

**PREPARATION AND EVALUTION OF SLS FREE
HERBAL TOOTHPASTE**

**Submitted to
ATMIYA UNIVERSITY**



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2023-24



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DECLARATION

We, all hereby declare the Work is presented in the project report entitled Preparation and Evaluation of SLS free Herbal toothpaste.

It is an authentic record of work carried out by us during the studying period of semester 8 at and under the guidance of Atmiya University, Rajkot, and is being submitted for partial fulfillment of the requirement for the award of a bachelor's degree in B.pharm. This is not submitted anywhere else for the award of any other degree/diploma.

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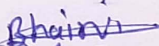
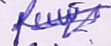


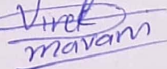
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ABSTRACT

- The goal of the research is to create toothpaste that is free of SLS in order to lessen the negative impacts that SLS can have.
- In current scenario, in oral dental care with use of herbal toothpaste containing natural ingredients are more acceptable in public belief than chemical based synthetic formulations due to their safety and efficacy in reducing dental caries, and preventing other dental issues to which this generation is prone to.
- It is observed that surfactant can be harmful if taken in excess and has been connected to cancer, neurotoxicity, skin irritation, organ toxicity, and endocrine disruption.
- We have identified natural surfactants in this work that may be useful in toothpaste formulations instead of SLS. Therefore, we are using its alternative Sodium methyl cocoylTaurate.
- We use ingredients in this formulation that have not previously been used in any other study endeavor, including Sodium methyl cocoylTaurate, Babool powder, Camphor powder, clove oil, and Ginger extract.
- This work is also comprised of the extraction process of these natural surfactants along with evaluation parameters.[1]
- In addition to this formulation based on herbs, a comparative analysis of previously available herbal toothpastes was conducted to gain insight into critical physical parameters such as pH, stability, extrudability, spreadability, foamability, and homogeneity that are necessary to create a successful, stable, and more effective formulation.[2] This study compares and assesses herbal toothpaste with commercial toothpaste.[2]
- This study shows that, when compared to commercially available herbal formulations, the effectiveness of our herbal-based toothpaste formulation with natural constituents is comparable.
- Our Aim is to prepare and evaluate SLS free Herbal Toothpaste.

Keywords: SLS free herbal toothpaste, sodium methyl cocoyltaurate, evaluation, and comparison with dantkanti toothpaste

AIM OF OBJECTIVE

- To formulate SLS free herbal toothpaste.
- To evaluate of physicochemical parameters of herbal toothpaste.

Rational

Sodium lauryl sulfate (SLS) is a common ingredient in many toothpaste formulations that is responsible for creating foam and lather. On the other hand, some people might be sensitive or irritated by SLS, which could cause discomfort, dryness, or mouth ulcers. Because of this, there is a rising market for toothpaste without SLS, especially among consumers looking for softer dental care products.

For people who are prone to tongue irritation or sensitivity, herbal toothpaste without SLS provides a mild alternative. It offers efficient dental care without the possible side effects of artificial chemicals thanks to natural substances like sodium methyl cocoyltaurate, ginger extract, camphor powder, clove oil, babool powder. It lowers the chance of discomfort and is consistent with holistic wellness beliefs by doing away with SLS. Additionally, by excluding a potentially hazardous chemical, SLS-free formulas support environmental sustainability. SLS-free herbal toothpaste is an appealing option for people looking for natural, gentler dental care products that support general health and oral health.

LITERATURE REVIEW

Since ancient times, people have used herbal and herbal-based toothpaste, and it's one of the main essential elements of dental health care. Between 300 and 500 BC, toothpaste formulations were first manufactured and developed in China and India.

During that time, abrasives such as crushed egg, clam shells, neem twigs and crushed bone were used to clean teeth. The nineteenth century saw the development of modern toothpaste formulas. Soap and chalk were added to those formulations following advancements in the medical field.

Following independence, a number of formulations as various detergents were developed; sodium lauryl sulfate was employed as an emulsifying agent. But due carcinogenic effect of SLS, more focus is given use its alternative. The release of active ingredients during formulation developments to prevent and/or treat oral illness has become more important.

