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Research Article

Formulation And Evaluation of Herbal Mouthwash of Piper Betle

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ABSTRACT

Herbal mouthwash emerges as a powerful, nature-based alternative to conventional chemical formulations, offering effective oral hygiene without the risk of harmful side effects. Infused with potent medicinal ingredients such as Honey, Amla (Emblica officinalis), Nagarvel (Piper betle), and Guava (Psidium guajava) leaves, this formulation harnesses the antimicrobial, anti-inflammatory, and antioxidant properties of traditional Ayurvedic botanicals. These natural agents work synergistically to reduce dental plaque, combat oral pathogens, soothe gum inflammation, and provide long-lasting freshness—all without alcohol or synthetic chemicals. Scientific studies affirm its efficacy in inhibiting microbial growth and enhancing overall oral health. Safe, sustainable, and holistic, herbal mouthwash is rapidly gaining popularity as a reliable and eco-friendly solution for maintaining dental wellness naturally.

INTRODUCTION

Good oral hygiene is vital for overall well-being, and mouthwash is an important component of this practice. While many conventional mouthwashes utilize antiseptics to manage plaque buildup, they frequently include artificial preservatives, alcohol, and synthetic Flavors. In contrast, herbal mouthwashes provide a natural and effective means of combating oral bacteria without adverse side effects.

Herbal mouthwash is formulated with powerful plant-derived ingredients recognized for their antimicrobial, anti-inflammatory, and analgesic effects. Unlike their chemical counterparts, herbal formulations operate gently yet effectively, diminishing plaque, gingivitis, and unpleasant breath while enhancing gum health. These mouthwashes incorporate essential herbs such as Neem, Clove, Tulsi, Triphala, Peppermint, and Yavani Satva, all of which have been scientifically validated for their ability to combat oral infections and promote the health of gums and teeth. A

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significant benefit of herbal mouthwash is its alcohol-free formulation, rendering it a safer and gentler choice for everyday use. Historical Beginnings: Ayurvedic Practices (circa 2700 B.C.): In ancient India, Ayurvedic medicine prescribed herbal rinses for treating gum diseases such as gingivitis, utilizing natural antiseptics and anti-inflammatory components. [3] Ancient Egypt: The Egyptians employed concoctions of honey, goose fat, frankincense, cumin, and ochre to enhance breath freshness and cleanse the oral cavity. [4] Greek and Roman Eras: Hippocrates, recognized as the 'Father of Medicine,' promoted a mouthwash made from salt, alum, and vinegar to support oral hygiene. [5] Traditional Chinese Medicine: Ancient Chinese customs involved gargling with salt water, tea, and wine post meals, capitalizing on their antiseptic qualities.

Medieval and Early Modern Periods:

Jewish Traditions: The Talmud, approximately 1,800 years old, references treatments for gum issues that included 'dough water' and olive oil.

Modern Developments: 19th Century: The late 1800s marked the advent of commercially produced mouthwashes, predominantly alcohol-based, designed to stabilize the solution and eliminate germs. [6]

Contemporary H. M.: Recently, there has been a revival of herbal mouthwashes featuring ingredients such as neem (*Azadirachta indica*), clove (*Eugenia caryophyllus*), cinnamon (*Cinnamomum zeylanicum*), and licorice (*Glycyrrhiza glabra*) for their antimicrobial and anti-inflammatory benefits.[7] It naturally cleanses the mouth, addresses gum issues, and delivers enduring freshness without the stinging sensation typical of alcohol-based products. Furthermore, herbs like Clove and Neem have a long history of use in traditional medicine due to their antiseptic and antibacterial qualities, aiding in pain relief and infection control. The development of herbal mouthwash is supported by scientific research and thorough testing. Studies have shown its strong antibacterial properties and effectiveness in inhibiting microbial growth. Stability and antimicrobial assessments confirm its capability in sustaining oral hygiene, establishing it as a safe and dependable alternative to chemical mouthwashes. As the demand for safe, environmentally friendly, and effective oral care products increases, herbal mouthwash is becoming a preferred option for individuals seeking to enhance their dental health naturally. Its effectiveness in combating bad breath, alleviating gum irritation, and preventing oral diseases positions it as a valuable addition to oral hygiene routines.

