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FORMULATION AND EVALUATION OF TOOTHPASTE PREPARATION USING AEGLE MARMELOS

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ABSTRACT

Aegle marmelos Correa, a member of the Rutaceae family, is commonly referred to as "Bael" has been revered in Indian mythology since ancient times. Every part of a tree, including its root, bark, fruit, leaf, and flower, is used to treat ailments in both ayurvedic and other mainstream medical systems. By identifying the occurrence of beneficial bioactive components, currentresearch has convincingly validated the pharmacological action of bael. The anti-bacterial characteristics of the plant extract ingredient can meet all of the requirements for maintaining oral hygiene and avoiding bacterial tooth decay. Alkaloids, cardiac glycosides, saponins, steroids, coumarins, terpenoids, phenylpropanoids, tannins, polysaccharides, and flavonoids are among the significant phytochemicals isolated from different parts of the plant. Studies have shown that bael has anti-oxidant and anti-microbial properties that help prevent gastrointestinal troubles and various cardiac ailments. Bael also reveals activities that are hepatoprotective, radioprotective, anti-diabetic, and wound-healing. The current study's objective is to develop and assess toothpaste using bael leaves (Aegle Marmelos).

KEYWORDS: Aegle Marmelos, bael, oral hygiene, rutaceae.

INTRODUCTION

Botanical gardens are well known in India. The world's largest supplier of medicinal plants Medicinal plants serve as a natural source of novel chemicals with therapeutic value and are being used in drug development. 80% of the population will develop. The country relies on traditional, mostly natural remedies. Plant products are crucial for basic health care,

according to WHO estimates. As people become more aware of the benefits of natural products, the demand for medicinal herbs is expanding all over the world. They are less toxic and less expensive, pharmacologically active, and a simple remedy for many human diseases as compared to synthetic medications that are prone to adulteration and negative effects.[1]

Since Charak (1500 BC), this plant has been the most important medicinal plant in India. Over 100 phytochemicals have been extracted from various areas of the plant. These links have been shown to have biological and pharmacological efficacy against a variety of chronic diseases, including cancer, cardiovascular disease, and gastrointestinal disease. Extracts of this plant have also been shown to have antioxidant, anti-ulcer, anti-diabetic, anti-cancer, anti-hyperlipidemia, anti-inflammatory, anti-bacterial, and anti-spermatogenic properties on various animal bodies of crude oil. Fruits, stems, bark, and leaves of Aegle Marmelos plants have therapeutic characteristics and are used to cure a variety of eye diseases. Infections of the skin. The leaf is thought to be one of the most accumulating plant sections, holding bioactive components and secondary metabolites.[2]

Toothpaste's Ideal Properties[3]

- Non-irritant and non-toxic
- Leaves no stain on teeth
- Good abrasive action
- Prolonged effect
- Cheap and conveniently available
- Keeps the mouth fresh and clean

Fig. No.1: Bael Leaves.

MATERIAL AND METHOD

Collection of various plant materials were collected for the preparation of Herbal Toothpaste. viz., Bael leaves, Neem, Honey, Acacia, Calcium carbonate, Sodium lauryl sulphate, Glycerine, HPMC (Hydroxypropyl Methylcellulose), Methyl paraben, Sodium Saccharin, Titanium dioxide, Propyl Paraben, Methanol from St. Wilfred's Institute of Pharmacy, Panvel, Maharashtra, India**.**

Table No 1: Ingredient's & Uses.

