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# Formulation and Evaluation of Herbal Soap

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## ABSTRACT

The aim of our study to develop the herbal hygienic soap by using cold process method and having antimicrobial agent. Herbal soap was prepared using coconut oil, castor oil, neem oil, lavender oil, rose oil, and NaOH (lye) and different extracts were included into basic saponification reaction. The herbal formulation was prepared and evaluated for the analysis of pH, moisture content, foaming index, foam retention time, saponification, TFM (total fatty matter) soluble matter, antimicrobial testing using different concentration of soap solution comparing with standard. The herbal soap has satisfactory antimicrobial results as compared to antibiotic. Moreover, oils used are added to treat various skin infection and for daily usage.

**KEYWORD**: Poly herbal soap, Evaluation, saponification value, antimicrobial potential.

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## INTRODUCTION

There is very large market of various bath soaps having so many varieties including herbal soaps. Personal hygiene, getting clean is treated as a big business. However, various skins related issues are being experienced by soap users too. Persons having skin issues like dryness, itching, acne, contact dermatitis are referred by Dermatologist and advised to use specific skin care products including specific type of soap according to skin type and related issues of patient.

Various skin types are normal, oily, dry, combination, or sensitive skin types. Factors like pH of soap and ingredients used as surfactants, high leather forming agents, colours, fragrances, can contribute skin related issues. The surface of the skin is slightly acidic, giving rise to the concept of the acid mantle. Studies have shown that potential of hydrogen (pH) of skin increases in proportion to the pH of cleanser used. Increase in pH causes an increase in dehydrative effect, irritability and Propionibacterium count. Changes in the pH are reported to play a role in the pathogenesis of some skin diseases. Therefore, the use of skin cleansing agents with a pH of about 5.5 may be of relevance in the prevention and treatment of those skin diseases. Unfortunately, pH is not mentioned in the labels of many products.

In view of above facts our team has focused to study the pH of soaps available in market by evaluating its parameters. Also, we have formulated preparation for herbal soap making and dealing with neutralization of pH during soap formulation. Further the report shall narrate and enlighten such aspects.

## DIFFERENT TYPES OF SKINS AND SKIN RELATED ISSUES OF SOAP USERS

Different skin types cover as normal, oily, dry, combination, or sensitive skin types. Skin type depends on things such as:

- How much water is present in skin, which affects its comfort and elasticity
- How oily it is, which affects its softness
- How sensitive it is

- **Normal Skin Type**

  Not too dry and not too oily, normal skin has:

  - No or few imperfections

- No severe sensitivity
- Barely visible pores
- A radiant complexion

- **Combination Skin Type**

  Skin can be dry or normal in some areas and oily in others, such as the T-zone (nose, forehead, and chin). Many people have this type. It may need slightly different care in different areas.

  Combination skin can have:

  - Pores that look larger than normal, because they're more open
  - Blackheads
  - Shiny skin

- **Dry Skin**

  Many persons have:

  - Almost invisible pores
  - Dull, rough complexion
  - Red patches
  - Skin is less elastic
  - More visible lines

A person's skin can crack, peel, or become itchy, irritated, or inflamed. If it's very dry, it can become rough and scaly, especially on the backs of hands, arms, and legs.

Dry skin may be caused or made worse by:

- Persons' genes, Aging or hormonal changes
- Weather such as wind, sun, or cold
- Ultraviolet (UV) radiation from tanning beds
- Indoor heating, Long, hot baths and showers
- Ingredients in soaps, cosmetics, or cleansers, Medications

**Oily Skin Type**

Such persons may have:

- Enlarged pores

- Dull or shiny, thick complexion
- Blackheads, pimples, or other blemishes

❖ **Skin related Issues: -**

High alkaline soap means there are lots of un-saponified lye left in soap, it can irritate skin. This is especially so for anyone with sensitive skin, including young children. Irritants in traditional soaps can cause dryness, contact dermatitis, inflammatory acne and throw off the delicate pH balance your skin maintains for both face and body.

➢ **Contact Dermatitis**

Soap bars containing a potent antiseptic, tetrachlorosalicylanilide (TCSA), can leave with some fairly serious side effects. TCSA was linked to an entire epidemic of photo allergic contact dermatitis in England in the 1960s. The parts of body exposed to an irritant, like TCSA or even strong fragrances in harsh soap and cosmetics, can break out into a red, often itchy rash accompanied by dry, cracking skin, oozing blisters, swelling and burning. Steer clear of TCSA, as well as other trouble chemicals like anionic surfactants, which are widely accepted as potent irritants to human skin. They are the most commonly used class of surfactants due to their relative ability to solubilize fats and oils. They may also solubilize the lipid membranes of skin cells.

➢ **pH Damage**

Our skin needs to maintain a specific, fairly acidic pH to function properly. The acid mantle, a thin, protective layer, is primarily composed of sebum; the skin's naturally produced oil. Its integrity is susceptible to irregularities caused by internal and external factors, like diet, pollutants and harsh soaps. To keep skin healthy, the acid mantle needs to be able to do its job, and to do its job we need to avoid cleansers that could upset its pH balance.

Highly alkaline soaps, which contain more of the lye that brings about saponification, have been linked to disruptions in the skin's pH balance. In a study on the effects of soap and detergents on skin surface pH in infants, the greatest increase occurred after washing with alkaline soap. The study concluded that any increase in the skin's pH level could irritate the protective acid mantle

and impair the composition of healthy bacterial flora and enzyme activity. Dissolution of fat from the mantle due to the change in pH could allow skin to become dry and squamous (scaly).

Even products specifically created for dry, sensitive skin can cause unwanted irritation. A study published in the International Journal of Dermatology measured the irritation factor of 17 products marketed for use on dry skin and 12 common soaps. They found that some products marketed for dry skin actually caused irritation based on the pH of the product.