1.1 Causes of Oral Cavity Diseases

1. Inadequate Oral Hygiene(IOH) – Insufficient brushing and flossing results in the accumulation of bacteria.
2. Formation of Plaque and Tartar – The buildup of bacteria, food remnants, and saliva creates plaque, which eventually hardens into tartar.
3. Infections from Bacteria and Fungi – Proliferation of harmful microorganisms such as Streptococcus mutans and Candida albicans.
4. Consumption of Acidic and Sugary Foods – These substances weaken tooth enamel, resulting in cavities and decay.
5. Use of Tobacco and Alcohol – Contributes to gum disease, unpleasant breath, and heightens the risk of oral cancer.
6. Xerostomia (Dry Mouth) – Decreased saliva production fosters bacterial overgrowth.

7. Deficiencies in Vitamins – Insufficient Vitamin C (leading to scurvy) or Vitamin D (resulting in weakened teeth) negatively impacts oral health.
8. Hormonal Fluctuations – Changes during pregnancy, menopause, or puberty can influence gum health.

Common Oral Cavity Diseases

1. Dental Caries (Cavities) – Tooth decay resulting from bacterial acid.
2. Gingivitis – Initial stage of gum inflammation caused by plaque accumulation.
3. Periodontitis – Advanced gum disease that results in bone loss and tooth mobility.
4. Oral Thrush (Candidiasis) – A fungal infection characterized by white patches on the tongue and inner cheeks.
5. Halitosis (Bad Breath) – Often caused by bacteria, inadequate hygiene, or dry mouth.
6. Oral Ulcers (Canker Sores) – Painful lesions within the mouth resulting from infections, stress, or nutritional deficiencies.
7. Tooth Sensitivity – Erosion of enamel leading to discomfort when consuming hot, cold, or sweet items.
8. Oral Cancer – Uncontrolled proliferation of abnormal cells, frequently associated with tobacco and alcohol use.
9. Black Hairy Tongue – An overgrowth of papillae due to insufficient oral hygiene.
10. Bruxism (Teeth Grinding) – Results in tooth wear, fractures, and jaw discomfort.

1.2 PIPER BETLE:

Betel leaves come from a plant that is an evergreen and a perennial vine. In India, the fresh leaves of Betel vines are commonly referred to as paan. This plant is a member of the Piperaceae family. Around 100 different varieties of the betel plant exist globally, with approximately 40 originating from India and 30 from West Bengal. Many countries have chewing traditions involving betel leaves, which are thought to help prevent bad breath, strengthen gums, maintain dental health, and enhance digestion. [11]