SR.NO	INGRIDENT	USE OF INGRIDENT
1	Bael Leaves	Prevents formation of bacteria
2	Neem	Prevent cavities
3	Honey	Reduces swellen gums
4	Calcium Carbonate	Reduce dental caries
5	SLS(Sodium Lauryl Sulphate)	Foaming agent
6	Glycerine	Prevents dryness of mouth
7	HPMC(Hydroxypropyl Methylcellulose)	Thickening agent
8	Methyl Paraben	Preservative
9	Propyl Paraben	Prevent growth of microorganisms
10	Sodium saccharin	Masks the bitter taste
11	Titanium Dioxide	Whitening effect
12	Methanol	Eliminate dental plaque

PREPARATION METHOD

All ingredients, such as bael leaves, neem, honey, acacia, calcium carbonate, sodium lauryl sulphate, glycerine, HPMC (Hydroxypropyl Methylcellulose), methyl paraben, sodium saccharin, titanium dioxide, propyl paraben, and methanol, were weighed accurately. Water was mixed with calcium carbonate, sodium lauryl sulphate, HPMC, honey, and glycerine. Acacia was added to the previously mentioned combination. Drop by drop, the solution was added to the mortar containing the herbal components, and the remaining ingredients were thoroughly triturated until a paste consistency was created. Finally placed in a collapsible tube.

FORMULATION

Table No. 2: Formulation.

Ingredient	Quantity
Bael leaves	3gm
Neem	3gm
Honey	2gm
Acacia	3gm
Calcium carbonate	35gm

Sodium lauryl sulphate	1.50gm
Glycerine	25gm
HPMC	1gm
Methyl paraben	0.10gm
Sodium saccharin	0.30gm
Titanium dioxide	0.50gm
Propyl paraben	0.02gm
Methanol	1.50gm
Purified water	q.s

PHYTOCHEMICAL TEST

A. Saponin Test

In 6 ml of distilled water, a 2 ml sample was dissolved. A fourth formation occurred as a result of the shaking. The froth's stability shows the presence of saponin in the samples.[1]

B. Tannin test

1 mL of the sample was diluted in 1 mL of 5% FeCl3. The presence of tannin is confirmed by the emergence of a dark blue or greenish black colour in the sample. If no colour changes occur, the FL heating mantle is employed. Tannin has been detected.[2]

C. Flavonoids

A 2 ml sample was added dropwise to 20 ml of NaOH. Dropwise addition of concentrated HCL resulted in the emergence of a yellow tint. The presence of flavonoids in the sample is confirmed. Flavonoid can be found.[3]

D. Carbohydrates

By combining Fehling, A and Fehling B solutions, Fehling's reagent was created. The Fehling A-0.35g CuSO4 was then dissolved in 5 mL of distilled water, and 2-3 drops of concentrated H2SO4 were added. 1.75 g of NaKtartarate was dissolved in 5 ml of distilled water for Fehling's B, then 1.25 g of NaOH was added and thoroughly stirred into the solution to dissolve it. Then, Fehling A and Fehling B were thoroughly combined in a 1:1 ratio (FA+FB = 10 ml). A 1 ml wad of Fehling's reagent is now dissolved in a 2 ml sample and heated for more than 20 minutes. The presence of crimson precipitation in the sample demonstrates the existence of carbohydrates. There are carbohydrates present.[4]

E. Protein

1. Xanthoprotein Test: 3 mL of sample with 1 mL of saturated H2SO4. There is white precipitation. It was boiled. Yellow precipitate forms. When NH4OH is added, the ppt turns orange, indicating the presence of protein.[5]

2. Test for protein containing sulphur: Combine 5 mL of T.S., 2 mL of 40% NaOH, and 2 drops of 10% lead acetate solution. Bring the mixture to a boil. PbS production causes the solution to turn black or brownish.[6]

There is protein present.

