International Journal of Research and Technology (IJRT)

International Open-Access, Peer-Reviewed, Refereed, Online Journal

ISSN (Print): 2321-7510 | ISSN (Online): 2321-7529

| An ISO 9001:2015 Certified Journal |

Formulation and Evaluation of Herbal Teeth Whitening Powder

Nityanjana[1], Surendra Goutam[2], Naman sharnagat[3], Abdul samad[4], Mr. Ashish wagh[5], Dr. Vaishali Rathi[6]

[1/2/3/4]Student, [5]Assistant Professor, [6]Principal

[1/2/3/4/5/6]NRI Institute of Pharmacy, Bhopal

ABSTRACT

The increasing awareness of oral hygiene and the demand for natural products have led to the development of herbal alternatives to conventional dental care formulations. This study focuses on the formulation and evaluation of an herbal teeth whitening powder using natural ingredients known for their antimicrobial, anti-inflammatory, and stain-removal properties. The formulation typically includes herbal components such as neem, clove, charcoal, tulsi, and baking soda, which collectively contribute to oral health improvement and effective teeth whitening. The prepared herbal tooth powder was evaluated for various physicochemical parameters including colour, odour, taste, texture, pH, and stability. Additionally, its cleaning efficiency, abrasiveness, and antimicrobial activity against common oral pathogens were assessed using standard laboratory methods. The results indicated that the formulation possesses satisfactory organoleptic properties, good stability, and effective stain removal capacity without causing damage to enamel. The study concludes that herbal teeth whitening powder can serve as a safe, cost-effective, and eco-friendly alternative to synthetic dental products. Its regular use may help in maintaining oral hygiene, reducing plaque, and enhancing the natural whiteness of teeth without adverse side effects.

1. INTRODUCTION

Herbal and herbal-based toothpowder have been used for many years and are one of the most significant components of oral health [3]. Natural-ingredient formulations are more widely accepted because they are believed to be safer than manufactured medications. As a result, there has been a greater focus on incorporating natural substances into herbal dentrifrices [5]. The goal of the study was to manufacture a herbal base product, compare its efficacy to that of commercially available toothpowder, and evaluate several parameters such as colour, spreadability, foamability, extrudability, and antibacterial activity [6,7]. However, there is a plan in the works to develop a formulation for the commercial manufacture of herbal dental products that is also environmentally friendly.

Herbal Teeth Whitening Powder

Herbal-based toothpowder has been used since ancient times in ancient life and is one of the most important parts of oral health care. The production and development of toothpowder production began in China and India, from 300-500 BC. At that time, crushed bones, crushed eggs, and mussel shells were used as abrasives as part of tooth cleaning. Modern toothbrushes were developed in the 19th century.

After advances in medicine, chalk and soap were added to these forms. Soon after independence, several developments in the formulation of various solvents had begun,

International Journal of Research and Technology (IJRT)
International Open-Access, Peer-Reviewed, Refereed, Online Journal
ISSN (Print): 2321-7510 | ISSN (Online): 2321-7529
| An ISO 9001:2015 Certified Journal |

sodium lauryl sulphate was used as an emulsifying agent. At present, the focus has shifted to the release of active ingredients during the development of the formulation to prevent and / or treat oral disease.

2. FUNCTION OF TEETH

Teeth serve critical roles in mechanical digestion (biting, tearing, grinding food), enabling proper nutrition intake. Beyond digestion, they facilitate clear speech, support facial structure, and maintain jawbone density. Adults typically have 32 teeth, categorized into four types with distinct functions: incisors (cutting), canines (tearing), premolars (crushing), and molars (grinding).

- Digestion Initiation: Teeth break down food into smaller pieces, increasing surface area for enzymes to act, preparing it for swallowing.
- Phonation (Speech): Teeth interact with the tongue and lips to produce clear sounds and speech.
- Structural Support: Teeth maintain the vertical dimension of the face and support the lips and cheeks, contributing to facial appearance.
- Bone Maintenance: Teeth keep the jawbone (maxilla and mandible) healthy and stimulated, preventing bone loss.
- Functions by Teeth Type:
- Incisors (8 total): Flat, sharp front teeth used for cutting and biting into food.
- Canines (4 total): Pointy teeth located at the corners of the mouth designed for gripping and tearing food.
- Premolars (8 total): Situated between canines and molars, these have flat surfaces for tearing and crushing food.
- Molars (12 total, including wisdom teeth): Strongest back teeth, responsible for heavy grinding and crushing of food before swallowing.