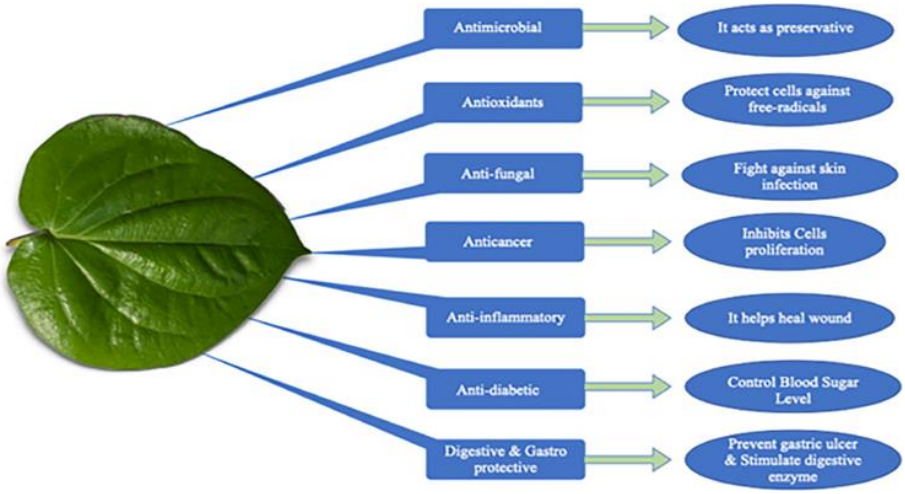

Fig. 1.1 Structure Of Piper Betle Leaf

2.How Herbal Mouthwashes Work and Their Antimicrobial Activity

- Mechanism: Bacterial membranes and cell w alls are broken down by herbal substances su ch tannins and essential oils, which causes c ell lysis and death.
  Effect: Prevents dental cavities and plaque fo rmation by lowering the oral bacterial load.

- Effects on Inflammation Reduction
  Mechanism: By inhibiting pro inflammatory cytokines (such as IL-6 and TNF-α), bioactive components like flavonoid and t erpenoids that reduce inflammation.
  Effect: Reduces gingival irritation and stops periodontal disorders from getting worse.

- Antioxidant Characteristics
  Mechanism: By neutralizing reactive oxygen species (ROS), antioxidants included in herb al extracts shield oral tissues from stress caus ed by oxidation.
  Effect: Promotes healing and guards against t issue injury.

- Prevention of Biofilm Development
  Mechanism: Some herbal ingredients impair the formation of biofilms by interfering with bacterial adherence and quorum sensing.
  Effect: Stops harmful biofilms from growing on oral surfaces.

4. DRUG PROFILE :

4.1 . MISWAK :

Biological Source – dried twig of *Salvadora persica L*. (commonly known as the Toothbrush Tree)

Family - Salvadoraceae

Common Names - Miswak, Peelu, Arak,

Part Used - Roots, twigs, and stems

Geographical Source - Indigenous to Africa, the Middle East, and South Asia .

Active Constituents - Tannins, Alkaloids (notably Salvadorine), Fluorides, Silica, Sulfur, Saponins, and Essential oils. Pharmacological Actions - Exhibits antibacterial, antifungal, anti-inflammatory, astringent, anti-plaque, analgesic properties .

Uses Serves as- a natural toothbrush, helps prevent dental caries, strengthens gums, freshens breath, and whitens teeth .

Fig no. 2.1 Twigs of miswak

4.2. PIPER BETLE

Biological Source: dried leaves of *Piper betle L.* (Betel Leaf)

Family: Piperaceae

Common Names: Nagarvel, Betel Leaf, Paan, Tambul

Part Utilized: Leaves

Geographical Distribution: Indigenous to India, Southeast Asia, and tropical climates

Active Compounds: Phenols (Chavibetol, Eugenol), Alkaloids, Tannins, Flavonoids, Essential oils (Betel oil)

Pharmacological Properties: Antimicrobial, Antioxidant, Anti-inflammatory, Stimulant, Antiseptic, Carminative

Applications: Oral hygiene, Digestive aid, Wound healing, Antifungal treatment, Utilized in Ayurveda and traditional medicine Traditional Applications: Employed as a mouth freshener (Paan), Provides relief from halitosis, Supports digestion, Treats oral infections.

Fig. 2.2 Leaves Of Piper Betle

4.3 AMLA

Biological Source: dried fruit of *Phyllanthus emblica L.* (Indian Gooseberry)

Family: Phyllanthaceae (previously classified under Euphorbiaceae) Common Names: Amla, Indian Gooseberry, Dhatri, Amalaki

Part Utilized: Primarily the fruit, along with leaves, seeds, bark, and root

Geographical Distribution: Indigenous to India, Southeast Asia, and the Middle East .

Active Compounds: Vitamin C, Tannins (Emblicanin A & B), Gallic acid, Ellagic acid, Flavonoids, Polyphenols, Alkaloids, Pectin .