A dentifrice called toothpaste is used to clean, preserve, and enhance the condition of teeth. In addition to being used primarily to clean teeth, toothpaste also serves as an abrasive to help remove food particles and dental plaque from teeth, helps to remove or mask halitosis, and releases active ingredients like fluoride to help prevent gum and tooth disease. With the aid of toothpaste excipients, the toothbrush's mechanical action does the majority of the cleaning.

The utilization of numerous because they include active chemical ingredients like polyphenols, gums, alkaloids, glycosides, etc., herbal formulations are very effective. Investigations have also revealed that these formulations have various biological activities. This broadens the possibilities for creating and assessing novel herbal toothpaste formulations. Comparing and evaluating herbal toothpaste formulations with commercial toothpastes is the primary goal of this comparative study.[2]

Theory

Toothpaste is a paste or gel dentifrice that is used as an add-on to a toothbrush to clean and preserve teeth's natural appearance and health. In addition to acting as an abrasive to help remove food particles and dental plaque from teeth, toothpaste also helps to suppress halitosis and contains active chemicals like xylitol or fluoride that can help prevent gum disease and tooth decay (gingivitis).

The majority of the cleaning is accomplished by the toothbrush's mechanical movement rather than the toothpaste. Some ingredients that can be used in place of commercial toothpaste are baking soda and salt. Although toothpaste is not meant to be consumed, even tiny amounts inadvertently eaten can usually not be extremely dangerous. These toothpaste formulations contain the most ideal kind of dentifrice needed for maintaining the health of teeth, gums, and the oral cavity.

The Benefits of Herbal Toothpaste:

Because of its all-natural ingredients and potential health benefits, herbal toothpaste has become more and more popular in recent years. This thorough analysis explores all of the advantages of using herbal toothpaste.

1. Natural Ingredients

The natural components of herbal toothpaste are among its main advantages. In contrast to regular toothpaste, which could include artificial tastes and chemicals, herbal toothpaste usually contains plant-based compounds like ginger, and clove that are proven to have positive effects on dental health.[3]

2. Antibacterial Properties

Toothpaste contains numerous natural components that have antimicrobial qualities. For instance, it has been demonstrated that neem oil inhibits the growth of the tooth decay-causing bacteria *Streptococcus mutans*. Likewise, tea tree oil has antibacterial properties against oral infections, promoting better oral hygiene and a lower chance of cavities.[3]

3. Anti-inflammatory Effects

Aloe vera is one of the examples of the botanical compounds in toothpaste that have anti-inflammatory qualities. In addition to improving general oral health and comfort, these substances can help calm inflamed gums and lessen inflammation brought on by gingivitis and periodontal disease.[5][6][12]

4. Reduction of Plaque and Tartar

The accumulation of plaque and tartar on teeth and around the gum line can be successfully reduced with herbal toothpaste. It has been demonstrated that some ingredients, such as peppermint oil, prevent dental plaque from forming, and that licorice root extract helps stop plaque from turning into tartar, keeping the mouth healthy and clean.[10][13]

5. Prevention of Bad Breath

Herbal toothpaste contains natural components like cloves that work to neutralize microorganisms that cause bad breath. Furthermore, herbal toothpaste's revitalizing flavors—which come from real essential oils—offer sustained freshness without the use of artificial sweeteners or scents.

6. Gum Health Improvement

Herbal toothpaste's anti-inflammatory and antibacterial qualities help to maintain healthy gums. Using herbal toothpaste on a regular basis can help keep gums strong and healthy and lower the risk of gum-related problems.[14]

7. Compatibility with Sensitive Teeth

Herbal toothpaste can be advantageous for those with sensitive teeth or gums because it frequently doesn't contain the harsh abrasives and irritating chemicals that are present in certain conventional toothpaste recipes.

8. Environmentally Friendly

Using components that are sourced sustainably and eco-friendly packaging, several herbal toothpaste businesses place a high priority on ecologically responsible methods. Customers can help businesses dedicated to lessening their environmental impact and encouraging environmentally friendly dental care practices by purchasing herbal toothpaste.

The Benefits of SLS-Free Toothpaste:

SLS, or sodium lauryl sulfate, is a frequent ingredient in a lot of toothpaste recipes. But worries about its possible negative consequences have prompted the creation and widespread use of toothpaste without SLS.