F. Alkaloids

After centrifuging 500 ml of extract, 500 ml of Wagner's reagent was added. Shaken well and left for some time. The existence of alkaloids is confirmed by the appearance of a reddish-brown tint. There are alkaloids present.[7]

G. Starch Solution

Add the sample; add 2-3 drops of yellow iodine solution; and stir with a glass rod. If there is starch present, the iodine solution will turn blue or black. The starch solution is missing.[8]

H. Fat Test

Press a small quantity of extracts between two filters; the presence of fixed oil was revealed by the strain on one filter. Fat test is Present.[9]

I. Terpenoid Test

In 0.25 mL chloroform, a 0.5-mL sample was dissolved. The solution received 0.625 ml of concentrated H2SO4. The presence of terpenoids is confirmed by the solution's reddish-brown precipitation. Terpenoid test is present.[10]

J. Phenol Test

In distilled water, 0.5 mL of extract was dissolved. There were two drops of aqueous FeCl3 added. The presence of phenol is indicated by the emergence of a blue or green tint. Phenol is Present.[9]

K. Coumerin Test

Examine the extract with 10% NaOH and CHCl3 added for observation. Yellow tint indicates the presence of coumarin. Coumarin test is present.[10]

L. Quinones Test

Examine the dilute 10% NaOH added to 1 mL of crude extracts. The presence of quinines was identified by blue-greening or red colouring. Quinones is absent.[10]

Fig. No. 2: Chemical Tests.

EVALUATION TEST

1. Physical examination (colour, odour, taste, smoothness, and relative density)

Visual evaluation was done of the toothpaste's colour. The product had a smell, which could be detected by sniffing it. The taste of the formulation was manually evaluated. By rubbing the paste mixture between the fingertips, the smoothness of the formulation was confirmed.[1]

2. PH

Pour 10 grams of toothpaste from the container into a 50-ml beaker along with 10 ml of recently boiling and cooled (at 270 °C) water to create a 50% aqueous suspension. Stir thoroughly to ensure perfect suspension. Determine the PH of the suspension in 5 minutes using a PH meter.[2]

3. Homogeneity

The toothpaste should extrude from the collapsible tube or other suitable container with normal force applied at 27 °C. In addition, the majority of the contents must gradually roll out from the crimp of the container.[3]

4. Sharp and edge abrasive particles

The contents were placed on a finger and scratched for 15-20 cm on butter paper to check for any sharp or abrasive particles. I must have repeated the procedure ten times. No particles with cutting edges or abrasive edges were found.[4]

5. Formability

By combining 2g of toothpaste with 5 ml of water in a measuring cylinder and shaking it ten times, the foaming power (flammability) of herbal toothpaste was determined. Foam's overall volume was calculated.[5]

6. Determination of moisture and volatile matter

To measure moisture and volatile matter, 5gm of herbal toothpaste was placed in a porcelain dish with a diameter of 6-8 cm and a depth of 2-4 cm. It was dried in an oven at 105 degrees Celsius.[6]

7. Determination of spread ability

The spreadability strategy is chosen based on the paste's slide and drag properties. No sliding was permitted, thus 1-2g of herbal toothpaste was weighed and placed between two glass slides (10 x 10cm), which were layered on top of one another. The slides were then moved in opposite directions. Measure the amount of toothpaste that has spread (in cm) after three minutes. Performing the experiment again and averaging the three readings.[7]

RESULT AND DISCUSSION

Phytochemical Test

Table No. 3: Phytochemical Test.

Test	Bael Leaves
Saponin	+
Tannin	+
Flavonoids	+
Carbohydrates	+
Protein	+
Alkaloids	+
Starch solution	-
Fat test	+
Terpenoid	+
Phenol	+
Coumerin	+
Quinones	-

Physical Examination

Table No. 4: Physical Examination.

Parameter	Observation
Colour	Light Green
Odour	Characteristics
Taste	Sweet
Texture	Smooth

Evaluation Test

Table No. 5: Evaluation Test.

