branded fabric softener in terms of appearance ( $t=1.464$ ,  $p=0.160$ ), scent ( $t=0.545$ ,  $p=0.593$ ), texture ( $t=0.361$ ,  $p=0.722$ ), and usefulness ( $t=-0.624$ ,  $p=0.541$ ) as reflected by the computed t-value and p-value which are almost the same as with the commercially branded laundry detergent. Laboratory tests revealed significant information about the Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent Product with the following sample code test analysis respectively which states that the liquid laundry detergent, lemongrass oil, washing soda, fabric softener, sodium benzoate and washing soda have high percentage of antibacterial content on a certain bacterium the *Staphylococcus Aureus*.

## Conclusion

The foregoing findings, data gathered and discussed, the following conclusion was derived: The hypothesis which states that there was no significant difference on the ratings made by the group of respondents of the acceptability of Lemongrass (*Cymbopogon Citratus*) Liquid Laundry Detergent and Fabric Softener in terms of the sensory qualities such as appearance, scent, texture and usefulness is accepted.

## Recommendations

In view of the summary and conclusions of the study the following recommendations are offered:

1. Find some ingredient/s for the liquid laundry detergent as a bubbler to produce more bubbles while washing so that the consumer will enjoy the washing.
2. Find some ingredient as liquid viscosity that will makes the liquid laundry detergent thicker than the usual

3. Container of the liquid laundry detergent product should be uniform in shape and size with distinction of which is the liquid detergent and fabric softener.
4. Do bring the detergent for a test in a laboratory to find out its best before date or expiration and have it written on the label.
5. For future researchers who will conduct same study to try other coloring on the laundry detergent to become more appealing to the possible buyer.

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