1. Introduction to SLS in Toothpaste

A typical surfactant used in toothpaste to produce foam and have a cleansing effect is sodium Lauryl sulfate (SLS). There is a need for SLS-free alternatives since, although good at eliminating debris and plaque, SLS has been linked to possible adverse effects such irritation, dryness, and mucosal damage. [19]

2. Reduction of Oral Irritation

An important advantage of toothpaste without SLS is that it lessens mouth irritation. SLS has been demonstrated to irritate and sensitize mucosal surfaces in certain people, especially in those who are prone to oral ulcers or canker sores. For those with delicate oral tissues, removing SLS from toothpaste formulas might help minimize discomfort and promote better dental health. [19][20][24]

3. Alleviation of Dry Mouth

Because SLS can deplete oral tissues of natural oils and moisture, it has been linked to aggravating symptoms of dry mouth. SLS-free toothpaste formulas can lessen the symptoms of dry mouth and encourage comfort and hydration in the mouth. They are frequently enhanced with moisturizing ingredients like glycerin and natural oils.[20]

4. Reduction of Allergic Reactions

In certain people, SLS has been linked to allergic responses and hypersensitivity, which can cause symptoms like oral mucosal irritation, redness, and itching. Those who have allergies or sensitivities to SLS can reduce their risk of negative responses and keep dental health pain-free by using toothpaste without SLS.[25]

5. Compatibility with Orthodontic Appliances

SLS-free toothpaste may be beneficial for orthodontic patients, especially those who use braces or aligners, as it has been demonstrated that SLS gradually deteriorates several orthodontic materials. Formulations without SLS are kind to orthodontic appliances, prolonging their life and maintaining their integrity while encouraging the best possible dental hygiene.[32]

6. Enhanced Taste and Flavor Options

A greater variety of tastes and flavor options are frequently available in SLS-free toothpaste since producers can use natural components and essential oils for flavoring instead of having to cover up the harsh taste of SLS. People can select toothpaste tastes that they like best and improve their brushing experience thanks to this variety.[20]

7. Minimization of Environmental Impact

Due to the use of biodegradable components and eco-friendly packaging, toothpaste formulations without SLS are frequently more environmentally beneficial than those with SLS. Customers may help promote sustainable dental care habits and lessen their environmental impact by using less potentially dangerous chemicals, such as SLS.[20]

8. Preservation of Tooth Enamel

By rupturing the enamel's protective covering on the tooth surface, SLS has been demonstrated to exacerbate enamel degradation and tooth sensitivity. Because they are kinder to tooth enamel, toothpaste formulas without SLS assist maintain the integrity of the enamel and lower the chance of erosion and dental sensitivity over time.[26]

1. Sodium Methyl Cocoyl Taurate (SMCT)

Taxonomicclassification:

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Liliopsida
- Order: Arecales

- Family: Arecaceae
- Genus: Cocos
- Species: *nucifera*



The typical process for producing sodium methyl cocoylaurate involves dissolving taurine, an amino acid found in coconuts, in a solution of sodium hydrate, isopropyl alcohol, and water. Stir this mixture with a solution of sodium hydrate and lauric acid chloride. The mixture is then mixed with a calcium chloride and hydrochloric acid solution. After filtering and drying, this mixture turns into a white powder. Another way to make it is to heat boric acid, coconut acid, and sodium methyl taurate solution to 200°C in order to distill the water.[32]

➤ Technical profile

Property	Values
Boiling Point	266.4±8.0°C at 760 mmHg
Solubility	Soluble in water

Because of its mild cleaning and foaming qualities, sodium methyl cocoylaurate, a surfactant made from coconut oil and amino acids, is frequently included in herbal toothpaste formulations. Even though it is a synthetic ingredient, its mild and biodegradable nature makes it a common inclusion in herbal toothpaste, which is in line with the natural and ecological philosophy of herbal products.[28]

The capacity of sodium methyl cocoylaurate to efficiently remove plaque and other debris from teeth and gums is one of its main functions in herbal toothpaste. By acting as a surfactant, it reduces water's surface tension, enabling it to permeate and lift particles from oral surfaces.