Pharmacological Properties: Antioxidant, Immunomodulatory, Anti-inflammatory, Antimicrobial.

Applications: Enhances immune function, Incorporated in oral care products

Traditional Applications: Utilized in Ayurveda for Rasayana therapy, Alleviates cough and cold symptoms, Enhances skin health, Fortifies gums and teeth.

Fig.2.3. Fruits Of Amla

4.4 GUAVA

Biological Source: dried leaves of *Psidium guajava L.* (Guava)

Family: Myrtaceae.

Common Names: Guava, Amrood, Perakka, Bayabas

Part Utilized: Primarily leaves, along with bark and fruit.

Geographical Distribution: Indigenous to the tropical and subtropical areas of America, India, and Southeast Asia.

Active Compounds: Tannins, Flavonoids (including Quercetin and Kaempferol), Saponins, Terpenoids, Polyphenols, Essential oils.

Pharmacological Properties: Antimicrobial, Anti-inflammatory, Astringent, Antioxidant, Analgesic.

Applications in Mouthwash: Alleviates gum inflammation, Prevents plaque accumulation, Addresses halitosis, Aids in wound healing, Relieves ulcers.

Traditional Applications: Chewing guava leaves for dental care, Decoctions utilized for treating mouth ulcers and sore throats .

Fig. 2.4. Leaves Of Guava

4.5 HONEY:

Biological Source: *Apis mellifera* (Honeybee)

Family: Apidae

Common Names: Honey, Madhu (Sanskrit), Shahad (Hindi)

Part Utilized: Honey (derived from nectar by bees).

Geographical Distribution: Found globally, with significant production in India, China, New Zealand, and the United States.

Active Components: Sugars (Fructose, Glucose, Maltose), Enzymes (Invertase, Diastase), Polyphenols, Flavonoids, Organic acids, Hydrogen peroxide Pharmacological Effects: Antimicrobial, Anti-inflammatory, Antioxidant, Promotes wound healing, Acts as a soothing agent.

Applications in Mouthwash: Aids in wound healing, Inhibits bacterial growth, Alleviates sore gums, Adds a natural sweetness, Treats oral ulcers

Traditional Applications: Utilized in Ayurveda and traditional medicine for promoting oral health, facilitating wound healing, and addressing throat infections.

Fig. 2.5. HONEY

4.6. TURMERIC

Biological source : dried rhizomes of *curcuma longa.*

Family : zingiberaceae.

Common names : Haldi .

Part utilized : dried rhizomes

Geographical distribution: **India** (largest producer and exporter; especially Tamil Nadu, Andhra Pradesh, Maharashtra, Odisha), **Sri Lanka**, Bangladesh, **Indonesia**, **Chin, Thailand Myanmar**, **Central America** (to some extent), **Africa** (small-scale cultivation)

- *(India accounts for more than 75% of global turmeric production.)*

Active components: **Curcumin** (main active compound; responsible for anti-inflammatory and antimicrobial effects)

Applications:

- **Anti-inflammatory agent**: Helps in reducing gingivitis, gum swelling, and oral mucosal inflammation.
- **Antimicrobial action**: Inhibits growth of bacteria like *Streptococcus mutans* and *Porphyromonas gingivalis* (common oral pathogens).
- **Anti-plaque activity**: Prevents the formation of dental plaque and biofilms.
- **Wound healing**: Promotes healing of mouth ulcers or minor injuries inside the mouth.
- **Pain relief**: Acts as a mild analgesic for toothache or gum pain.
- **Antioxidant**: Protects oral tissues from oxidative stress.
- **Natural colorant and freshener**: Provides a natural yellowish hue and subtle flavor (may need to manage staining).