- **Dryness**

Dry skin looks about as good as it feels: tight, uncomfortable and, in some instances, even painful. Harsh cleansers can strip the skin's natural oils, leading to dryness and irritation. Surfactants in cleansers can damage proteins and lipids in skin, leading to tightness, itching, dryness and barrier damage after washing, according to a study published in Dermatologic Therapy.

The study concluded that cleansers first have to minimize damage to lipids and proteins before they can even begin to care for skin. Only then can they deliver beneficial agents like occlusive, skin lipids and humectants that improve hydration.

Another study of elderly participants prone to dry skin showed that high levels of trans-epidermal water loss, which can lead to low skin hydration and reduced surface lipid content, were associated with using products that had a high pH.

- **Inflammatory Acne**

It seems counterintuitive, but the cleanser you're using to rid your skin of dirt and oils that clog pores could be contributing to the very acne you're trying to prevent or clear up. Cleansing agents such as harsh soap with a higher pH may damage the acid mantle's natural antimicrobial defences and lead to acne vulgaris, among other conditions, according to a study published in Skin Pharmacology and Physiology. The study postulates that using a moisturising cleanser with a pH of about 5.5, the same natural pH as your skin, could prevent and treat acne. It may also allow recovery from other consequences of using harsh soaps.

## LITERATURE REVIEW

**History of soap making and basic ingredients of soap: -** The precise nature in which soap came to be discovered is somewhat unclear and there are various legends surrounding its beginnings. The following timeline gives a broad indication of how it all started and how it progressed to the product we have come to enjoy as the modern soap.

**3000BC**
The Sumerians were using soap solutions made from a slurry of ashes and water. Sumerian priests and temple attendants purified themselves probably using this solution before carrying out sacred rites.

**2800BC**
The Babylonians were the first to record the basic method of soap-making through inscriptions on the side of clay cylinders where soap-like products were found stating that fats were boiled with ashes and water.

**1500BC**
The Ebers papyrus records shows how the ancient Egyptians produced a soap-like substance by mixing animal and vegetable oils with alkaline salts. This soap was not only used for washing but also for a treating a variety of skin diseases and threatening sores.

**1200BC (approx)**
From around 1200-200BC, the ancient Greeks bathed for aesthetic reasons and not for hygiene, apparently not using soap but instead using blocks of clay, sand and pumice, and anointing themselves with oil. The first Roman baths were also design around this time with aqueducts to supply them with water.

**79AD**
Discovery of an entire soap factory amongst the ruins of Pompeii. Ancient Germans and Gauls mixed ashes with animal fat to produce soap.

**100AD (approx)**
Early Romans and the Roman Empire were renowned for their Roman baths. Latin word for soap = sapo. Latin word sebum = tallow or fat. By 200AD, they were using soap in their baths.

**700AD**
Arabian soap is manufactured (Arabian chemists were the first to use vegetable oils eg. olive oil). They were also the first to produce solid soaps which were perfumed and coloured as well as the first to product liquid soaps and the first specialised shaving soap.

**800AD**
First soap-making process using goat fat and ashes from beech trees. Well known in Italy and Spain but the French used olive oil.

**1200AD**
The Italians and French started developing fragrance in soaps particularly in Savona in Italy and Marseilles in France becoming significant soap-making centres of the region.

**1500AD (16th Century)**
Mainland Europe started using vegetable oils such as olive oil as opposed to animal fats.

**Late 1700AD (18th Century)**
The first industrial manufacture of soap began.

**1791**
The first commercial soap-making by Nicholas Leblanc and Michael Chevreul. It was a patented method of making sodium carbonate (soda ash) from commonly available salt.

**1811**
Chevreul discovered the relationship between the chemical nature of fatty acids, glycerine (glycerol), alkali and fats ie. the understanding of the chemistry of soap.

**1789**
Andrew Pears (from London, UK) produced the first high quality transparent (clear) soap.

**1837**
Robert Spear Hudson produced the first soap powder.

**1850**
William Gossage produced the first low-priced good quality soap.

**1886**
Brothers William and James Hesketh Lever bought a small soap works in Warrington, the beginning of what is still one of the largest soap businesses (formerly Lever Brothers now renamed Unilever).

**1914**
The first commercially available soap is made triggering modern soap-making practices.

**1916**
The first development of synthetic detergents. Castile Soap first makes an appearance

**1930s-present day**
The 'batch kettle boiling' method allowed for small scale production of soap using large steel tanks (kettle) stacked on top of each other and using steam to heat up the reaction mixture of fats and alkali (batch). This process was replaced by industrial scale saponification called the continuous process where the ingredients are fed continuously into the reaction chamber rather than in batches. The soap is siphoned off as it settles thus reducing manufacturing time to less than a day and revolutionised soap-making. Proctor & Gamble (P&G) refined this process that began in the US and also initiated the first production of synthetic detergents using this method.

## History of cleansing in India and China

Before the advent of soap, the primary cleansing agent in ancient India was taken from soap nuts also known as soap berries (from the plant Sapindus Saponaria). The literal translation of Sapindus is sap = soap and Indus = India. In other words, soap from India!

**Fig-1 Cleansing agent- Aritha and Turmeric**

The nut was used in ancient China as well and its usage spread from India to Middle Asia and then Europe. The skincare routines of ancient Indians involved the addition of a variety of herbs such as turmeric, tulsi (holy basil), neem (bark and leaves), lotus petals and sandalwood paste amongst others which were common ingredients in their skincare creams.

## Modern day soap-making practices

Modern soaps benefit enormously from the industrial process, our advanced understanding of the chemistry of soap and an array of ingredients from around the world on the back of a global trading history. Historically, the fat component of the very early soaps was from animals as harvesting and processing of fats from vegetable sources were not discovered as yet. Notably, these fats tended to be tallow from the carcasses of animals i.e. fat from rendered beef, and there are very compelling reasons for using this.

## The chemistry of soap

The Sumerians (approx. 3000BC) used slurry of ashes and water to remove grease from raw wool and cloth so that it could be dyed. Ashes were referred to as ‘al-qualy’ and modern chemistry uses the word ‘alkali’ which is derived from this original word. Modern analytical methods have shown that ashes have a high alkali content which is one of the basic ingredients of soap-making.