According to studies, sodium methyl cocoylaurate is a useful component for maintaining oral hygiene because of its superior foaming and cleansing qualities.[33]

Moreover, sodium methyl cocoylaurate is thought to be less harsh and more gentle than certain other surfactants that are frequently used in toothpaste formulas, like sodium lauryl sulfate (SLS).

2. Camphor

Taxonomic classification:

- Kingdom: Plantae
- Division: Tracheophytes
- Class: Magnoliids
- Order: Laurales
- Family: Lauraceae
- Genus: Camphora
- Species: *officinarum*



For millennia, people have used the wood of the camphor tree (*Cinnamomum camphora*) for its medicinal benefits. Camphor plays a number of significant functions in herbal toothpaste formulas. First of all, camphor has antibacterial qualities that may aid in preventing the oral germs that cause dental cavities and plaque development from growing. Studies have indicated that camphor is effective against common oral infections such as *Lactobacillus acidophilus* and *Streptococcus mutans*, indicating that it may be useful in fostering good oral hygiene.[34]

Furthermore, camphor has analgesic and anti-inflammatory properties of its own. People who are experiencing dental discomfort might find relief from toothaches and gum pain thanks to its cooling sensation. Moreover, the anti-inflammatory qualities of camphor can aid in lowering

gum swelling and inflammation, improving gum health overall.[35]

Additionally, customers may find herbal toothpaste more enticing since it provides a more pleasant sensory experience thanks to the invigorating flavor and scent of camphor. Its unique flavor can also aid in masking any off-putting flavors linked to other herbal constituents, enhancing the toothpaste's overall palatability.

Herbal toothpaste formulations that contain camphor are in line with consumer demand for all-natural, holistic oral care products. Manufacturers are able to create toothpaste formulas that not only encourage good oral hygiene but also offer calming relief from dental discomfort by utilizing the therapeutic qualities of camphor.

3. Ginger Extract

Taxonomic classification:

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Liliopsida
- Order: Zingiberales
- Family: Zingiberaceae
- Genus: Zingiber Mill.
- Species: *Zingiber officinale*



For centuries, the medicinal properties of ginger extract, which is obtained from the root of the *Zingiber officinale* plant, have been acknowledged. Ginger extract can be added to toothpaste as a natural substitute for artificial ingredients and may have various advantages for dental health.

The antimicrobial activity of ginger extract is one of its main functions in herbal toothpaste. Bioactive substances with antibacterial qualities found in ginger include paradol, shogaol, and gingerol. It has been discovered that these substances prevent the growth of a variety of bacteria, including those that cause periodontal disease and dental plaque. A study showing the antibacterial activity of ginger extract against common oral pathogens like Porphyromonas gingivitis and Streptococcus mutans was published in the Journal of Ayurveda and Integrative Medicine. This suggests that ginger extract may be useful in preventing gum disease and dental caries.[36]

Additionally, the anti-inflammatory qualities of ginger extract can help to preserve dental health. The capacity of ginger to prevent the synthesis of pro-inflammatory cytokines and enzymes has been linked to its anti-inflammatory properties.[37]

The anti-inflammatory properties of ginger extract were emphasized in a study that was published in the Journal of Natural Science, Biology, and Medicine.[37]

Apart from its antibacterial and anti-inflammatory characteristics, Ginger's unique spicy and aromatic flavor can improve the herbal toothpaste's sensory experience and increase its attractiveness to customers looking for natural substitutes for store-bought oral hygiene products. Moreover, the flavor profile of ginger might assist in covering up any disagreeable odors related to other herbal constituents that are frequently used in natural toothpaste formulas.

For those with sensitivities or concerns about the possible health dangers linked with synthetic substances, ginger extract provides a natural substitute free of harsh chemicals.[38]

4.Clove

Taxonomic classification:

- Kingdom: Plantae
- Division: Tracheophytes
- Class: Rosids
- Order: Myrtales
- Family: Myrtaceae
- Genus: Syzygium
- Species: *aromaticum*



