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A JOURNEY OF SOAP FROM ANCIENT ORIGIN ITS TYPES AND METHODS OF MANUFACTURING

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ABSTRACT

The main objective of this review is to know the history of soap making, various methods of preparation and types of soap. Soap has a history spanning thousands of years and different cultures. It's made by mixing fats or oils with a base like wood ash or soda ash. Soap has cleaning and lubricating properties useful for washing, bathing, and more. Different civilizations developed their techniques, using various ingredients. Soap was used for personal hygiene, medicine, textile production, and religious rituals. Common methods of soap-making include melt and pour, cold process, hot process, and rebatching.

Keywords: History Of Soap, Saponification, Type Of Soap, Method Of Manufacturing, Evaluation.

I. INTRODUCTION

According to the drugs and cosmetic act 1940 soap is defined as articles intended to be rubbed, poured, sprinkled or sprayed on, introduced into or otherwise applied to the human body or any part there of for cleansing, beautifying, promoting attractiveness or altering the appearance. [9] cleaning oneself every day has been a societal norm since ancient times. Initially, cleaning served a purely functional purpose of maintaining hygiene. However, it is now promoted as an act of relaxation to improve one's skin health. Soap made of fat and ash has been in use since the mesopotamian era for cleaning clothes and wool. The importance of soap for personal hygiene was only recognized after the first century. Since then, the personal cleanser industry has evolved rapidly with scientific advancement1 soap is an essential item that we use in our daily lives. It is available in different types to cater to the diverse needs of the users. The following are some of the various types of soap. Medicated soap: this type of soap contains medicinal properties that help to treat various skin conditions. It is commonly used for treating acne, rashes, and other skin infections. Transparent soap: this type of soap is ideal for hydrating the skin. It contains glycerin, which helps to moisturize the skin without making it oily. It is suitable for people with dry and sensitive skin. Laundry soap: this type of soap is specifically designed for cleaning clothes. It contains strong cleaning agents that can remove tough stains and dirt from clothes. It is available in both powder and liquid forms. Toilet soap: this type of soap is used for cleaning the skin. It is available in various fragrances and is ideal for daily use. It helps to remove dirt, oil, and other impurities from the skin, leaving it clean and fresh. So, depending on your specific needs, you can choose the type of soap that suits you the best.[23]

History of soap

For hygiene and skin health, cleansing daily is a practice from ancient times. Babylonians made the first soap from lye and animal fat, which has changed into different forms with extra ingredients. Surfactants and skin-conditioning agents make modern skin cleansers more than soap. The art of skin cleansing has progressed over several 1000 years practiced for personal hygiene or religious ritual or therapeutic purpose.

As recorded in "grihya sutras," the ancient indians performed the oldest accountable daily ritual of bathing. A piece of bone or stone was used to scrape off the impurities in ancient days. The suspension of soapwort plant ash was used by later civilizations to wash their hands. The earliest record of soap making was found in sumerian clay tablets dating to circa 2000 b.c. Boiling a mixture of fat with wood ashes made the soap and it was used for removing grease from wool before dying. An egyptian scroll, ebers papyrus, mentioned that the ancient egyptians used a combination of animal oil with ashes dating to 1550 b.c. And bathed regularly. Using tree ash and animal fat, the phoenicians prepared soap by 600 b.c.soap got its name from the roman legend that

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mentioned mount sapo where the animals were sacrificed. This material helped in washing clothes, the roman women discovered. In his book "naturalis historia" from 77 a.d., the roman scholar, pliny the elder, mentioned that the gauls used the soap made from tallow and ashes for giving a reddish tint to the hair. The first to write about the use of soap for personal hygiene was the greek physician galen (130–200 a.d.).

When rome fell in 467 a.d., bathing habits had declined throughout europe. The plague and the black death in the middle ages were contributed by the uncleanliness and sub-standard living conditions. Soap making became an art in spain, italy, and france where olive oil was used for soap making by the 7th century. Fragrances were added to soap eventually and specialized soaps for bathing, shampooing and laundry were available. Large areas of british woodlands were destroyed by soap making which began in britain by the 13th century.

The tax on soap was abolished by gladstone in 1853 and made it affordable. An alkali soda ash was discovered by the french chemist nicolas leblanc in 1791 by chemically transforming sodium chloride. This discovery became a milestone for commercial soap manufacturing as alkali was a key ingredient in soap.there was an acute shortage of raw materials for soap manufacturing during world war ii (1948). Synthetic detergent was discovered by german scientists as a result. This was a key event in shaping the skin cleanser industry of the current day as most of the modern cleansers were based on synthetic detergent (syndet) systems.[1]

Indian history of soap

Modern soap by the name "lifebuoy" was imported in india by lever brothers in england during the british era . The first soap manufacturing plant in india was set-up by north-west soap company in meerut, uttar pradesh by 1897. A soap manufacturing plant was found by mr. Jamshedji tata after buying coconut oil mills in cochin, kerala. The first branded soap in early 1930s.[1]

History of laundry detergents

The oldest recorded mention of soap is found on a sumerian tablet dating back to 2200 bc. The tablet describes a soap formula that consisted of water, alkali and cassia oil. However, the exact date of its discovery is unknown. The industrial production of soap involved boiling fats and oils with an alkali and remained unchanged until 1916. It was at this time, in response to a shortage of fats for making soap during world war i, that the first synthetic detergent was developed in germany. Soaps have an advantage over synthetic surfactant systems when it comes to soil re-deposition and whiteness maintenance. They act as their own water softener, so when there is enough soap to form suds and wash, the water has already been softened.

the need for anti-redeposition agents arose with the introduction of multi-component laundry detergents based on synthetic surfactants. Even though synthetic surfactants help to prevent soil redeposition to some extent, this effect is not very pronounced, making a whiteness retention aid a necessity.sixty years ago, it was discovered that chemical technology could change the molecular structure of water by introducing the first laundry detergent. It was understood that lowering surface tension is necessary for better cleaning, and this was achieved by using chemical surfactants.

Before world war i, laundry products consisted mainly of sodium and potassium neutralized fatty acid soaps. The first synthetic detergents were produced in germany during world war ii as a replacement for the then-scarce animal fats traditionally used in the production of soaps during the shortages. These were called branched-chain alkyl benzene sulfonates and short-chain alkyl naphthalene sulfonates. Like soap, they could remove hard minerals from water, leaving it soft.