Modern chemistry has made the understanding of the process of soap-making much clearer. Essentially, the production of soap entails a chemical reaction involving the saponification of fats by an alkali such as sodium hydroxide (traditionally, this was lye, originating from the Old English word léag, meaning ‘to wash’ or ‘to lather’). The reaction releases glycerine (or glycerol) which can

remain in the soap to varying extents as a softening agent but some manufacturers separate it from the final product. The type of alkali and fats used determines the type of soap yielding any number of combinations on formulation and creating the many wonderful varieties that are on the market today.

## Natural soaps

Even before soap started to make an appearance, early civilisation looked to nature. The soapwort plant (Saponaria officinalis) was mixed and agitated with water giving rise to the first natural soap. Modern interest or resurgence in natural skincare products has led to soap making using only plant fats and plant-based alkalis and using only natural fragrances such as essential oils to add fragrance to the final product.

Advances in modern soap-making as well as our understanding of the chemistry of soap ingredients has also enabled superior products that are now refined for different purposes. Soap in the mid-19$^{th}$ Century became a separate commodity from laundry soap which we now refer to as household detergents (modern petroleum-based detergents cannot, by law, be called soap). Laundry soaps were far too strong and drying to be used on the skin but were more suited to cleaning hard surfaces and clothes. Advances in technology and chemistry has enabled variations of soaps such as liquid soaps and shower gels, the latter which were invented in the 1970s to enter the market and which have now become the mainstay for most households.

## Herbal Soap Formulations, Basic Ingredients and Various Herbs

**Fig 2:- Saponification**

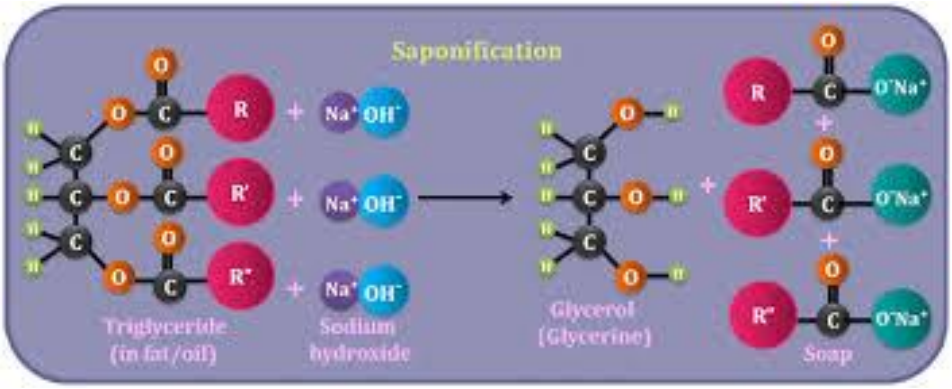


**Fig 3:- Saponification process**

- **Lye / Sodium hydroxide**

Soap making is essentially the chemical reaction between oils and lye, which in cold process soap making is sodium hydroxide. Together and through the wonder of chemistry, they will form a completely new compound — soap.

- **Distilled water**

Distilled water in soap making to activate the lye and disperse it through the oils. Most of this water evaporates out of bars during the curing process. Using tap water, or spring water, in soap making as it can have minerals and impurities that impact the quality and shelf-life of soap. This will usually be formulated to give you a 33-38% lye concentration.

- **Oils & Fats**

Most soap recipes include 3-6 oils but some have a lot more, or less. Soaps made from a single oil, such as Castile (olive oil) soap are uncommon because very few single oils make good soap. Different oils give different properties to soap including hardness, lather, creaminess, and conditioning. Most soap recipes are also super-fatted. These extra oils don't combine with lye and make the difference between a bar of soap that's cleansing and a bar of soap that's cleansing and moisturizing.

- **Common oils, fats, and butters used in soap making**

- Castor oil is a thick liquid oil that creates gorgeous lather in soap recipes—typically used at around 5% of soap recipes since more can cause soap to be too soft or sticky.

- Cocoa butter provides gorgeous moisture and skin protection and also helps to harden your soap. Use in smaller percentages of up to 15% of base oils or as a super fatting oil.
- Coconut oil is used in most soap recipes and helps create a hard bar with loads of fluffy lather and cleansing power. Recipes tend to include 25% or less of coconut oil, and unless otherwise stated, you use solid refined coconut oil that melts at 76F. Liquid (fractionated) coconut oil has different properties and a different SAP. Virgin coconut oil, the expensive stuff from the supermarket that tastes and smells so lovely, isn't used very much in soap making.
- Grapeseed oil has many of the same properties as sunflower oil in soap. It creates creamy and conditioning lather and can be used as up to 15% of a recipe.
- Neem oil is often a thick and pungent green oil used in skincare and soap to help soothe eczema and other skin conditions. It sometimes arrives as a dark liquid oil, though. It can be use at 5% or less of recipe as a super fatting oil.
- Olive oil is also used in most soap recipes and creates sensitive and conditioning bars excellent for all skin types. Most soap makers prefer using olive oil pomace (second grade olive oil extracted using solvents). Extra virgin olive oil is purer but takes longer to come to trace and may add a yellow or greenish-yellow tint to soap. Up to 100% olive oil can be used.
- Palm oil is an inexpensive solid oil that creates good lather and hard bars without the over drying factor that's such an issue with coconut oil. It's used as up to 33% of the base oils in a soap recipe, and if you use it, please use sustainable palm oil certified by the RSPO and Rainforest Alliance.
- Sunflower oil is also an inexpensive oil that's best used at 15% or less of a soap recipe. It creates a lovely conditioning lather in soap and is also easy to find in most regions. Using too much of it can create soft bars that have a shorter shelf-life.
- Sweet almond oil is used for its light feeling and ability to condition the skin without leaving it feeling greasy. It's also is the carrier oil used by most massage therapists. Used up to 20% of base oils in soap recipes, it creates a rich and conditioning lather and decent hardness.