Fig. 2.6 Turmeric

5. Properties of components :

Table no . 1 components profile

Ingredients	Scientific name	Chemical constituents	categories	Uses
Miswak (roots)	*Salvadora parsica*	Silica ,sulfur	Antibacterial	Effectively reduce bacteria & plaque formation.
Nagarvel	*Piper betle*	Eugenol ,hydroxychavicol	Antimicrobial antibacterial & preservative	Remove bad breath, reduce microbial growth.
Amla	*Phyllanthus embelica*	Ascorbic acid ,vit. c	Antioxidant	Strengthen gum , promote oral health.
Honey		Glucose ,fructose	Anti inflammatory.	Promote healing.
Turmeric	*Curcuma longa*	curcumin	Anti microbial and bacteriocidal.	Kill bacteria.
Guava	*Psidium guajava l.*	Quercetin	Antioxidant, anti inflammatory	Reduce gum inflammation.
Coco glucoside	-	-	Co solvent	Increase solubility.

6. METHODOLOGY:

1. Preparation of Individual Extracts: Prepare extracts of Amla, Guava, Miswak, Turmeric, and Piper betle separately.
2. Preparation of Mixture A: Take all the prepared extracts into a beaker labelled 'A'. Slightly boil the mixture while stirring continuously.
3. Preparation of Mixture B: In another beaker labeled 'B', add Honey, Turmeric extract and Coco glucoside solution. Slightly boil this mixture with continuous stirring until homogenous mixier is obtain.
4. Combining Mixture B into Mixture A: Gradually add the contents of beaker B into beaker A with continuous stirring.
5. Filtration: Filter the combined solution to obtain the final formulation.

7. EVALUATION TESTS:

7.1 Evaluation test of mouthwash:

1. Physical characteristics: things like smell and color were checked through visual inspection.

2. pH: The pH level of the made herbal mouthwash was measured using a digital pH meter. The pH meter was set up with a standard buffer solution. About 1 ml of mouthwash was weighed and mixed in 50 ml of distilled water, and its pH was measured.

3. Stability test: The stability test aims to ensure that the mouthwash stays the same over a long time before testing for bacteria-killing ability. Before antibacterial tests, many mouthwash formulas undergo stability checks. This test looked at the mouthwash's visual look, separation, and cons istency. The mouthwash was stored at 30 °C, and its appearance was checked every 10 days for up to 1 month, with results recorded.

4. Viscosity: The thickness of the mouthwash was measured using a digital viscometer at 100 rpm with the spindle.

5. Foam test: The foaming ability of the product was tested by taking a small amount of the mixture with water in a measuring cylinder. The starting volume was noted, and then it was shaken ten times. The final foam volume was noted.

8. RESULTS AND DISCUSSION:

Table no. 2. Analysis of Physical properties of mouthwash

Parameters	Formulations
Colour	Pale yellow
Taste	Sweet
Odour	Pungent

FIG. 4.1. physical properties of formulation

8.2 pH STABILITY ANALYSIS:

Table no. 3. pH stability analysis

parameters	25 c	Batch no.	PH reading
Colour	Light brown	F 1	5.72
Layer	No saturation	F 2	5.39
Stability	Stable	F 3	4.96