The introduction of long-chain alkyl aryl sulfonates as detergents in the 1930s and by 1945 had become the main surfactant component of synthetic laundry detergents. The first built synthetic detergent, using sodium diphosphate as a builder, was introduced in the united states in 1947. Straight-chain detergents did not work in hard water, and phosphates were added to detergents to soften the water. However, as phosphates were an excellent fertilizer for algae in rivers and oceans, they resulted in algae blooms that depleted the oxygen in the water, killing fish. As a result, phosphates were replaced with other water softeners such as sodium carbonate and edta.

In the mid-1960s, concern arose over the environmental fate of complex phosphates due to their implication in eutrophication of waterways. Since then, the detergent industry has devoted considerable energy to finding cost-effective replacements. The surfactants used in early synthetic detergents were prepared by reacting

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benzene with propylene tetramer to form the alkyl aryl group, which was then sulfonated. These materials are called hard abss (alkyl benzene sulphonates), were highly branched, and non-biodegradable. Over time, they accumulated in the environment to such an extent that foaming resulted in some sewage treatment plants and waterways.

In 1965, the detergent industry in the u.s. Voluntarily removed hard abss from the market and replaced them with biodegradable linear chain analogs. In the mid-1970s, the introduction of ion exchange materials and zeolites as detergent builders led to a gradual shift away from phosphate technology.

At the time when they converted to compacts, the most commonly used surfactants in synthetic powder detergents were the anionic, linear alkyl aryl sulfonates (lass), long chain fatty alcohol sulfates (ass), long chain fatty acids, and the nonionic alkyl ethoxylates. With the recent change in formulations and manufacturing processes, brought about by the transition to compact detergents, major u.s. Manufacturers took the opportunity to formulate their products without phosphate.

Importantly, this was accomplished without compromising performance or consumer value. Today, the conversion of the u.s. Detergent market to phosphate-free formulas is almost complete. 32% of european powders are zeolite-based, canada is about 50% converted but latin america and many of the pacific region geographies still largely use phosphates.

However, the move to a phosphate-free builder system increased the overall complexity of powdered detergents. In addition to binding hardness ions, phosphate provides a number of other functions that are critical to efficient soil removal and cleaning. These include soil peptization or breakup, soil dispersion, suspension, and ph buffering. Removing phosphate from detergent formulas required manufacturers to identify other actives that could fulfill its multifunctional role.

Today, phosphate-free powders contain zeolites and/or layer silicates for hardness control, polycarboxylate polymers for soil suspension, citric acid for soil peptization and dispersion, as well as ph control, and carbonate for calcium control and buffering.[10-11]

Saponification

Saponification is a process that involves converting esters into alcohols and salts of carboxylic acids. The word "saponification" comes from the latin word "saponins", which means 'soap'. This process is not only used in soap making, but also in other applications such as papermaking, where some substances in wood pitch can be altered by alkaline papermaking conditions. Saponification can also refer to any alkaline hydrolysis of any type of ester.

The overall reaction of saponification of triacylglycerol has two steps. The first step involves the breaking of the ester bonds to produce glycerol and three fatty acid molecules: fat or oil + 3h2o → 3 fatty acids + glycerol. The second step involves the reaction between the fatty acid molecules and a base (usually naoh) in the alkali solution. This is an acid-base reaction that results in the formation of water and salts: 3 fatty acids + 3naoh → 3 fatty acid salts + 3h2o.

These were the steps for conventional heating with a hot plate: first, 10.107g of sodium hydroxide (lye) was weighed using an electric balance and put in a beaker. Next, 27 ml of distilled water was measured and poured into an erlenmeyer flask. The sodium hydroxide in the beaker was then added to the water in the flask, and mixed using a magnetic stir bar until a homogeneous mixture was obtained. Using a hot plate, the mixture was heated and the temperature was maintained at around 115°c.

At the same time, 60.430g of chipsi fat was measured using an electric balance and warmed in a small beaker on a hot plate. The oil was stirred using a magnetic stir bar to prevent burning and keep the temperature at 115°c. Once the sodium hydroxide solution and oil were within 10°c of each other, the sodium hydroxide solution was poured into the beaker with the oil. The mixture was stirred vigorously using the magnetic stir bar, while the temperature was continually maintained at 115°c. Finally, the contents were poured into an aluminum weigh boat to cool and solidify.

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II. TYPES OF SOAP

Types of laundry detergents _ heavy duty detergents_ liquid detergents_ powder detergents_ ultra-detergents_ single-use detergents_ soap bars_ combination detergents

1) Heavy duty detergents

Mainly use anionic surfactants like linear alkylbenzene sulfonates, alkyl sulfates, and alkyl polyethoxyethylene sulfates. Soaps may be used as foam controlling agents. Nonionic surfactants like polyoxyethylene alkyl ether have strong detergency for oily dirt.

Heavy duty high efficiency laundry detergent is a superior blend of synthetic detergents, water conditioners, and fast-acting, soil-specific enzymes. These enzymes quickly break down a variety of stains such as blood, grass, cooking oil, organic grease, ink, and food soils. The detergent works in both hot and cold water. A free-flowing granular heavy duty high efficiency laundry detergent is created by blending a detergent builder (such as zeolite a) and other optional ingredients with a discrete tertiary amine.

2) Liquid detergents

Liquid detergents are a type of laundry detergent that is commonly used to clean clothes, towels, and sheets. They are called "liquid" because they are a liquid form of detergent, as opposed to powder or tablet forms.

One of the main ingredients in liquid detergents is water, which is added to help dissolve other additives and make the detergent pourable. In addition to water, liquid detergents may also contain other solvents, such as alcohol or hydrotropes. These solvents help to blend all the ingredients together and ensure that the detergent is effective at cleaning.

Liquid detergents are particularly effective at removing food, grease, and oil stains from clothing and other fabrics. They are also good for pre-treating spots and stains prior to washing, ensuring that the stain is removed completely during the wash cycle. Overall, liquid detergents are a versatile and effective cleaning solution that can help keep your clothes and other fabrics looking their best.

3) Powder detergents

This laundry detergent is perfect for all types of wash loads, big or small. It's specially designed to remove stubborn dirt and grime, like clay and ground-in dirt, from your clothes. With its powerful cleaning action, this detergent will leave your clothes looking and feeling fresh and clean every time you wash them. So, whether you're dealing with tough stains or just need a reliable detergent for everyday laundry, this is the product for you!