➢ **Antioxidants**

Soap does not require preservatives since the water used in the recipe will evaporate out. All body care soap recipes are calculated to have more oils in them and than can be transformed

into soap by the lye. This is called 'super-fatting,' and it's a field that can control in soap recipe calculators. Depending on the oil, they also have varying shelf lives, not because they spoil, but because they oxidize and go rancid. It can cause soap to smell bad or to develop 'Dreaded Orange Spot.' Orange spots on soap that sometimes seep with liquid. To combat rancidity, and help soap have a longer shelf-life, soap makers use two main antioxidants. These are completely optional and are unnecessary if oils and butters are made into soap, and used as soap, well within their original best-by dates.

- Grapefruit Seed Extract (GSE) extracted from the seeds and pulp of grapefruit this thick and clear liquid doesn't add a scent to your soap and is very effective at keeping other oils from spoiling.
- Rosemary Oleoresin Extract (ROE) extracted from rosemary leaves and quite a thick and strong-smelling herbal liquid.

➢ **Soap Fragrance**

Some people will choose to let their soap scent speak for itself and leave it to smell like simple, clean, handmade soap. Another idea is to use oils like sesame or beeswax in recipes since they will impart their own unique and natural fragrances. However, the most common way to scent soap is with either essential oils or cosmetic grade fragrance oils. Essential oils are concentrated plant and flower extracts and come in a fairly extensive range. The downside of using essential oils is their expense and propensity for fading with time. It's especially problematic for citrus essential oils such as lemon and orange.

➢ **Fragrance oils**

Fragrance oils are commercially produced perfumes for the toiletry and home industry. They're relatively inexpensive, have a scent that lasts ages, and have a much more varied range to choose from. If you like baby powder scented soap or a shampoo that smells like coconut then you'll need to use fragrance oils, which are both synthetic and patent protected products though. In many cases, they can contain petrochemicals and allergens that cause people to sneeze or have skin reactions. All fragrance oils are not skin-safe. Many made for the candle and diffuser industry can cause rashes and burns if used on the skin and required to ask the supplier for the MSDS (material safety data sheet) if it's not clear.

➢ **Scent Fixer**

Above mentioned that the scent of essential oils can fade over time but there are ways to 'fix' the scent so that they'll last longer. Sometimes another essential oil can help the others to stick and at other times it's best to use another additive that works to absorb the essential oils into it. Fixers are a bit more advanced in soap making but I thought I'd add them in so that those experimenting with making nice smelling soap aren't frustrated by their soap's scent evaporating during the curing process. Here are some of the choices you'll come across:

- Arrowroot is an edible white powder used in thickening sauces and gravy. Use as little as a teaspoon in 800g (28oz) batches.
- Benzoin is available as both a powder and as an essential oil.
- Corn starch is another food thickener that you use as little as a teaspoon in 800g (28oz) soap batches.
- Kaolin clay works similarly to corn-starch and in the same amount. You can use up to a teaspoon per 1-lb soap batches, and many soaper's mix it with the essential oils the night before. With clay you need to add 3x its amount in distilled water to disperse it just before you add it at trace.
- Oatmeal is one that I've discovered on my own. Using finely blended oatmeal in your soap will add light exfoliation and will absorb and hang onto your essential oils.
- Orris root powder is made from the dried and powdered root of the Iris (Iris germanica) and has a woodsy and violet scent of its own.
- Essential oils- base note essential oils such as cedarwood, patchouli, and balsams can ground the other essential oils in the blend.

➢ **Soap Colours**

In natural soap making have several options for colouring the soap which will include powders which can be purchased from specialty suppliers and even flowers and plants that could be growing in garden right now. Other options could include clays, plant extracts, or ingredients that will caramelize and give a warm colour to the finished product.

▪ Some of your base oils, such as olive oil, will impart a more yellow or creamy colour. White and/or light-coloured oils will create white soap.

▪ Cosmetic clays can add beautiful natural colour to your soap and come in a range of shades including blue, brown, yellow, green, and pink.

▪ Sugars: milk, sugar, and honey will caramelize if you add them to your batch before trace. They'll do the same thing if your soaping temperature is warm enough — over 105F in my experience.

▪ Herbs, Flowers, & Roots: Nature creates all types of wonderful colours useful in soap making. Use calendula petals for golden orange, alkane root for purples, and madder root for pink.

▪ Mineral pigments are available in a wide range of colours that can help you hit most of the hues of the rainbow. However, they are considered 'nature identical' rather than 'natural'. These are the same colours used in mineral make-up but are created in a controlled environment, rather than mined from the earth. This is because their natural counterparts are often tainted with dangerous heavy metals, such as arsenic and lead.

▪ Mica's are similar to mineral pigments as they are created in a lab. They're even less natural, some are made with nature-identical colours and others with dyes. Many micas misbehave in cold-process soap making too and end up colours that they're not supposed to be.

- **Botanicals**

The word botanicals simply mean natural fruit, flower, leaf, and root additives that impart either colour, visual interest, or exfoliation to your soap. There is some conjecture as to how much of the original properties found in these ingredients survive the soap making process. However, many are useful in adding colour, texture, and decoration.

- Botanical oils are mainly used in the super-fatting phase and may include rose-hip oil, neem oil, and borage seed oil
- Dried fruit & whole spices – lemon and orange slices, peppercorns, and cinnamon sticks are just some of the items you can add to your soap to create holiday or scent themed designs.
- Powdered spices, such as turmeric powder, can also provide vibrant natural colour.
- Exfoliants such as rolled oats, ground almonds, and poppy seeds can all be added at small amounts to create scrubby soap.

- Herbs and flowers can be used to both decorate and tint your soap. Use infusions of flowers and herbs in place of some or all of the water content and feel free to use dried flowers on both the tops and interiors of your soap.
- There are various roots with medicinal value that can be used in soap making. However, the effectiveness of the active ingredients can be questionable in your final product. Alkane and Madder root are roots used purely for colour and tend to be added by infusing liquid oils with the dried root. You can also add a powdered version of the root directly to the soap.