The flower buds of *Syzygium aromaticum* yield clove oil, which is a valuable ingredient in herbal toothpaste formulations and a well-known natural treatment with a variety of medical characteristics. Clove oil is a key ingredient in herbal toothpaste because of its strong antibacterial properties. Eugenol, a substance with potent antibacterial qualities, is present in clove oil. Studies have indicated that eugenol is a potent inhibitor of oral pathogens, including *Lactobacillus* species and *Streptococcus mutans*, which cause tooth caries. Clove oil also possesses antifungal qualities, which enable it to effectively combat candida species that are frequently found in the oral cavity.[40][11]

Moreover, clove oil has analgesic and anti-inflammatory qualities that might lessen gingival irritation and ease toothaches. By temporarily relieving tooth pain by numbing the nearby nerves, eugenol functions as a natural anesthetic. Additionally, because of its anti-inflammatory properties, the gums and other oral tissues are generally healthier.[40]

Herbal toothpaste formulations that include clove oil provide a natural substitute for the artificial analgesics and antimicrobials that are frequently present in conventional toothpaste. Herbal toothpaste producers can provide consumers efficient oral care solutions that support dental health while reducing exposure to artificial chemicals by utilizing the therapeutic qualities of clove oil.[39]

5. Babool

Taxonomic classification:

- Kingdom: Plantae
- Division: Tracheophytes
- Class: Rosids
- Order: Fabales

- Family: Fabaceae
- Genus: *Vachellia*
- Species: *nilotica*



Babool leaves, scientifically known as *Acacia arabica*, Because of its many medicinal qualities, it has been utilized traditionally in oral care and are a great component of herbal toothpaste formulations.

The ability of babool leaves to encourage good oral hygiene and stave against dental problems is one of its main functions in herbal toothpaste. Strong antibacterial qualities are exhibited by tannins, flavonoids, and alkaloids found in babool leaves. Research has demonstrated that babool leaf extracts can successfully stop oral bacteria like *Streptococcus mutans* from growing, which is a big cause of dental cavities and plaque development.[41]

Moreover, babool leaves have astringent qualities that support and tighten the gums. This can be especially helpful in preserving the health of your gums and avoiding diseases like gingivitis and periodontal disease. Moreover, babool leaves contain tannins, which add to their anti-inflammatory properties and help lessen gum irritation while enhancing general dental health.[42]

Adding babool leaves to herbal toothpaste formulations provides a natural substitute for the artificial astringents and antimicrobials included in conventional toothpaste. Manufacturers of herbal toothpaste are able to provide consumers dental health products that are both effective and reduce exposure to artificial chemicals by utilizing the therapeutic characteristics of babool leaves.

Uses of base ingredients

1) Dicalcium phosphate and calcium carbonate:

- The main component responsible for cleaning the teeth.
- It should be abrasive enough to clean the tooth and avoid damage to tooth surface.
- Ability depends on particles size, shape, & brittleness of the material.

2) Glycerin:

- It is use as Humectants.
- Prevents toothpaste from drying out.

3) Gum Tragacanth:

- Tragacanth is used as Thickening Agents.
- Needed to maintain the stability of high-solid dispersion.
- Affect the dispersibility, foam character, and mouth feel.

4) Sodium Saccharin:

- Sodium saccharin is used as Sweeteners.
- It masks the bitter taste of herbal ingredients in toothpaste and make it palatable.

5) Sodium Fluoride:

- Sodium fluoride has Anticaries Activities.
- Fluoride ions reduce the incidence of carious lesion by reducing the acid solubility of tooth enamel.
- FDA recommends levels of soluble fluoride ion between 850-1150 ppm.

6) Methyl Paraben:

- Methyi paraben is used as preservative.[43][44]

MATERIAL AND METHODOLOGY**INGREDIENTS LIST:**

<u>SR NO.</u>	<u>INGRIDENTS</u>	<u>QUANTITY (100gm)</u>
1.	DICALCIUM PHOSPHATE	27gm
2.	CALCIUM CARBONATE	9.75gm
3.	GUM TRAGACANTH	1.20gm
4.	GLYCERIN	20gm
5.	SACCHARIN SODIUM	0.008gm
6.	METHYL PARABEN	0.2gm
7.	SODIUM METHYL COCOYL TAURATE	CHILDREN- 5.91%(5.91gm) ADULT – up to 10%(10gm)
8.	WATER	20ml
9.	GINGER EXTRACT IN WATER	4% (4ml)
10.	CHAMPHOR POWDER	0.5gm
11.	BABOOL LEAVES POWDER	0.5gm
12.	CLOVE OIL	2-3 drops
13.	SODIUM FIUORIDE	0.9gm