4) Ultra-detergents

Ultra detergents are highly concentrated and can be used in smaller amounts. You can add the detergent directly onto the laundry or to the wash water at the beginning of the wash cycle, or you can add it beforehand or soon after starting the wash. These ultra detergents come in both liquid and powder forms and are available in smaller packages. Despite their smaller size, they are designed to offer the same cleaning power as similar products in larger packages, and you'll need to use less of them.

5) Single-use detergents

Unit-dose detergents are laundry cleaning products that come in small, pre-measured sizes to ensure accurate and consistent use. They are available in a variety of forms such as compacted and concentrated powder, liquid, or tablet. These detergents are designed to be highly effective in removing dirt, stains, and other contaminants from different types of fabrics while being convenient and easy to use. The compact and concentrated nature of these products also means that they require less storage space and produce less packaging waste. With unit-dose detergents, you can be sure to get the right amount of cleaning power every time you wash your clothes.

6) Soap bars

Soaps are one of the oldest cleansing agents that have been used for a long time. They are typically made from the fatty acid of tallow or a combination of fatty acids of tallow and cocoa, which is also known as coconut oil. Recently, palm oil fatty acids have also been used. It is interesting to note that soaps are the predecessors of the chip and powder forms of detergent.

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7) Combination detergents

Laundry detergents have come a long way since their inception, and today's products are designed to cater to the needs of consumers who are looking for effective and easy-to-use solutions. Laundry detergents that come with bleach alternatives, color-safe bleach, or fabric softener are among the most popular products on the market today. These combination products are designed to eliminate the need to buy multiple products and provide a one-stop solution for all your laundry needs.

The detergent/bleach combination products use new technology that provides a more effective, low-temperature bleaching system, which is well-suited to the lower wash temperatures used in today's washloads. This technology has been developed in response to the changing needs of consumers who are looking for products that are effective at lower temperatures, reducing the amount of energy needed to wash clothes. The detergent/bleach combination products are highly effective in removing stains and keeping clothes looking bright and vibrant.

Combination detergents are a mixture of liquid or powder detergents with built-in fabric softeners that have a high foaming property and provide different sensations during washing and rinsing. These products are designed to provide an all-in-one solution for consumers who are looking for convenience and ease of use. The built-in fabric softeners ensure that clothes are soft and comfortable to wear, and the high foaming property ensures that the clothes are thoroughly cleaned and rinsed.

In conclusion, laundry detergent is an essential product for every household, and the combination products that come with bleach alternatives, color-safe bleach, or fabric softener provide a convenient and effective solution for all your laundry needs. With new technology and innovative formulas, these products are designed to meet the changing needs of consumers and provide a superior laundry experience.[10,11]

Toilet soaps

Toilet soaps use a higher quality of oils and fatty acids to give them better quality. Sometimes perfumes and colours are added for cosmetic purposes.[22]

There is a vast market available for beauty toilet soap in kerala and its around. It being soft in nature will act on skin giving soothing effect. This beauty soap is nothing but a toilet soap of good and refined quality and balanced ph, so this soap have as good market as other toilet soap have. Because of its charming name this soap can be used by all male, female irrespective of caste, creed and sex. As the fashion grows up its market potential will also grow accordingly. Considering the population trend in the state, there is still an ample scope for growth of this industry. There are so many kind of toilet soap flooded in the market but because of its peculiar name and nature, quality and properties it will also grab good market in present scenario.[23]

Medicated soaps

In these types of soaps we add antiseptics to the soap as an ingredient. The antiseptic is to help kill germs from the surface along with the dirt and dust.

The manufacturing process of medicated soaps typically involves combining active pharmaceutical ingredients with soap base. [23]

Transparent soap

Transparent soap, also known as glycerin soap, is a type of clear soap containing high amounts of glycerol. It is less drying than opaque soap and can have additional oils like shea butter or jojoba oil added to it for extra moisturizing benefits.

This soap is made by dissolving soap in a solvent to make the crystals so tiny that light can pass through the soap. Sodium hydroxide causes crystals to form in soap, making it opaque. By dissolving the soap in a solvent, the soap becomes transparent.[23]

Cheapened soaps

When making silicated soaps, soap-makers regulate the strength or density of the solublo gluss solution based on the desired quality of soap and the materials used in manufacturing. Some materials form hard soap with a large amount of silicate. However, it's important to note that even a small amount of soluble glass can cause the

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insoluble base, silica, to separate and leave a deposit on the skin or linen cleaned with it. While silicated soaps are good at cleaning, they're not ideal for use in the bathroom as they can make the skin feel rough after use.[25]

1) Hot process

Soap-making process

A combination of solid and liquid fats is prepared in a stainless-steel pot and heated until the solid fats dissolve, which is usually around 43°c. To prepare the lye solution, lye (sodium hydroxide) is mixed with goat's milk in a stainless-steel or glass bowl. The combination of lye and milk reacts chemically and produces heat, raising the temperature of the solution to about 93°c. After that, the solution is cooled down to 43°c.the lye and fat mixtures are blended together at a high temperature and stirred vigorously. The stirring is done until the mixture reaches the trace stage. The trace stage is when the mixture is thick enough to hold a slight shape. [3]

Hot process

The process to create soap involves several steps. Firstly, a mixture is heated to 68°c for two hours until it becomes gel-like. This is when saponification occurs. After that, essential oils are mixed in for fragrance. The hot mixture is then poured into molds and allowed to cool. Once the soap is solidified, it is taken out of the molds and cut into bars. At this point, the soap is ready to be used.[3]

To ensure safety during soap production, saponification is a better choice than hot-process soap. Although it takes quite a long time to cure, the saponification process is cleaner, yields a polished finish, and does not require controlling a constant high temperature for two hours straight before being poured into the mold. Furthermore, saponification allows users to determine the amount of free fatty acids present in the soap.