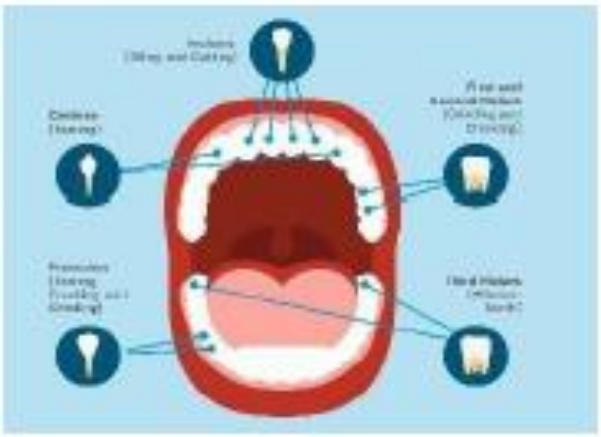

Fig. 1

3. REVIEW OF LITERATURE REVIEW

Suraj Maurya et al., 2021 studied that Clove (Syzygium aromaticum) was found to have the ability to suppress bacteria. The antibacterial pharmacological action of the developed

Polyherbal dentifrice was found to be essential against all of the pathogens examined. This finding suggests that the activity is due to the presence of several phytoconstituents in the extract. As a result, the dentifrice's antibacterial drug activity was determined due to the existence of active ingredients in the extract, and therefore activity was well maintained once it was reintroduced to dentifrice.

Piyush Yadav et al., 2021 studied that Herbal teeth whitening powder is more emphasising and accepted in dental research, and they are safer with less adverse effects than synthetic preparations, according to the study. The antibacterial activity of the designed toothpowder against pathogens can be seen in the toothpowder and oral hygiene. When comparing the formulation to market preparation, as a result, it demonstrates the same patronising and absorbing passion for the promoted formulations (Colgate, Dabour Red, and Dantkanti). The designed Herbal teeth whitening powder has a bright future in natural remedy research and public dental health.

Davies R., et al., 2021 Toothpowders have been used since the ancient past [1] and are one of main irreplaceable components of oral health care. The design of toothpowder formulations began in China and India, as 300-500 BC. During that period, squashed bone, pulverized egg and clam shells were utilized as abrasives as a part of tooth cleaning. Modern toothpowder formulations were developed in the 19th century. Later on, chalk and soap were incorporated to those formulations. After 1945, several formulation advancements of different detergents had begun; sodium lauryl sulphate had been used as emulsifying agent. In recent years, the focus has shifted towards the release of active ingredients during formulation developments to prevent and /or treat oral illness [2] [3].

Ritu Choudhary et al., 2021 investigated the anti-inflammatory effects of herbal ingredients on gums. The results indicated reduction in gum swelling, bleeding, and irritation. Manish Pandey et al., 2021 studied the formulation and evaluation of herbal tooth powder and concluded that it shows good stability, cleaning efficiency, and whitening effect.

Kavita Verma et al., 2021 investigated the use of licorice (Glycyrrhiza glabra) in oral hygiene products. The study demonstrated its antimicrobial and anti-inflammatory properties, which help in reducing plaque and soothing gum irritation.

Rahul Sharma et al., 2021 studied that Clove (Syzygium aromaticum) possesses strong antibacterial activity against oral pathogens. The study showed that polyherbal dentifrice containing clove extract effectively inhibits bacterial growth due to the presence of active phytoconstituents like eugenol. do not produce harmful side effects. The findings suggest that clove plays an important role in maintaining oral hygiene and preventing dental infections.

Amit Verma et al., 2021 reported that herbal teeth whitening powders are widely accepted due to their safety and fewer side effects compared to synthetic products. The study demonstrated that herbal formulations show effective antibacterial activity and help in cleaning teeth, removing stains, and improving oral hygiene.

Gupta A., Sharma R., et al., 2021 Oral aesthetics and hygiene can be improved significantly by using herbal-based dentifrices formulated with plant-derived whitening agents. Natural whitening achieved through mild abrasives and enzymatic actions rather than chemical bleaching. The main objective of current research is to formulate and evaluate polyherbal teeth whitening powder and compare its efficacy with commercial whitening products. The

tooth powder was prepared using herbal ingredients such as activated charcoal, orange peel, lemon peel, neem, clove, licorice, and papaya leaf extract which exhibit antibacterial, stain-remouing, and breath-freshening properties. Several natural products are incorporated to develop an ideal herbal tooth whitening powder which satisfies all essential properties to remove extrinsic stains and prevent plaque formation caused by oral bacteria. The method used for formulating the herbal teeth whitening powder is the trituration method. The prepared tooth powder was evaluated for its organoleptic and physicochemical characteristics such as colour, odour, taste, pH, particle size, flow property, foamability, and abrasiveness to ensure that it possesses all.