METHODOLOGY

Methods of manufacturing:

There are two methods used to manufacture the tooth paste:

1) **By dry gum method**

2) **By wet gum method**

Dry gum method

All the solid components of the formulation like abrasive agent, binding agent etc. except the surfactants are mixed together in a dry mixer, which consist of slow rotating blades. The liquid component such as humectants and water are gradually added to the dry mixer. The mixing process is carrying out till the smooth paste is formed. The remaining ingredients like surfactant & flavoring agent are added to the homogenous under vacuum.

Wet gum method

In this process, all the liquid ingredient are mixed together to form a liquid phase. The binding agent is then mixed with the liquid phase with uniform stirring in order to form mucilage. The solid ingredient excluding the surfactant is then gradually added to the mucilage with uniform in an agitation mixer, in order to form a homogenous paste. The remaining i.e. surfactant, flavoring agent, coloring agent are added under vacuum to the homogenous paste.[50][51][52]



Procedure

CaCO₃, gum tragacanth, dicalcium phosphate, babool powder, camphor powder, sodium fluoride, gum tragacanth was mixed properly in the mortar with the help of pestle.



The crystals of sodium saccharine were finely crushed in glass mortar pestle and then added to the above mixture. Before adding all mixture in mortarpestel, it should be passed through sieve.



Glycerin with sodium methyl cocoyltaurate in water was mixed in another 250 ml beaker. This was added drop wise to above mixture with continuous triturating to get white, fine, shiny and homogenous paste.



At last 3 or 4 drops of clove oil were then added wit continuous stirring in above mixture.



Transfer into collapsible tube and label it.[50][51][52]



Extraction of Ginger in water:

First, cut the ginger into small species



And then grind it.



Add boiling water in to above ginger paste.



keep it steady for 10 to 15 min and allow it get cool upto room temperature.



After this filter the extract obtained.



Evaluation

1. Physical appearance:

The color of the toothpaste formulation was assessed and visually checked. The product was smelled to determine its odor. Taste was manually assessed by tasting the paste. By rubbing the paste formulation between the fingers, the smoothness was evaluated.

2. pH:

The pH of toothpaste was determined using digital pH meter. Calibration of digital pH meter was done using various buffer solutions such as buffer solution of pH4, pH7 and pH9.2. 1 gm herbal Toothpaste was stirred in distilled water till uniform suspension is formed. The volume was made upto 50 ml and pH of the suspension was measured.[49]

3. Spreadability:

The spreadability method is determined by involving the drag and slip characteristics of the paste. Weighing out one to two grams of herbal toothpaste, we sandwiched it between two 10-by-10-cm glass slides (sliding is not allowed) and pulled the slides in the opposite direction. After three minutes, measure the toothpaste's spreading (in centimeters). Performing the experiment again and recording the mean of the three readings.

4. Foambility:

By combining 1 grams of toothpaste and upto 10 milliliters of water in a measuring cylinder, the initial volume was recorded, and the cylinder was shaken ten times, the foaming power (or foamability) of herbal toothpaste was ascertained. The total amount of foam was recorded.

Foam capacity was determined by volume increase (%) immediately after whipping and was calculated by the formula $(V_2 - V_1)/V_1 \times 100$, where V_2 (ml) is the volume of protein solution after whipping and V_1 (ml) is the volume of the solution before whipping. $[(11.5-9)/9 * 100 = 27.77\%]$

5. Determination of moisture:

A porcelain dish with a diameter of approximately 6-8 cm and a depth of 2-4 cm was filled with 5 grams of herbal toothpaste to measure the moisture content and volatile matter. Dried at 105°C in oven.

➤ Calculations:

$$\% \text{ by mass} = 100MI / M$$

- MI -Loss of mass (g) on drying
- M- Mass (g) of the material taken for the test.