## SOAP PREPARATION

Herbal medicines, plant products and extracts are imitative for its utilisation since the prehistoric times. Plants comprehending with pharmacological active properties are in utilisation since the existence of mankind as functional foods, medicines, cosmetics, dyes as well as in prevention, cure and treatment of various diseases. The extract produced from roots, stem, leaves, flowers possessing medicinal properties acts as a natural remedy for the disease or ailment. Though with the advent of synthetic medicines, the utilisation of herbal medicines has been recouped. But the standards of the herbal medicines in pursuit of its safety and efficacy have still not matched by the synthetic drugs. There have been tremendous increases in the use of herbal medicines in the recent times. It has been estimated that in the countries –developed as well as developing, the application of herbal plant extracts in the medicines is about eighty percent of the total world population. It is regarded as one the primary health care measures for the treatment of various ailments especially in the developing countries. This spectacular rise in the utilisation of the herbal plant and well as its extracts gave rise to a newer branch of medicinal science referred as 'Herbal Medicinal Products' These may be defined as the Plant or part of plant used as a whole or as an extract for the treatment, prevention of disease or ailment to be utilised in the health care management. These herbal medicinal products impart various properties such as anti-microbial, anti-inflammatory, anthelminthic, anti-diabetic, antioxidant and many more. Thus, herbal medicine imparting various properties are used in various pharmaceutical formulations such as soaps, ointments, gels, creams for the treatment of various skin related disorders as well as for the cosmetic use. The elevating rise in the pursuit of herbal medicines has caused an increased demand of the larger production of herbal products. Herbal medicinal products are in greater demand than the synthetic ones because of many reasons:

- Lesser Side effects
- Better safety and efficacy
- Easily available
- Better compatibility with additives
- Potent therapeutic effect
- Cost-friendly
- Greater are for selection
- No requirement of animal testing
- Better compatibility with all types of skin

Skin is the most revealed part of the body which is prone to various foreign particles which may lead to various skin related disorders. Therefore, in order to prevent the skin from various disorders there is a need for the proper cleanliness as well hygiene for the most exposed part of the body and prevent it from pervasive micro-organism spread in the environment thus, preventing various disorders of the skin. The better and efficacious way to remove all the foreign particles, dirt is the use of Soaps. The utilisation of soap helps in cleansing the skin along with the anti-microbial properties. Various micro-organisms such as Staphylococcus aureus, Pseudomonas spp., Klebsiella pneumonia and Proteus vulgaris being the causative agents for various skin infections. Antimicrobial property in regard to the human body helps in prevention of diseases as well as skin infections. Antibacterial property is defined as the property of inhibiting the growth of bacteria. Soaps are defined as the cleaning agents–solid, liquid, semisolid powders which help in removing dust, dirt, microorganisms, stains and for maintaining health and beauty. The free fatty acids when reacted with an alkaline base by the process of saponification comprises of a soap. Fatty acids such as lauric acid, palmitic acid, stearic acid help in imparting washing property of soaps. The soap industry is estimated to be about 186 billion US Dollars. Also, the current trends have elevated to a tremendous rise in regard of the natural ingredients. The origin of the basic soap can be traced back to the Egyptians when an alkaline plant was mixed with animal fats for the generation of crude soaps. Herbal soaps have gained importance in the recent years which include the extracts of various plant.

Extracts incorporated in to the basic soap reaction. It is reported that herbal antimicrobial soaps have been reported to have about 60-80% of the property to inhibit the growth of micro-

organisms. Production natural as well as handmade soaps have been a total artistry work involving various factors such as skill, ingredients, creativity and thoughts tend to produce a quality soap. Another factor affecting the quality of soaps are:

- Ability of lather producing
- Colour of the soap
- Fragrance of the soap
- Moisturizing ability
- Compatibility of the skin
- Storage Stability.

Herbal soaps can be defined as fatty acids in combination with alkali salts being derived from vegetable or plant origin containing natural fragrances or organic ingredients. The method of preparation is by two processes – hot process and cold process which involves the presence of base such as potassium hydroxide and sodium hydroxide along with the fatty acids to form soap.

Cold process is usually preferable process by the artisans. The quality of the soaps is dependent on various factors such as type of alkali used, its hardness, foam height, solubility etc. Various types of oils are used depending upon the properties they impart such as: Olive oil, Castor oil, Sunflower oil, Palm oil, Rice bran oil, soybean oil etc. Additives include antioxidants which help in suppression of the oxidation of fatty acids in the herbal soap bar. For instance: Rosemary extracts, tomatoes, fruits etc. Fragrance and colouring agent are also included. The aim of this study is to formulate an antimicrobial herbal soap containing various extracts incorporated into one. Castor oil is obtained from castor plant whose biological source is Ricinus communis L. belonging to family Euphorbiaceous. Basically, castor oil is a non-volatile, almost yellow (pale in colour). In addition, castor oil is non-volatile in nature. About 40-50% oil is present in the castor seeds which are subjected to extraction by various methods. These methods include: Mechanical method and solvent Extraction. The former process the seeds are subjected to crushing along with its introduction to a steam vessel for lowering of the moisture content present in the seeds. These are then place in hydraulic press mechanical for the extraction of oil. While the latter method is employed in association with the later as mechanical process extract out about only 40% of the total oil present in the seeds. Solvent extraction method is carried out in Soxhlet apparatus along with solvents such as petroleum ethers, heptane and hexane. Chemically castor oil consists of about 90% of the total– ricin olein acid which provides its vast application in the industry such as chemical industry, about

three percent oleic acid and about four percent linoleic acid. Castor imparts lathering property during the formulation of herbal soap. In addition, it provides moisturizing, softening and conditioning effect to the soap. It is often referred to as super fat soap. Neem oil obtained from Neem tree which is botanically called as Azadirachta indica, belonging to the family– Meliaceous which is indigenously found in almost all parts of India, Pakistan and other neighbouring countries. On a characteristic basics Neem oil is generally yellowish greenish- brownish in liquid state. The oil consists of an acrid taste and somewhat obnoxious odour. This results because of latency of sulphur as a volatile element. Extraction methods for extracting out the oil inside the Neem seeds include: Mechanical method, method of extraction using a solvent and SFE- Super critical fluid method. Neem oil is said to possess anti-bacterial properties and is used in treatment of pain as well as inflammation. In addition to it, in an herbal soap formulation along with bactericidal action it helps in treatment of various skin diseases such as ringworm, scabies etc.