For soap production via the saponification process, the required materials are pure olive oil, sodium hydroxide (naoh), distilled water, and rose essential oil. The naoh solution was prepared by dissolving 39 g of 100% pure naoh in 114 g of distilled water, which was left to cool for a few minutes before being mixed with olive oil. The naoh solution was then poured and mixed well with 300 g of olive oil. Once the color had changed, a few drops of rose essential oil were added to the soap solution. The mixture was mixed until a homogeneous mixture was formed. It was then poured into an 18 cm x 18 cm x 3 cm mold and left in a cool and dry place for a few weeks. The drying process required four to six weeks to ensure the mold was completely dry.[4]

Dunn's process for cheapened soaps

The purpose of this process is to combine silicates of soda or potash with soap under pressure, resulting in a more effective union. This method can be applied to ordinary soaps as well. For yellow soap, the typical proportions are tallow 7, palm oil 3, and resin 3 parts, with caustic soda leys at 21° b, totaling 140 to 150 gallons. These materials are placed in a steam boiler equipped with a manhole, safety valve, thermometer, feed-pipe at a, and a discharge-pipe at b. The finished soap is collected in the receiving-pan at c. After lighting the fire, the boiler is heated until the pressure at the safety-valve is sufficient to allow the temperature inside the boiler to gradually rise up to 310°f. The temperature is then maintained for approximately an hour. Once the contents of the boiler are discharged into the pan c, the process is complete.

To create silicate of soda or potash under pressure, you can add crushed flint or quartz and caustic soda or potash in a boiler. The ratio should be 1 cwt. Of silica to 100 gallons of ley at 21° b. Heat the mixture as before, under pressure, until the temperature of the boiler reaches 310° fahr. The steam pressure should be equal to 50-70 lbs. To the square inch. After approximately three to four hours, discharge the silicate through the exit-pipe. It's now ready to mix with soap in any proportion you need.[12]

Liquid soap:

1. The precise amount of oils required for the formulation were measured out and then carefully poured into the beaker. This was done to ensure that the correct proportion of oils was used in the mixture, which is crucial for achieving the desired end result. Once the oils were added to the beaker, they were ready to be further processed according to the formulation guidelines.
2. The oils were subjected to a heating process where they were gradually raised to a temperature of 1600°c with a tolerance range of ± 100°c. This heating process was likely performed in a controlled environment to ensure consistency and accuracy in the heating process.

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3. By properly preparing the lye-water (potassium hydroxide) solution while the oils were being heated, we ensured a smooth and efficient process in creating our product. Our attention to detail and careful planning guarantees a high-quality result.
4. After completely mixing and ensuring that the lye-water is clear, slowly add it to the oils. Calculate the amount of lye and water required to dissolve using the following formulas.

A. (amount of fat) × (saponification value of the fat) =(amount of lye)

B. (amount of lye) ÷ 0.3 = (total weight of lye water solution)

C. (total weight of lye water solution) − (amount of lye) = (amount of water)

5. Oils and lye were stirred together. Then, started blasting it with the mechanical stirrer.
6. Depending on the type of oils, it will take a long time to get to trace. Sometimes as much as 30 minutes.
7. Once the soap has reached trace it was stirred for one more time and heated by placing a lid.
8. Soap was checked every 15-20 minutes for any separation.
9. It was cooked for 3-4 hours and went through several stages, including thick applesauce, cooked custard with small bubbles, watery mashed potatoes, solid taffy, and chunky/creamy vaseline.
10. To test whether the soap has been cooked enough or not, wait until it softens and turns translucent. Then, take 10 ml of boiling water and add 5 gm of soap paste. Stir the soap until it dissolves in the water (this may take several minutes). Once it's completely dissolved, check to see how clear it is. A lightly cloudy appearance is satisfactory, but if the dissolved soap mixture is milky or very cloudy, it means that it was not cooked properly. It's worth noting that the cloudiness may be due to the type of oil used, and the soap will become even clearer as it cools and settles.
11. Sufficient amount of water was add to get the desire consistency and mixed it well.
12. After the soap paste has completely dissolved in the water, it was neutralized using 33% borax solution.
13. Fragrance and color were added in this step.
14. 10ml 4 % of ocimum sanctum or 2.5 % eugena caryophyllus oil and combination of both as per the formulation code were added and stirred well10,-14.
15. It was then cooled and poured it into a suitable dispenser and stored it in room temperature and used it for the further evaluations.[13]

2) Cold-process soap-making

Step 1: don protective equipment

When making soap, it's always a good idea to take some safety measures to protect yourself. Wear a long-sleeved shirt, long pants, goggles, an apron, shoes, and gloves to prevent any irritations or burns from the lye and to avoid ruining your clothing with oils that can make your skin feel greasy. If you're using additives, be cautious as some essential oils can irritate your skin in large quantities. Additionally, to make cleaning up easier, it's recommended to protect your work area with a trash bag or newspaper.

Step 2: prepare molds

To make soap, you need to choose a mold that suits your preferences. You can use almost anything as a mold, and the appearance of your soap will depend on the mold you use. If you want intricately designed soaps, you can utilize candy or gelatin molds. However, even simple items like cardboard tubes or pvc pipes can work fine (you can take out the soap in a cylinder and cut it into bars). If you want to make plain square soap, cardboard milk or juice containers are great because they are coated with wax, and the soap can be easily removed once it has solidified. If you prefer to use untreated cardboard or wooden boxes, you can cut the soap into squares once it has been removed. To make it easier to remove the soap from the mold, line it with wax paper. However, if you are using a non-porous material like glass or plastic, you may simply grease the mold with cooking spray instead of lining it with wax paper. Make sure you have enough molds to accommodate all the soap mix before you start. You don't want to be caught short of molds while the soap is beginning to set.

Step 3: measure your ingredients

For making soap using the cold-process method, it is essential to measure the fat and lye amounts accurately to ensure the full neutralization of the lye and fats. To determine the amount of lye required to saponify a given amount of fat or oil, you need to check the saponification value of the fats being used. This value varies for each

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fat, so always check it before measuring your lye. The saponification value can also differ for different types of lye, so it is important to know which type of lye is being referred to with this value.

To measure the lye powder, you should use a digital scale, along with a measuring cup for oils and water. Zero the scale by measuring the container's weight first and then set that weight as zero. This way, you can avoid making any calculations to deduct the container's weight, or accidentally include the weight of the container in your measurements.

It's crucial to measure the ingredients accurately because incorrect measurements can result in excess lye, causing burning and irritation of the skin, or excess fats, which will leave skin feeling greasy. Soap makers often use a formulation that allows for some excess fat, depending on their preferences and the type of skin for which the soap is intended.