Time(minute)	Wight(gm)
00 min	48.26gm
05 min	48.10gm
10 min	47.78gm
15 min	47.46gm
Moisture index:	1.657%

6. Determination of sharp and edge abrasive particles:

To check for the presence of any sharp or abrasive particles, the contents were placed on the finger and scratched for 15 to 20 centimeters on the butter paper. This identical procedure is carried out for the ten times. There were no sharp or edge-abrasive particles found.

7. Washability:

After applying the formulation to the skin, the ease of washing with water was assessed.

8. Non-irritancy test:

Herbal cream formulation was evaluated for the non-irritancy test. Observation of the sites was done for 30mins.

9. Phase separation:

The prepared cream was transferred in a suitable wide mouth container. Kept aside for storage, the oil phase and aqueous phase separation were visualized after 24hours.

10.Extrudability:

Using this approach, a conventional capped collapsible aluminum tube was filled with the prepared paste, and the end was sealed by crimping. The tubes' weights were noted. The tubes were clamped after being positioned between two glass slides. After covering the slides with 500g, the cap was taken off. Weighing was done on the amount of extruded paste that was collected. It was computed what percentage of the extruded paste was calculated.

$$\text{Extrudability} = \frac{\text{Applied weight to extrude emulgel from tube (in g)}}{\text{Area (in cm}^2\text{)}}$$

11. Anti-Microbial Activity:

In-vitro anti-bacterial study of formulated paste was performed by disc diffusion method by using Soyabean casein digest medium against a pathogenic bacterial strain E coil. Initially, the cells in the E coli were cultured and tended to multiply in agar plates. Plates were first spread with inoculum, and sterile cork borer was used to create 5 mm diameter holes in the medium. Next, the commercial antibacterial formulation and the prepared paste were inserted into the bores on the cultured plates. The plates underwent a 24-hour incubation period at 37°C after being labeled and wrapped in paraffin. Both plates were inspected following a 24-hour incubation period. The zone of inhibition's (ZOI) diameter was measured in millimeters (mm) with scale.[53][46][47][48][49]

RESULT

1. Physical appearance:

parameter	Formulation	Dantkanti
color	Light Brown	Brownish
odor	Stringent	Stringent
Texture	Gritty	Smooth
State	Semisolid	Semisolid



2. pH:

Normally The pH of the herbal toothpaste has been mostly found between 7.30 to 8.10

Parameter	Formulation	Dantkanti
pH	7.79	7.6



3. Spreadability:

Parameter	Formulation	Dantkanti
Spreadabilty	5.05	6.9



4. Foaming Ability:

Parameter	Formulation	Dantkanti
Foaming Ability	5	6

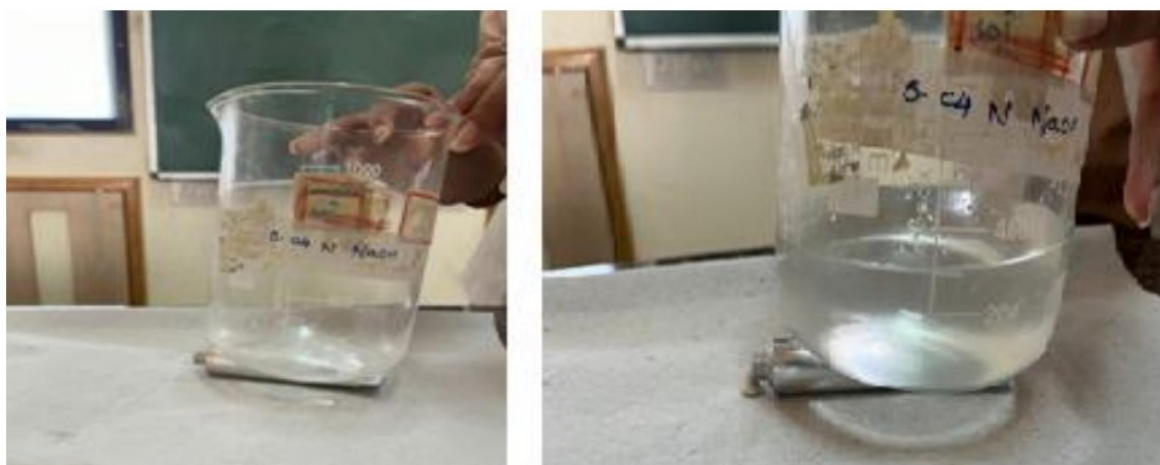


5. Determination of moisture:

Parameter	Formulation	Dantkanti
Moisture index:	1.65%	1.89%

**6. Extrudability:**

Extrudability:	23.55gm/cm ²
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7. Anti-Microbial Activity:

Microbial activity is not observed.