Parameter	**Observation**
pH determination	7.50
Homogeneity	Good
Spread ability (cm)	4.4cm
Abrasiveness	Good abrasive
Stability	Good
Foaming Power	54

Microbial Strains

The following microbes were used in the study.

a. E. coli MTCC443 (Gram –ve)

b. Sauers MTCC 96 (Gram +ve)

Zone Of Inhibition

A microbiological investigation was conducted on a prepared extract of Bael leaves. Bacterial sub-cultures were added to the sterile nutrient agar medium and vigorously shaken to ensure an even dispersion of the organisms (5 X 105 cfu/ml). Each sterilized Petri dish received an equal amount of this agar medium, making sure that each dish had roughly 45–50 mL of the medium. The medium was then given time to set up. A sterile cork borer (6 mm in diameter) was used to punch holes into the package of agar media to create cups. To enable the medication to disseminate in the agar matrix, a prepared extract of guava leaves was poured into the bored cavities and stored in a cold environment. After that, it was incubated for 24 hours at 37°C. Sliding callipers or a ruler was used to measure the diameter of the zones of complete inhibition (as determined by the naked eye) in millimetres. To find the zone of inhibition, the total measure was subtracted from the diameter of the cups that were bored.

Microbial Evaluation of Prepared extract of Bael leaves

The diameter of the zones of complete inhibition (as determined by unaided sight) was measured in mm, together with the diameter of the cups drilled, and the combined

measurement is then deducted from it. Sliding callipers or a ruler were used to measure zones, and they were held on the back of an upside-down petri dish. Measurements were made to the nearest full millimetre.

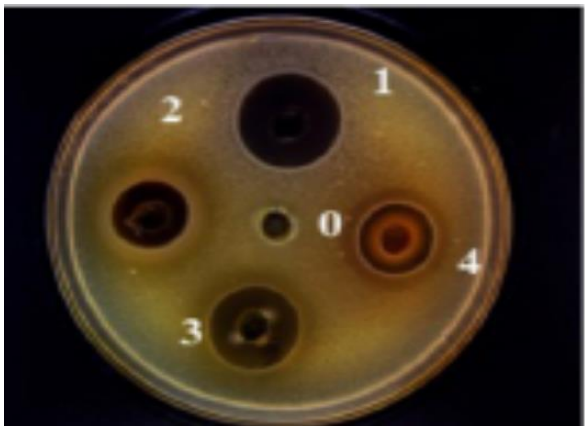

Fig No. 03: Antimicrobial activity of prepared extract of Bael leaves.