Step 4: prepare the lye mixture

To dissolve the lye, use cold water, preferably refrigerated. Add the lye to the water slowly while stirring constantly. Remember to add the lye to the water, not the other way around. If you add water to the lye, a crust will form on the surface and the lye underneath will continue to react. This can cause a buildup of pressure and eventually lead to an eruption of lye powder, hot steam, and fumes.

As you add the lye to the water, the temperature of the mixture will increase rapidly due to an exothermic reaction. This means that the chemical reaction between the lye and water will release a lot of heat. The mixture will also release fumes that contain lye molecules, so make sure not to inhale them. Use a thermometer to monitor the temperature of the mixture while stirring. The temperature should not exceed 190°f, or the mixture may boil over. If the temperature gets too high, try submerging the container in a larger container of ice water.

To prevent the mixture from getting too hot, use refrigerated or ice water to mix the lye solution if you are working with a large quantity of lye. Keep stirring the mixture until it is clear and all the lye is completely dissolved. Once all the lye is dissolved, allow the water to sit and cool until it reaches a temperature between 100-110°f.\

Step 5: heat the fats

As you wait for the lye mixture to cool down, it's time to heat up the fats. It's crucial to handle this step with care since every oil has a flashpoint, which means it can ignite at a certain temperature. Hence, you must heat the oils slowly, using a stainless-steel pot on a low-heat setting, and stir frequently. If you're using a microwave, use a microwave-safe container and heat the oils for one minute on high power, then continue to microwave them in 20-second intervals while regularly checking the temperature with a thermometer. If the fats are in a liquid state, heat them to about 100-110°f to match the lye mixture's temperature. However, if the fats are solid at room temperature, you will need to melt them, which will likely require heating them beyond 110°f and then allowing them to cool to the correct temperature. Regardless of the method you use to heat the oils, it's crucial to keep checking the temperature of the lye mixture and the fats to ensure they match. Remember to keep the thermometer floating in the middle of the mixture for accurate readings.

Step 6: mix the fat and lye

When both the lye and fat mixtures reach a temperature of 100-110°f, they can be combined. Slowly pour the lye mixture into the fat while stirring in small, rapid circles.

Step 7: stir

Before proceeding to the next step, the ingredients should be stirred thoroughly. If stirring manually, the mixture should be stirred for 5 minutes and then allowed to settle for 15. Repeat this process for up to 3 hours, depending on the recipe. However, using a stick blender is more convenient and speeds up the process considerably. With a stick blender, the mixture only needs to be blended for approximately 30 minutes, instead of being stirred for 3 hours. However, be cautious when using a stick blender, as over-stirring the mixture may cause air bubbles to form. Additionally, the fast stirring process of the stick blender may leave the mixture undercooked, and it may not have reached the desired consistency yet. In such cases, stir the mixture manually occasionally until it reaches the desired consistency.

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Step 8: trace stage

Fats trace refers to the viscosity of the mixture as it is stirred; the term "trace" originated from a method of testing the soap mixture. Take a spoonful and drizzle it across the top of the mixture; if it remains visible, or leaves a trace, for a few seconds before blending back into the mix, then the mixture has begun to trace. Light trace refers to mixture that has just begun to thicken, whereas medium trace and heavy trace refer to a mixture that is thicker and more difficult to stir. (some recipes will take longer to trace than others; humidity and temperature also affect tracing times.

If the mixture doesn't trace as quickly as it should, don't worry; keep stirring, and it will eventually.) Most additives, such as superfatting oils, herbs or colorants, will be added at the trace stage; once the soap mixture has reached this stage, the lye and are about 80-90% saponified, meaning that anything added to the mixture will not be significantly affected by the saponification process. Depending on the ingredients, they may be added at light, medium, or heavy trace. Measure out the essential oils, colorants, or any other additives you plan to use in a separate bowl. Mix a spoonful of the soap mixture with the additives. When it is well-blended, add it to the soap mix, stirring slowly and steadily as you pour.

Step 9: pour into molds

The soap-making process involves allowing the mixture to set for 18-48 hours, during which saponification takes place. If the soap becomes too solid to stir or pour easily, it has reached the "seize" stage where saponification has progressed to the point of solidifying the soap. At the end of the "trace" stage, the soap mixture is poured into the molds. It's important to pour the soap into the molds before it reaches the "seize" stage. If you notice the soap getting increasingly difficult to stir, you must quickly pour it into the molds.

Step 10: insulate the molds, and allow to set

The molds should be wrapped in towels or blankets, to retain as much of the mixture's heat as possible. If the soap turns transparent during the molding stage, it means that the soap mixture has overheated in the mold. If this happens, unwrap the molds, and put them someplace a bit cooler. The soap should return to its normal opacity. The soap may have lost its scent, due to the essential oils or other additives having been "cooked" by the soap's high temperature; it may also have a hard rind, but this should only be noticeable if the soap is cut. Other than these flaws, the soap is still perfectly usable.

If you notice your soap developing a light coating of white powder while in the mold, it means that the soap is reacting with the air. To avoid this problem, seal the soap while it is in the mold. The white powder will be highly acidic, and irritating to the skin, so it must be rinsed or trimmed from the soap. If the mold is airtight, this problem should not occur; however, monitor the soap closely, as sealing it off from the air may also cause it to overheat.

After being poured into the mold, the soap should turn slightly darker in the middle, continue to get hotter, and have some bubbles rising to the surface. This is an indication that proper saponification is taking place. Once the neutralization process begins to slow, the soap should return to a normal, uniform color. If the soap is poured into a mold that is too small, or is not insulated properly (or if it cooled too much during tracing) you may not see these signs of neutralization taking place, and caution should be used with the soap, as it may be greasy, or have an excess of lye. If you notice, within the first 24 hours of the molding stage, that the mold is no longer warm to the touch, or the soap fails to harden, there may be a problem with the mixture. If your measurements were off, then the saponification process may have failed. If you're sure that the measurements were correct, then pour the soap into a pot and heat it on the stove, until it reaches approximately 130°f. Then pour it back into the molds. If the soap still doesn't solidify normally, then you may have to discard the batch.