Mentha oil botanically from the family Lamiaceae is obtained from the flowering leaves of Mentha piperita. This commonly called Peppermint is found in Europe and its cultivation is in almost all regions of the world. Mentha as an essential oil consists of methyl esters, alcohols, ocimene, terpenes, thujone, acetaldehyde, menthone, iso-menthone, sabinene as its chemical composition. This essential oil is said to have potent antibacterial activity against organism such as E. coli and it provides greater antioxidant property in the soap formulation. Mentha oil as volatile oil help in relaxation of mind as well as help in ameliorate the mood.

## PLANT PROFILE

### Neem Oil

**Botanical name of neem:** Azadiracta indica

**Fig-4: Neem oil**

**Plant typically used** – leave

**Colour**- Green

About 80% of all neem oil in India is used in the process of making neem soap. Neem oil is extracted from neem tree. It is sourced from the tropical neem plant which is also called the Indian lilac. Neem oil thus acquired is a primary ingredient used in making neem soap for skin. Unlike other essential oils like that of the tea tree or lavender, neem oil is not just an additive in soap, it instead is the main product. It forms the base of the neem soap in India and elsewhere. It is considered as the best antibacterial soap in India.

Neem oil has been used around the world as folk remedy for centuries. It has been used for years to treat a variety of conditions. Neem soaps are rich in medicinal properties and can be used for many purposes. Because of the presence of neem extracts, neem soap is full of nutrients and has high content of fatty acids, vitamin E, calcium, antioxidants, triglycerides and limonoids.

**Benefits of neem oil**: Its lipids help tone and lock moisture into dry skin. Neem extracts have been used in organic soaps for many years. It is ideal for treating skin disorder and daily skincare. Because of its nutritional effects on scalp and skin, neem shampoo and neem soap are trendy cosmetics. Neem products are known to relieve itching and redness in irritated skins. Cracked and dry skin can be moisturised and made smooth by using neem soaps for skin. Because of its disinfecting properties, skin problems caused due to fungi, parasites or infection is cured quickly by neem soap.

**Constituents:** flavonoids, alkaloids, azadirone, nimbin, nimbidin, terpenoids, steroids, margosicasid, vanillic acid, glycosides, B-sitosterol, nimbectin, kaempferol, quercursertin are present in neem leaf.

## COCONUT OIL

**Botanical name**: Cocos nucifera

**Fig 5: Coconut oil**

**Benefits**: coconut oil helps to produce a bar of soap that has excellent cleaning properties

**1. Cleansing:** Coconut oil soap is highly cleansing and conditioning to the skin and produces a wonderfully bubbly, creamy lather. It is rich in fatty acids which help to remove blemish causing dirt, bacteria and dead skin, and it does so gently without irritating the skin. The soap is great for removing makeup and even for cleansing hair without the use of harsh chemicals.

Its natural deodorising properties can also help to eliminate body odour.

**2 moisturising:** the fatty acids in coconut oil soap provide intense hydration to the skin without stripping away natural skin oils, making skin feel soft smooth. Skin can readily absorb this oil without becoming greasy. Coconut oil moisturising enough to soothe the direst of skin while gentle enough for sensitive skin types, so even babies can enjoy these benefits.

**3 Anti-inflammatory -** coconut oil-based soap has antibacterial, antifungal and anti-inflammatory properties so it can help to tackle many kinds of skin issues. The lauric, capric and caprylic acids within the oil are credited with many of these benefits. These fatty acids help to soothe skin and reduce inflammation, making it a great solution for problem prone or sensitive skin.

**Constituents:** fatty acids, Caprylic acid, Capric acid, Lauric acid, Myristic acid, Palmitic Acid, Stearic Acid, Oleic Acid, Linoleic Acid.

**OLIVE OIL**

**Botanical name of olive:** Olea Europa

Fig 6: Olive oil

**Benefits:** Olive oil as a base ingredient due to its deeply moisturising and nourishing properties. Also be used as a pure body oil, hair treatment, or natural soap which can help to relieve dry skin and

soften wrinkles.

**Constituents:** Triacylglycerol', fatty acids, mono and di acyl glycerols, and an array of lipids such as hydrocarbons, sterols, aliphatic alcohols, tocopherols, and pigments. A plethora of phenolic and volatile compounds are also present.

**ROSE OIL**

**Botanical name of rose:** Rosa

**Fig-7: Rose oil**

**Plant typically used:** Leaves

**Benefits of rose oil in soap:** Rose essential oil has antibacterial, anti-fungal, and anti-viral properties, which makes soap ideal to typically treat a host of skin conditions. Rose water purifies the skin and maintain the pH level of skin.

**Constituents:** Citronellol, Aerol, Geraniol, Nondecane, and Heneicosane.

## ALMOND OIL

**Botanical name:** Prunus amygdalus

Fig-8 Almond oil

**Benefits of almond oil**: Almond oil is rick source of vitamin E, sweet almond oil is used as a carrier oil in aromatherapy, bitter almond oil is used as food flavouring and in perfume.