Fig .4.2. pH Analysis of F1 Batch

Fig. 4.3. pH Analysis of F2 Batch

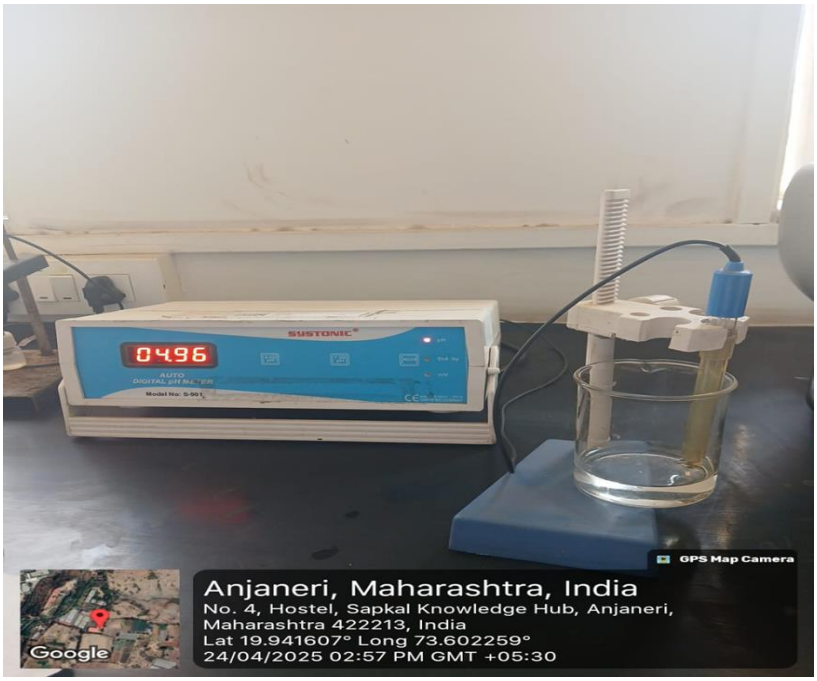

Fig. 4.4 pH Analysis of F3 Batch

8.3. PHYSICOCHEMICAL TEST FOR MOUTHWASH:

Table no. 4. Physiological tests of formulation

Sr. no.	Physicochemical Tests /Test Name	Observation	Inference
1.	Alkaloid test / dragandroff's reagent test.	Light orange colour obtained.	present
2.	Tannin /lead acetate & gelatine test	White ppt. observed.	present
3.	Saponin / foam height.	Slight foam observed.	present
4.	Carbohydrate / benedict test	Reddish colour obtained.	present

Fig. 5.1. gelatine test

fig .5.2. Benedict's test

Fig. 5.3 Lead acetate test

fig.5.4 dragndroff's test

9. VISCOSITY:

Table no. 5. Viscosity evaluation parameters of formulation.

Sr. no.	Batch no.	Viscosity time	Viscosity readings
1.	F 1	3 min 34 sec	3.84
2.	F 2	3 min 49 sec	3.93
3.	F 3	3 min 02 sec	3.16

Fig. 6.1 viscosity of formulation

10.1 DENSITY:

Table no. 6. Density evaluation parameters of formulation

Batch No.	Density Reading
F1	1.533
F2	1.478
F3	1.48

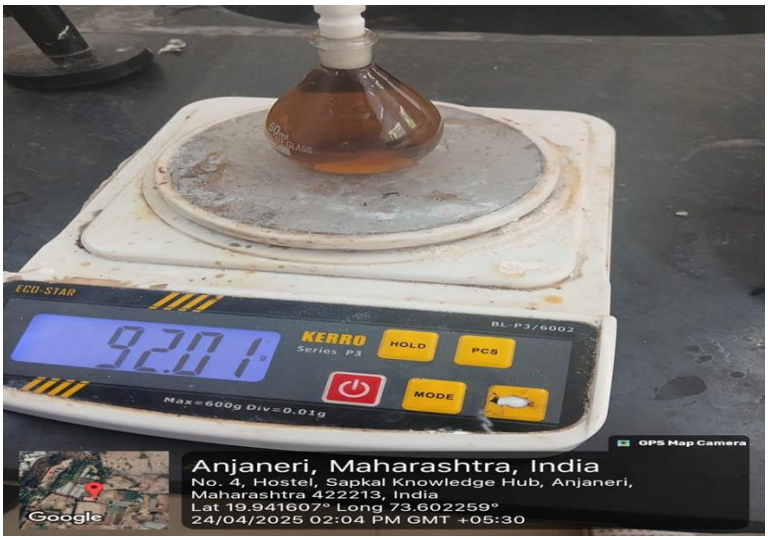

Fig.7.1 density of formulation

CONCLUSION:

The herbal mouthwash made with Miswak, Piper betle, Amla, Guava, Turmeric, and Honey shows notable phytochemical efficacy because to it consists of alkaloids, tannins, flavonoids, curcumin, and phenols, according to the thorough evaluation and the body of existing literature. These substances have potent antibacterial, anti-inflammatory, and antioxidant properties. The mouthwash demonstrated acceptable organoleptic characteristics as well as effective stability physicochemical qualities (pH 4.96–5.72, viscosity, density). Saponins were detected by mild foaming. According to studies on herbal mouthwash, this formulation is a natural, reliable, and promising substitute for synthetic mouthwashes in the maintenance of oral hygiene.