Step 11: remove the soap from the molds

Once the one- to two-day molding process is completed, the soap is firm enough to be removed from the mold and cut. Be sure to use gloves when you remove the soap from the mold, because the lye may still burn your skin. If you lined the mold with cellophane or wax paper, it should be fairly easy to get the soap to release; if not, try putting the mold in the freezer for a while. The cold will cause the soap to contract, and it can be removed much more easily, but if you used colorant in the soap, it may fade a bit.

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Step 12: curing the soap

After they are removed from the mold, the bars should be placed on wax paper, and left in a cool, dry place for 2 to 6 weeks, to cure and harden. The actual curing time required will depend upon the recipe, because the initial water content of the mixture will vary depending upon the ingredients used.

Step 13: test the ph of your soap

Before using your soap, test a bar for ph level. This is an important step; even veteran soap-makers test their soap before using it, because mistakes are always possible, and a single batch with a lye content that is too high can have dire consequences (chemical burns, etc.). You can test the ph of the soap using a chemical called phenolphthalein; this chemical turns fuchsia, or pink, if the ph is too high. Un-reacted lye is a very alkaline substance, meaning that it has a ph of 14;water has a ph of 7, and most of the oils you will use have a ph of 0-2. The ph of soap that will be used on skin should be between 7 and 9.5; if the drop of a phenolphthalein stays clear, or very pale pink, then the soap is safe to be used on skin. If it turns a deep pink, the soap should not be used on skin, but is safe to use for household cleaning, dishes, or laundry. You can also test the ph of your soap using a ph test strip, such as the ones commonly used for aquarium water. Mix one gram of the soap with 100ml of room-temperature water – the water should be just enough to dissolve the soap in, because if there is too much water it will give a false ph reading. (also, test the ph of the water beforehand, and make sure that it is a neutral 7.) Use the strip to test the solution, following the directions on the strip. There is a third method to test for lye content, if you don't have the materials available for the other tests. Touch your tongue to the bar of soap, or touch the bar with a wet fingertip and touch the fingertip to your tongue. If your tongue tingles, or you experience a pinching or burning sensation, then there is still too much un- reacted lye in the soap. This test can be somewhat dangerous; your tongue can get burned if the lye content of the soap is very high. Also, you won't be able to get more than a very general idea of how much lye is in the soap, so this test isn't highly recommended.

Step 14: storing your

Soap if your soap is satisfactory, and you want to keep it, be sure to store it in a cool, dry place, out of direct sunlight. Label each bar clearly with the batch code, so that you will be able to quickly reference what is in each bar, when it was made, etc. Your memory is good now, but after a few months go by, and you have made several batches, it may become difficult to distinguish one bar from another. [26]

Paper soap making

In the process of making paper soap, there are several stages involved. Firstly, pure coconut oil or vco is heated up to 60oc and then mixed with a 30% solution of naoh. The mixture is stirred until it thickens to produce a homogeneous solution between the oil and naoh. The next step involves heating and melting stearic acid, followed by the addition of glycerine, 96% ethanol, and aquades. The mixture is then stirred until it is completely homogeneous. The mixed solution from the previous step is then combined with the stearic acid solution which is heated for approximately one hour. The soap solution can then be poured into a silicone mold and left for approximately 24 hours for the soap to harden. Once the soap has hardened, it is cut using a wooden slicer. The paper soap produced is 2x2 cm in size with a thickness of 1 mm. Next, a curing process is carried out to reduce the ph value. This process involves storing the paper soap at room temperature for about two weeks. A flowchart of the process of making pure coconut oil soap is shown below.[14]

Toilet soap manufacturing process

The beauty toilet soap can be made or manufactured into 2 steps namely preparation of soap base and to obtain finished products soap base. For making the soap base the specifications is carried which is done by either remitting and perfuming and secondly by milling process. Fat should be used of high standard quality. Weigh fat oil & lye (sodium- hydroxide) accurately, if the lye is weighed more, the soap will be hard and harmful to skin and if the lye is low, the fat will not be saponifed properly. Melt oil fat into a kettle and filter it to remove any impurity. Now add caustic soda lye into it slowly and stir continuously when the oil is saponified fully add perfume and colours and pour into moulds.[23]

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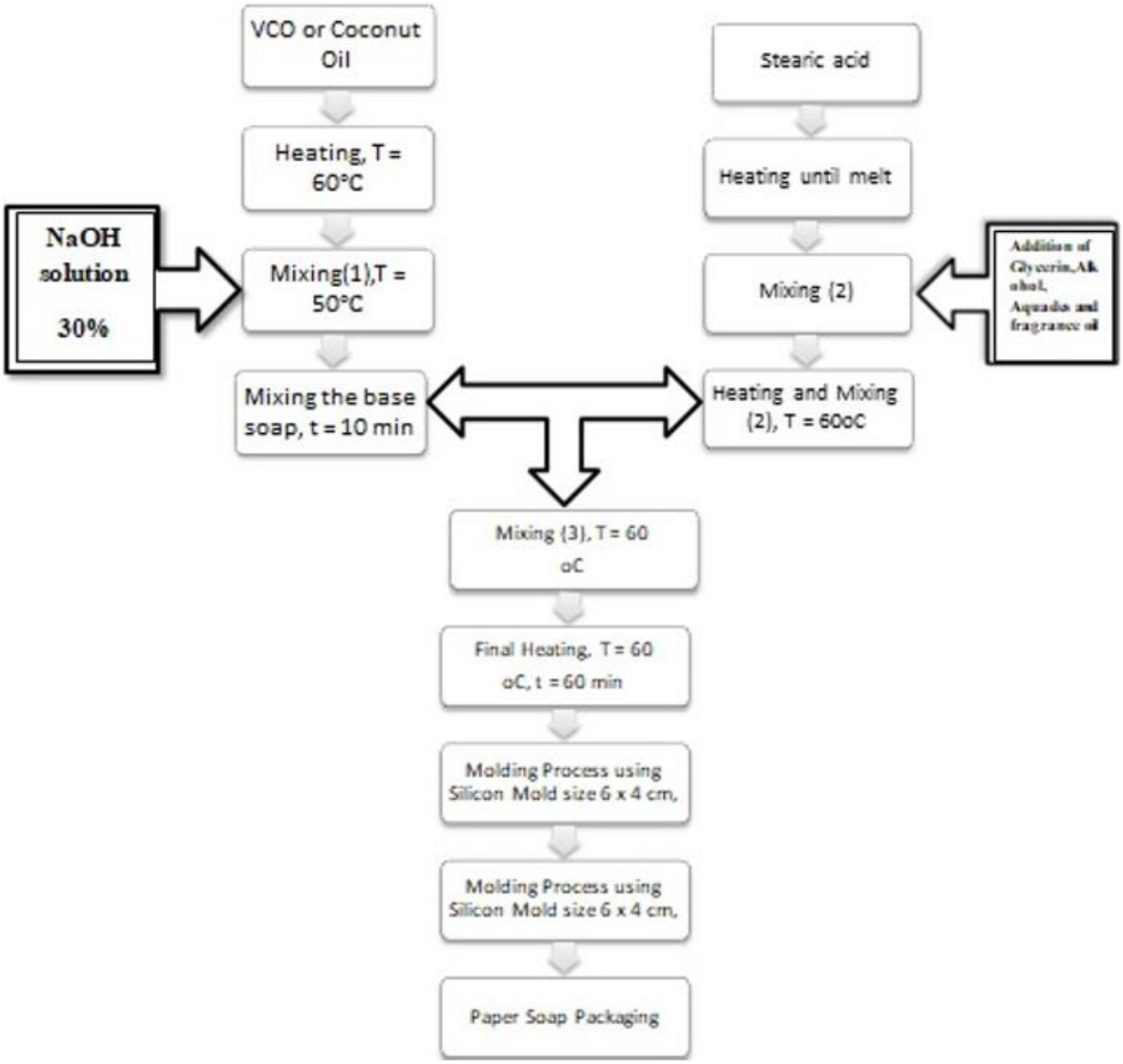