**Constituents:** glycerides of oleic, linoleic, palmitic, myristic, margaric, stearic, linolenic, behenic and erucic acids

## MATERIALS AND METHOD

- **Collection of Materials/Ingredients: -**

  Neem oil, Coconut oil, olive oil was purchased from the local market. Sodium hydroxide and Distilled water was obtained from our college. Following table represent the list of ingredients used for the formulation of Poly herbal soap**.**

**For Neem Soap:** **[Table No.1]**

| SR.NO. | Ingredients | Quantity |
|---|---|---|
| 1 | Distilled water | 32.92gm |
| 2 | Lye (sodium hydroxide) | 14.72gm |
| 3 | Olive oil | 70gm |
| 4 | Coconut oil | 25gm |
| 5 | Neem oil | 5gm |
| 6 | Neem leaf | 1 |
| 7 | Green colour | 2-3 drops |

**For Rose Soap:** **[Table No.2]**

| SR.NO. | Ingredients | Quantity |
|---|---|---|
| 1 | Distilled water | 32.92gm |
| 2 | Lye (sodium hydroxide) | 14.72gm |
| 3 | Olive oil | 70gm |
| 4 | Coconut oil | 25 gm |
| 5 | Rose oil | 5gm |
| 6 | Rose petals powder | 0.20 gm |
| 7 | Pink colour | 2-3 drops |

**For Almond Soap:** **[Table No.3]**

| SR.NO. | Ingredients | Quantity |
|---|---|---|
| 1 | Distilled water | 32.92 gm |
| 2 | Lye (sodium hydroxide) | 14.72 gm |
| 3 | Olive oil | 70 gm |
| 4 | Coconut oil | 25 gm |
| 5 | Almond oil | 5 gm |
| 6 | Brown colour | 2-3 drops |

**For Rose Almond Soap:** **Table No.4]**

| SR.NO. | Ingredients | Quantity |
|---|---|---|
| 1 | Distilled water | 32.92 gm |
| 2 | Lye (sodium hydroxide) | 14.72 gm |
| 3 | Olive oil | 70 gm |
| 4 | Coconut oil | 25 gm |
| 5 | Rose oil | 5 gm |
| 6 | Almond oil | 5 gm |
| 7 | Pink, brown colour | 2-3 drops |

- **Herbal soap making process: -**

  The reaction between an alkali (like Sodium Hydroxide) and any neutral fatty acid is the basic saponification reaction. In this reaction neutral fatty acid used was coconut oil, olive oil and alkali used sodium hydroxide (lye).

**Procedure for Neem Soap: -**

a) Weighed amount of coconut oil, olive oil, neem oil was poured in a beaker.
b) In another beaker, prepare the basic saponification reaction by adding NaOH in distilled water.
c) Add the oil mixture in the solution of lye and mixed well with the help of magnetic stirrer without heating involving the cold process of soap formation.
d) Green colour added gradually with continue measurement of pH to achieve between 6 to 7.
e) The soap mixture was then allowed to solidify and kept at room temperature.

**Procedure for Rose Soap:**

a) Weighed amount of coconut oil, olive oil was poured in a beaker.
b) Separately weigh rose oil in a beaker and stir well.
c) In another beaker, prepare the basic saponification reaction by adding NaOH in distilled water.
d) Then mix oil mixtures and rose oil pink colour, and lye was then poured involving basic soap formation with continuous stirring on a magnetic stirrer without heating involving the cold process of soap formation.
e) Rose petals added gradually with continue measurement of pH to achieve between 6 to 7.
f) The soap mixture was then allowed to solidify and kept at room temperature.

**Procedure for Almond Soap:**

a) Weighed amount of coconut oil, olive oil was poured in a beaker.
b) Separately weigh almond oil in a beaker and stir well.
c) In another beaker, prepare the basic saponification reaction by adding NaOH in distilled water.
d) Then mix oil mixtures and almond oil, brown colour and lye was then poured involving basic soap formation with continuous stirring on a magnetic stirrer without heating involving the cold process of soap formation.
e) Measurement of pH to achieve between 6 to 7.
f) The soap mixture was then allowed to solidify and kept at room temperature.

**Procedure for Rose Almond Soap:**

a) Weighed amount of coconut oil, olive oil was poured in a beaker.
b) Separately weigh rose oil and almond oil in a beaker and stir well.
c) In another beaker, prepare the basic saponification reaction by adding NaOH in distilled water.
d) Then mix oil mixtures and rose oil - almond oil, pink and brown colour and lye was then poured involving basic soap formation with continuous stirring on a magnetic stirrer without heating involving the cold process of soap formation.
e) Measurement of pH to achieve between 6 to 7
f) The soap mixture was then allowed to solidify and kept at room temperature.

## EVALUATION PARAMETERS

- . **pH of the Poly herbal soap:** 10% of soap solution was prepared by dissolving 10 gm of soap in distilled water in a volumetric flask of 100 ml. For the determination of pH, pH meter was used. Electrode was introduced into the solution and the pH was noted down.

- **Colour and clarity characterization:** The soap was visualized against a white background for the determination of its colour and to see the clarity of the formulated Poly herbal soap.

- **Foam forming ability:** For the determination of the Poly herbal soap for its ability to form foam about 1.0 gm of soap was taken and was dissolved in distilled water (about 50ml) in a 100 ml graduated measuring cylinder. It the measuring cylinder was then shaken for about 2-3 minutes and it was allowed to stand for about 10 min. Foam height was measured after 10 minutes. Record the observation for three consecutive experiment and the mean was taken.

- **Retention time of foam:** Foam retention time refers to the time for which the foam produced by the soap retains. The above procedure was repeated and the foam interval was measured for about 5-10 minutes.

- **Saponification value determination:** The amount of Potassium Hydroxide in milligrams which is required for the complete saponification of fat or oil of 1 gm. In either word it is defined as the mean of molecular weight of fatty acid which is present in oil or fat. For the determination of saponification value about 2 gm of the soap sample was taken in a conical flask and 0.5M KOH solution was added to it. This mixture was heated to about 55 degree Celsius along with stirring continuously on a hot water bath. Then the temperature was further increased 100 degree Celsius and boiling was continued for about 1-hour Titration was performed with phenolphthalein was an indicator and 0.5M HCl. The end point observed is pink colour disappearance.