REFERENCES

1. Shivani Suresh Uttarwar, formulation and evaluation of herbal mouthwash, (2022) d55-d64.
2. S.D. Mahajan ,C.R. Doijad, S.R. Dhanvij ,formulation and evaluation of herbal mouthwash containing piper betle, (2021) 4652-4659.
3. The history of mouthwash in India , Ancient Teeth Cleaning Methods In India: Miswak & Neem! 2024.
4. Akula Nikhil, Prashant , Sandip Reddy Cheruku, Shrikanth Devra Shetti ,Rakam Gopi Krishna and SVP Rahul ,formulation sand evaluation of herbal mouthwash , (2024) f780-f789.
5. Hawaii family dental,mouthwash , history of mouthwashes, Mouthwash: History, Uses, And Types | Hawaii Family Dental .
6. Samruddhi M Jagdale , Harshada S Nawale, Prof. Vikas D. Kunde, use of herbal

mouthwashes for oral diseases , (2023) h652-h666.
7. International dental journal 73, mouthwashes :alternative and future directions, 17 oct 2023.
8. Shivani B. shambharkar and vinod M. Thakare, formulation and evaluation of herbal mouthwash , (2021) 775-791.
9. Kalyani G. Thakre,Dr. Ajay Pise , Ujwala N. Mahajan , formulation development and evaluation of herbal mouthwash ,(2022) 1316-1326.
10. P. Divya ,N. Deepa ,Lokeshvar . R. , Asuvathaman. , traditional use and pharmacological activity of betel leaf (piper betle Linn.) , (2021) 640-650.
11. Ranjeet D. MORE , Vipul M Patil , Sachinkumar V Patil, Piper Betle – A Review, (2021) b405-b415.
12. A journal of Elsevier, food chemistry advances , A literature review on bioactive properties of betel leaf (Piper betel L.) and its applications in food industry - ScienceDirect 2023.
13. Sukanya S. Kad, Priyanka A. Panmand,Pranali M. Lendave, formulation and evaluation of herbal mouthwash , (2024) , 1110-1120.
14. Bipul Biswas , Kimberly Rogers , Fredrick McLaughlin , Dwayne Daniels & Anand Yadav, Antimicrobial Activities of Leaf Extracts of Guava (Psidium guajava L.) on Two Gram- Negative and Gram-Positive Bacteria. International journal of microbiology, 2013, 746165.
15. A. Pandey ,Antibacterial properties of Psidium guajava leaves, fruits and stems against various pathogens. Int. J. Pharm. Res. Dev, (2011), 3, 15-24.
16. Z. A. Lone , & N. K. Jain, Phytochemical Screening Of Guava (Psidium Guajava L.) Leaves Extract And Its Medicinal Importance. Int. Journal. Innov. Eng. Res. Manag, (2022),9(06).
17. N. A Jain , N. A. Azizi, , & N. I. Aminudin, Phytochemical screening and anti oxidant activity of Psidium guajava. Malaysian J Anal Sci, (2020), 24(2), 173 178.
18. E. Kenneth Paul, T.,Istifanus, N., Uba, Phytochemical analysis and antibacterial activity of Psidium guava L. leaf extracts. GSC Biological and Pharmaceutical Sciences, (2017), 1(2).
19. Dr. ashok A. Hajare , A practical book of physical pharmaceutics - ||, published by Nirali prakashan , determination of viscosity and density , page no . 19 & 26

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