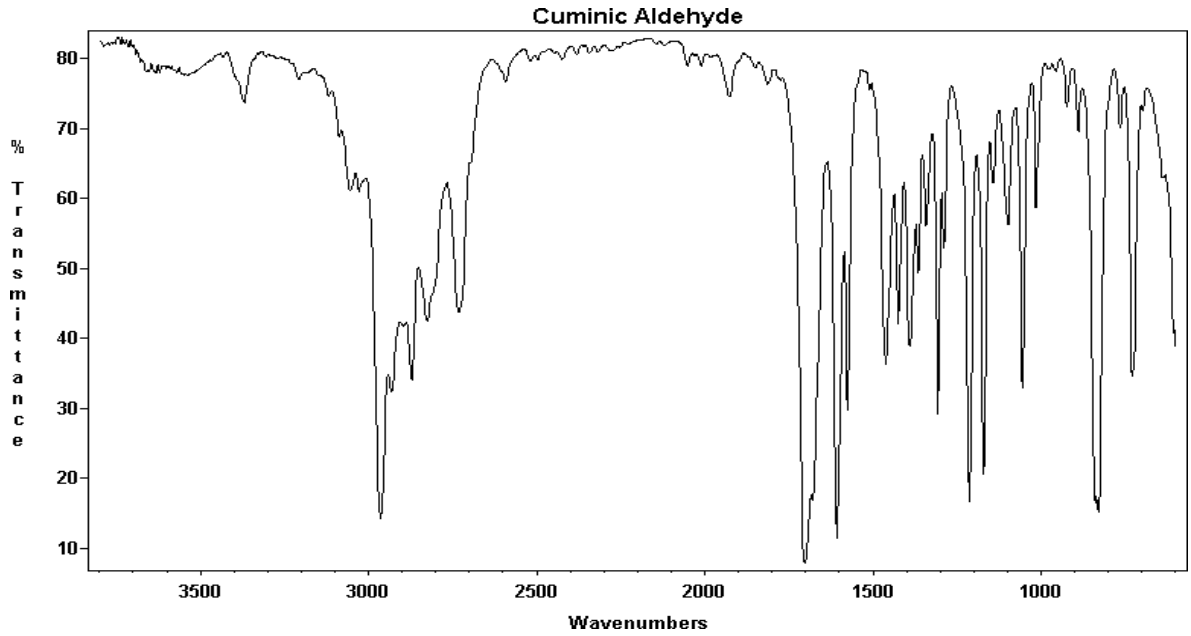

Fig. 4: IR spectrum of Cuminic Aldehyde.

RESULTS AND DISCUSSION

Table No 6: Evaluation of Herbal Toothpaste.

Evaluation parameter	Inference
pH determination	7.50
Homogeneity	Good
Spreadability (cm)	5.5cm
Abrasiveness	Good abrasive
Stability	Stable
Foaming determination	10ml

Table No 07: Zone of Inhibition of Prepared extract of Bael leaves.

Extract of Bael leaves	Gram Positive	Gram Negative
Conc. (mg/ml)	***Staphylococcus Aureus***	***Escherichia coli***
10 (1)	1.67±1.22	1.86±0.86
25 (2)	8.83±0.57	7.37±1.41
50 (3)	12.45±0.74	11.67±0.82
Blank (0)	0	0
Std. (Ciprofloxacin) (4)	13.56±0.38	12.94±0.62

Values are expressed as mean ± SEM (n=3).

Table No 8: Interpretation of IR.

Name of Constituents	IR (cm^{-1})
Cuminaldehyde	**3015.45 (Ar-CH str.); 2840.38 (-CH3 str.); 1718.65 (-C=O str.); 1240.67 (-C=C bend);**

The research project's findings allow for the following conclusion: Comparing this natural toothpaste to artificial toothpaste created with chemicals, it plays a key role in preserving dental cleanliness. Natural toothpaste maintains oral hygiene and prevents dental cavities while being safer and having fewer negative effects. Future research and dental care for the general population, society, and nation will benefit from the formulation of the herbal toothpaste, which will increase the usage of natural ingredients to produce more and safer natural medicines. [Ref]

CONCLUSION

Plant-based medicines have significantly improved human health and served as an inspiration for the development of new medicinal molecules. According to the research mentioned above, this plant has enormous potential for application in pharmacology and as a potential source of beneficial medications. It can also be used to raise the general state of society's health because it contains a variety of substances that are necessary for excellent health. The extracts' antibacterial action against the microorganisms was noticeably strong. The data clearly shows the presence of substances used to treat numerous bacterial infections, demonstrating their long history of usage in the conventional medical system.

Furthermore, the creation of novel antimicrobial formulations in the near future is encouraged by the broad-spectrum action of aqueous, methanol, and aqueous-ethanol extracts. The GC-MS study of the methanolic extract of Aegle marmelos revealed a spectrum of substances with potent antibacterial, antioxidant, and anti-inflammatory properties.

Plant-based antimicrobials have a wide range of therapeutic benefits because they are less likely to cause side effects than synthetic antimicrobial medications. Aegle Marmelos is a promising plant species with possible medicinal benefits, to sum up. Understanding the chemical makeup, formulation processes, and evaluation criteria of Aegle Marmelos products is crucial for both product development and evaluation. Products made by Aegle Marmelos can be used in a variety of fields and have potential as functional foods and nutraceuticals.

The formulation of the polyherbal toothpaste was effectively assessed utilizing a variety of industry-recognized criteria, such as its antibacterial characteristics. Both gram-positive and gram-negative organisms were susceptible to the extract's beneficial antibacterial properties. In contrast to totally synthetic toothpaste, the designed toothpaste might be safer. To demonstrate the effectiveness and safety of the toothpaste formulation, more research is required.

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