8. Phase separation:

No phase separation is observed in our formulation and Dantkanti.



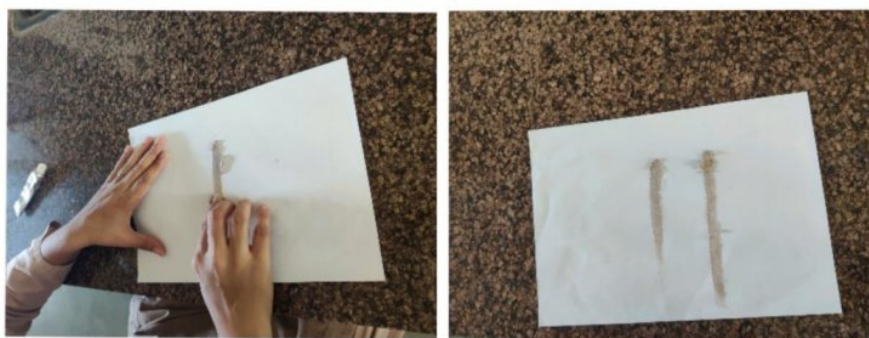
9. Washability:

parameter	Formulation	Dantkanti
Washability	Easily	Easily



10. Hard and sharp edged abrasive particles:

parameter	Formulation	Dantkanti
Hard and sharp edged abrasive particles	Present	Present

**11. Non- irritancy Test**

parameter	Formulation	Dantkanti
Non- irritancy Test	Non- irritant	Non- irritant



DISCUSSION

The aim of this study was to assess the efficacy of an herbal toothpaste without SLS in comparison to a toothpaste containing SLS as a surfactant. We have used Dantkanti, a marketed toothpaste and evaluation test were performed. Although SLS is the most frequently used surfactant worldwide, there are alternatives that have less side effects such as SMCT.

Due to many sides of sls such as mucosal irritation, mouth ulcers and chances of cancer in future the future generation will opt for sls free products.we tried to manufacture the sls free herbal toothpaste with purpose of including the benefits of natural ingredients and to minimize the side effects of synthetic ingredients. We also tried to minimize the excipients as possible to avoid the side effects.

We conducted many evaluations test and got successful except one i.e. antimicrobial activity. This toothpaste for further study requires pre-clinical and clinical trials.To sum up, there are several advantages to using herbal toothpaste, such as its natural constituents, antibacterial qualities, and enhanced gum health. Herbal toothpaste offers a comprehensive approach to dental care that supports general health and environmental sustainability thanks to its mild yet potent formulation.

In summary, there are several advantages to using toothpaste without SLS, such as less irritation to the mouth, protection against recurrent mouth ulcers, and relief from dry mouth. SLS can be removed from toothpaste formulas so that people can keep their teeth as healthy and comfortable as possible without sacrificing effectiveness.

CONCLUSION

In conclusion, opting for SLS-free herbal toothpaste combines the benefits of natural ingredients with the absence of potentially harsh sulfates. Herbal toothpaste offers a gentle yet effective alternative for oral care, promoting overall dental health while minimizing the risk of irritation or allergic reactions. It demonstrates the beneficial effects on oral hygiene and dental caries prevention. A variety of test, including physical examination, pH measurement, homogeneity, sharp and edge abrasive particles, moisture and volatile matter determination, spreadability, stability study, and extrudability, etc are used to assess the SLS free herbal toothpaste formulations.

However, individual preferences and dental needs should always be considered, and consulting with a dentist is recommended for personalized oral care recommendations. SLS free Herbal toothpaste demonstrates its beneficial effects on oral hygiene and dental caries prevention. The SLS free herbal toothpaste exhibits the least number of adverse effects. A variety of tests, including physical examination, pH measurement, homogeneity, sharp and edge abrasive particles, moisture and volatile matter determination, spreadability, stability study, and extrudability, etc are used to assess the SLS free herbal toothpaste formulations.

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