Transparent soap method

To create coconut oil cold-process soap, you will need a batch of lye made with equal weights of naoh and de-ionized h2o. To do this, weigh and mix the ingredients together in a 125ml labeled pp bottle. For this particular recipe, use 50g of naoh and 50g of h2o. As the lye mixture reacts, it's best to remove the cap of the bottle to prevent pressure buildup from the heat emitted during the lye reaction. Preheat the oven to 60°c. Weigh out 100.00 g of coconut oil into a 500ml pp bottle and heat it in the microwave until it's liquefied. Then weigh out 35.2g of lye into the same 500ml pp soap bottle with the coconut oil and mix the two together vigorously until the mixture thickens. Pour the mixture into a mold and let it sit in the oven for 4 hours. After 4 hours, remove the soap from the oven and let it cool and harden.

To create crystal clear melt and pour soap base using fioravanti's method, follow these steps:

1. Mix 3.03g of naoh and 3.03g of di h2o in a 125ml pp-labeled bottle to create the lye solution.
2. In a 250ml beaker on a hot plate with a stir bar, add 18.8g of propylene glycol, 6.28g of vegetable glycerin, 17.11g of 70% sorbitol solution, and 30.25g of sodium laureth sulfate. Heat the mixture to 60°c.
3. Once the temperature is reached, add 13.00g of stearic acid and 6.06g of myristic acid. Heat the mixture to 68°c.
4. Slowly add the 50:50 lye solution while continuously stopping and starting stirring for 20 minutes until the mixture becomes transparent.

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5. Let the solution sit for 1 hour at 68°c.
6. After 1 hour, slowly add 2.59g of triethanolamine (tea).
7. Let the soap solution cool to 62-64°c and pour it into a soap mold. Let it cool and harden.[24]

3) Melt-and-pour method:-

Melt-and-pour is the process of melting pre-made soap bars, adding fragrance and other ingredients, and using the mixture to create new soap bars.[5]

Melt-and-pour soap bases have two benefits. Firstly, they don't require lye, a caustic chemical that is already mixed into the soap base. Secondly, the final product doesn't need a curing period, unlike cold-processed soaps. This means that melt and pour soaps can be used right away once they have been removed from their molds, without needing to be left for days or weeks for the neutralization of lye. After the pouring it will continue to harden and become useful for skin.[7]

The type of soap that is always in liquid form can be solidified by the addition of other chemicals. The natural ingredients can be added in the production of commercial soap, the glycerin is often extracted. [5] its glycerin base is synthetic, which could make it expensive. You may have less control on the materials used and they affect quality of the soap. For making of soap using melt and pour method is quicker, more convenient. You also don't have to wait for weeks for the soap to cure; the bars are ready to use as soon as they cool and harden.[6]

Handmade soap is always made using pure glycerin, which can be derived from animals or plants. This type soap is glycerin-rich and highly moisturizing. Clear soap often has extra glycerin add, making it more nourishing for the skin. Glycerin is known as a 'humectant', and retain moisture in the skin. When you use glycerin soap, a thin layer of glycerin remains on your skin, helping to keep it hydrated and moisturized.[5]

Procedure:-

1. Cut and weigh the soap base:- place the glass cup on the weighing balance, tare it. Cut the soap base into small pieces, and put into container and measure it.
2. Melt the soap base:- for the melting soap base firstly cover the container with plastic wrap to prevent the soap base from drying. Use a microwave to heat the soap base for 1 minute, repeat process until it has been completely melted. Also can using the double boiler for the melting the soap base. Almost all soap bases will be reach a temperature of approximately 150°c for melting and get cautious to any burns.
3. Fragrance or essential oil:- weigh the fragrance and essential oil and add them to the container. The fragrance and essentials add into the melted soap base and stir it properly.
4. Color: add color into soap base. It's important to use dyes, and natural colors and check it is safe for the skin. Keep in mind that the dyes used for soap are weaker compared to those used for candles. Use a larger amount of soap-safe dye to achieve the desired color intensity in the soap.
5. Stir the melted soap:- stir continuously melted soap. Gently mix in your chosen fragrance and color. Do not stir too hard, because it will cause bubbles.
6. Pour the melted mold:- the melted soap slowly pour into the mold. Try to avoid bubbles. You can use silicone molds or plastic containers. Once the soap is in the mold, move carefully to a safe place and cover it with plastic wrap. Place in the cool place for some hours to cool and harden. Do not place in to the freezer.
7. Harden soap:- the soap bars should be left to harden for another 3 to 8 weeks, it will be depend on the ingredients used. Tap the mold to remove the soap. And you can start using the soap.[8]

4) Rebatching:-

Rebatch is a process of melting scraps of soap base and remolding them. It also helps to extract the full medicinal or beautifying benefits from any herbs you have added to the soap. The fresher the soap is important for the better rebatching. It is just like the melt-and-pour method.[5]

To rebatch soap,

1. Firstly cut all soap bases into small parts. Then mix it by using milk or water. As a rule, use one cup of milk or water for every pound of soap.
2. Using olive oil and animal fat for making soften soap, you can use 1 cup of milk or water. Place into a container and let it sit in the liquid for 1-2 hours, stir every 30 minutes.