  Saponification is calculated as:

  Saponification Value: Avg. Volume of KOH × 28.056 / Weight of oil (g)

- **Determination of TFM (total fatty matter):** The procedure for the analysis of total fatty matter present in the soap sample is carried out by the reaction of the soap with an acid in association of hot water. In this procedure approximately 10g of the soap sample was taken and dissolved in 150 of water (distilled). It was dissolved by heating. Then this soap solution was treated with 20% sulphuric acid and heated till the solution gets cleared. Fatty acids would be observed at the surface or the film which were then solidified by the addition of 7 gm of bees wax and again heated. Cake formation takes place and it was removed and weighed.

  % Total Fatty Matter = (A –X)/W x 100

  where, X= weight of wax

  A= weight of wax+ oil

  W= weight of soap

- **Antimicrobial testing of the given sample:** The given sample of the soap was tested for its antimicrobial properties. By bore diffusion method. The micro-organism used were E. coli. In this method soap solution was prepared by dissolving 1 g of soap in distilled water. Various concentrations were produced such as 5, 10, 20, 50 mg/mL, the antibiotic used is Ciprofloxacin -5µg. The plates were then kept for incubation for about 24 hours at a temperature of 37 ºC. Calculated the zone of inhibition

## EVALUATION OF SOAP

**[Table No. 5]**

| SR. NO. | Evaluation parameter | For Neem Soap | For Rose Soap | For Almond Soap | For Rose Almond Soap |
|---|---|---|---|---|---|
| 1 | pH | 7 | 6.7 | 6.0 | 7 |
| 2 | Colour | Green | Pinkish red | Light brown | Reddish brown |
| 3 | Form forming ability | 15.0ml | 16.0ml | 15.0ml | 15.0ml |
| 4 | Retention time of foam | 10-15 Minutes | 10-15 Minutes | 10-12 Minutes | 10-15 Minutes |
| 5 | Saponification value determination | 164.5g/ml | 165.29g/ml | 163.2g/ml | 163.0g/ml |
| 6 | Total fatty matter | | 73% | 72% | 72% |

## DESCRIPTION ABOUT SOAP

**NEEM SOAP:**

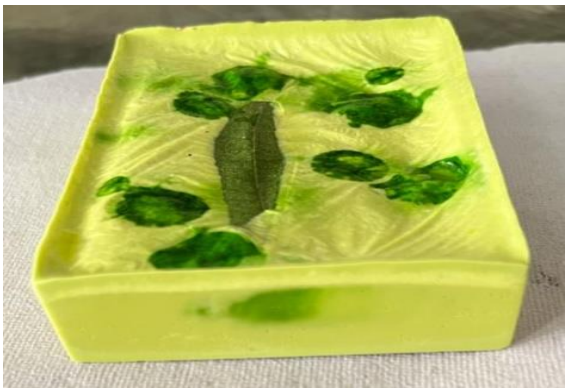

Fig.- 9 Neem soap

- Neem is an excellent skin care ingredient. The neem soap is known to relive a dry skin and smooth the skin.

- It is rich in antifungal and antibacterial properties. It is protecting the skin from bacteria and cleanses thoroughly from dirt and pollution. It can be used for all type of skins.
- Being a natural handmade product there is bound to be variations in scent and colour.

**ROSE SOAP:**

Fig.-10 Rose Soap

- Rose soap is a perfect blend of rose essential oil, pure rose water and extra virgin coconut oil. Rose essential oil has antibacterial, antifungal and antiviral properties which make this soap ideal to treat a host of conditions.
- Rose water purifies the skin and maintains the pH level of the skin. The coconut oil is rich in fibre, vitamin and minerals which helps relieve dryness, removes dead skin cells.
- Being a natural handmade product there is bound to be variations in scent and colour.

**ALMOND SOAP:**

Fig.-11 Almond Soap

- The herbal almond soap is filled with vitamin E which helps to keep the skin soft and supple. It protects the skin cells from UV radiation and makes it healthy and radiant.
- The fatty acids present in almond extracts helps to keep the skin moist and nourished.
- Being a natural handmade product there is bound to be variations in scent and colour.

**ROSE- ALMOND SOAP:**

Fig.-12 Rose Almond Soap

- The rose - almond soap help leaves your skin feel soft. The rose is known to revitalise the skin and leaves it feeling rejuvenated.
- The almond oil is excellent skin softener which moisturizes your skin.
- Being a natural handmade product there is bound to be variations in scent and colour.

## RESULT AND DISCUSSION

- The Poly herbal soap results of various evaluation parameters are shown in the table 1, table 2, table 3, and table 4. The tables depict that the pH of the herbal formation was between 6.5 to 7, which was optimum for its utilization on the skin. Higher as well as lower pH refers to the harmful effects on the skin. The foaming index of the given herbal formulation as found to be 15.0ml, 16.0ml, 15.0ml and 15.0ml while the foam retention time was found to be 10-15 minutes for respectively table 1, table 2, table 3, and table 4. This means that the lather producing ability of the soap was satisfactory and stable. The total fatty matter determination was 71%, 73%, 72%, and 72% each respectively for table

1, table 2, table 3, and table 4. The quality of the soap is represented by the total fatty matter. If the total fatty matter is lower, then it is not optimum for the dry skin. Greater the fatty matter more it helps in moisturizing the skin. The saponification value was found to be 164.5g/ml, 165.29g/ml, 163.2g/ml, and 163.0 g/ml.

## CONCLUSION

- During this project work our team had finally achieved the desired results and formulation to make the poly herbal soap which does not contain any harmful chemicals. The pH between 6.5 to 7. Volunteers responded well and gave good feedbacks by using these poly herbal soaps. Soaps were found to be skin friendly. It was nice learning and a great achievement for our team to prepare the poly herbal soap with balanced pH. Furthermore, the prepared soap was evaluated by testing various physic-chemical properties such as pH appearance, colour, odour, antimicrobial, TFM in which they exhibit satisfactory effect.

## Product Image:

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