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3. For melting soap use stainless steel, enamel, or glass containers.
4. Put container in the oven, and stir it every 15 minutes. The temperature is not higher than 170°f.
5. The soap will take 1 hour to melt.
6. Add fragrance, essential oils, color, herbs, or superfatting oils. Mix the better and stir continuously.
7. Pour the soap mixture into molds and a few hours until it hardens. Once it is hard, remove it from the mold and cut it into bars. After cutting the soap is safe to use. But after 1 week it will be more hard and better to use.[5]

Evaluation parameters

1. Colour: Colour was checked against a white background by naked eye. [15]
2. Odour: Odour was checked by smelling. [15]
3. Appearance/shape: Checked by eye, it will be round, circle, rectangular shape. [15]
4. Thickness determination: Thickness was determined by using of screw gauge which is pre-calibrated. Thickness was measured by observing five different parts of soap. [16]
5. Weight determination: The weight is determined by using of digital weighing balance.[16]
6. Ph: ph is determined by using of ph meter. The ph was found to be in nature. Prepared formulation dissolved in 100ml distilled water and kept for 2hr. Ph measure of solution was done using a previously calibrated ph meter. [17,18]
7. Washing capability: Washing capability was checked using of water. [19]
8. Irritation of skin: The soap was applied on hand and mark this site, area and time noted. After 24 hr checked irritant effect, erythema, and edema on the surface of the skin. [15]
9. Moisture content: A soap sample weigh 10gm and note down as weight of wet sample (initial weight) take place in oven for some time at 115°c. After cooling weigh again (dry weight).[18]

$$\%weight=a-b/b\times100$$

A=initial weight b=dry weight

10. High temperature stability: Soap was allowed to stand at 50°c for 1 week. Stability of soap was observed during this period. And checked soap of sample it stable or homogeneous after standing. [16]
11. Foam forming ability: Take 1 gm of soap and dissolved in distilled water about 50 or 100 ml in graduated measuring cylinder. Shake measuring cylinder for 2-3 minutes and allowed to stand for 10 minute and check the height of the foam. Record the observation for three time and mean was take.[15]
12. Foam retention time: Prepared soap solution transferred into 100 ml measuring cylinder. Cylinder was shake for 10 times and foam volume was recorded at 4 to 5 minutes. [16]
13. %free alkali content: 10 gm dried soap was filled with 150 ml of distilled water, heat up to 30 to 40 minute at reflux on water bath. Solution was cooled and transfer with washing 250 ml conical flask and fill with water. Add phenolphthalein indicator solution titrated against 0.1 m hcl until turned colourless. [18]
14. Alcohol insoluble matter: 5gm of soap was take in conical flask, add 50 ml warm ethanol and shake until soap was dissolved. Solution was filtered using tarred filter paper with 20 ml of warm ethanol and dry at 105°c at 1 hour. Weight the dried paper with residue was taken. [16] % alcohol insoluble matter= weight of residue/weight of sample ×100
15. Determination of tfm (total fatty matter): 10 gm soap was dissolved in 150 ml distilled water and heat. 20 ml solution of 15% h2so4 add while heating until clear solution was obtained. Fatty acid that are present on the surface of the resulting into solution are solidified by add 7 gm beeswax and heat again. Cake removed and dry. Weight the sample. [20]% tfm= (weight of cake- weight of beeswax) in gm / weight of soap ×100
16. Saponification value: koh is required for saponification of fat or oil of 1gm. It is defined as the mean of molecular weight of fatty acid which is present in oil or fat. Get 2gm of soap sample in conical flask add 0.5 koh solution heat up 55°c and increased up to 100°c boil at continuous 1 hour. Add phenolphthalein indicator and add 0.5 m hcl. The end point is pink is disappear.[21]

Saponification value= average volume of koh×28.056/weight of oil

17. Anti-bacterial test: An antibacterial experiment was conducted against two bacterial strains gram positive (b.subtilis) and gram negative (s.t using disc diffusion method.[18]

18. Anti-microbial: Take sample of soap was tested for its anti-microbial properties. By using bore diffusion method. E.coil was used in this method. 1gm soap was dissolved in distilled water. Various concentration was produced as 5,10,20,50 mg/ml. Antibiotic used is ciprofloxicin. Plate kept in to incubation for 24 hour at 37°c and calculate zone of inhibition.[21]

III. CONCLUSION

Soap is an ancient invention that has evolved over time. It is used for hygiene, health, and beauty. soap reflects the culture and history of different regions of process and saponification. saponification is safer, cleaner, and more customizable than hot process. Cold-process soapmaking involves safety, molds, measurements, and lye. It is a simple and customizable way to create your soap with natural ingredients. The melt-and-pour method is a simple and convenient way to make soap at home. It involves melting a pre-made soap base, adding fragrance, color, and other ingredients, and pouring the mixture into molds. The soap base contains glycerin, which is a natural moisturizer that helps to hydrate and nourish the skin. The soap does not require lye or curing, and can be used as soon as it hardens. The melt-and-pour method allows you to customize your soap according to your preferences and creativity. Rebatching is a way to recycle and improve soap scraps. It involves cutting, soaking, melting, adding ingredients, and molding the soap. Rebatching can enhance the soap's appearance, fragrance, and benefits. Rebatched soap can be used immediately or cured for longer. Cheapened soaps clean well, but can leave skin feeling rough. Transparent soap, or glycerin soap, contains high amounts of glycerol and is less drying than opaque soap. It's made by dissolving soap in a solvent to create tiny crystals that allow light to pass through. Adding oils like shea butter or jojoba oil can provide extra moisturizing benefits. Medicated soaps contain antiseptics to kill germs and can be made by combining active pharmaceutical ingredients with soap base. Beauty toilet soap is a high-quality toilet soap with balanced ph and a soothing effect on the skin. It has a unique name that appeals to everyone and has a good market potential due to its nature, quality, and properties.

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