4. RESEARCH ENVISAGED

In India, there are 45000 old medicinal plant species in the Japanese chain, Eastern Himalayas, Western Ghats, and Andaman and Nicobar Islands. Although there are only 3000 officially recorded plants having medicinal properties, ancient practitioners used around 6000. India is the world's largest producer of medicinal herbs, earning it the moniker "Botanical Garden of the World." There are currently 2,50,000 Ayurvedic medical practitioners registered in the United States. The goal of this study was to develop and test a polyherbal dentifrice that used commonly available healthy herbs in Lucknow to treat dental disorders. Cloves are the fragrant flower buds of the Syzygium aromaticum tree, which belongs to the Myrtaceae family. Clove are the greatest medicinal value which is used in Ayurveda. Oils, dried flower buds, leaves, and stems are used to produce medication. Clove is most typically used directly to the gums for toothaches, pain relief during dental work, and other dental concerns. Clove oil contains a chemical called eugenol that may help to decrease pain and fight infections.

5. MATERIALS AND METHOD

Collection of Materials

Clove, Amla powder, kadukkai powder, Cardamom, Soap Nut (Soapberry). At a local market in Salem, cinnamon, neem leaf, crystal salt, Himalayan crystal rock salt, turmeric powder, honey, and coconut oil were purchased at a local market in Salem.

Apparatus

A measuring cup made of glass, a bowl, and a handcrafted wooden mortar.

A spoon

Making a powder base for Herbal teeth whitening powder

If desired, add products, colour, and aroma to the mix.

Digital balance.

Materials and Method

Collection of Materials

Clove, *Amla* powder, *kadukkai* powder, *Cardamom*, Soap Nut (Soapberry). At a local market in Salem, cinnamon, neem leaf, crystal salt, Himalayan crystal rock salt, turmeric powder, honey, and coconut oil were purchased at a local market in Salem.

Apparatus

A measuring cup made of glass, a bowl, and a handcrafted wooden mortar.

A spoon

Making a powder base for Clove Herbal Powder • If desired, add products, color, and aroma to the mix.
Digital balance.

6. EXPERIMETAL WORK

Clove, Amla powder, kadukkai powder, Cardamom, Soap Nut (Soapberry). At a local market in Salem, cinnamon, neem leaf, crystal salt, Himalayan crystal rock salt, turmeric powder, honey, and coconut oil were purchased at a local market in Salem.

Collection of Materials

Clove, Amla powder, kadukkai powder, Cardamom, Soap Nut (Soapberry). At a local market in Salem, cinnamon, neem leaf, crystal salt, Himalayan crystal rock salt, turmeric powder, honey, and coconut oil were purchased at a local market in Salem.

Apparatus

A measuring cup made of glass, a bowl, and a handcrafted wooden mortar.
A spoon
Making a powder base for Clove Herbal Powder
If desired, add products, color, and aroma to the mix.

Colour

The prepared tooth powder was evaluated for its colour. The colour was checked visually by naked eye.

Odour

Odour was checked by smelling the product.

Taste

Taste was manually checked by tasting the product.

Texture

Texture was evaluated in relation to product quality.

Appearance

The appearance was visually evaluated

Patch Test

Doing a patch test before implementing it completely. Check for allergic responses by applying a tiny amount of tooth powder scrub to a small area. The patch test includes Swelling, Redness and Irritation**.** Determination of pH Using a digital pH meter, the pH of the prepared herbal tooth powder was determined. Add 5g of tooth powder in 50ml of beaker. To this freshly boiled and cooled distilled water was added. Stir vigorously and make a mixture and its pH was measured.

Determination of Bulk density

It is the weight of a powder volume unit. Expressed in g/ml. In a dried graduated measuring cylinder (10ml), approximately 5g of sample was weighed. The volume occupied by the powder was given in the formula for calculating the bulk density..

$D = M/V$

D = Bulk density, M = Mass of particles, V = Total volume occupied
Determination of Tapped density

The increase in bulk density that results from mechanically tapping a container containing a powder sample is known as tapped density. 5g weighed formulation was taken and slowly added to the graduated cylinder (10ml). After that initial volume was noted and the sample is then tapped until no further volume reduction occurred. The value obtained after tapping was noted. Continued tapping until no further change in volume was observed. Tapped density was calculated by given formula.

Tapped density = Weight of powder (g) / Tapped density (ml) Determination of Angle of repose [Flow property]

The funnel was taken and fixed with a burette stand. The graph paper was placed below the funnel and distance between lower tip of the funnel and sheet was adjusted to height of 2cm.Add 25 g of powder and poured into funnel and it started following down onto the graph paper. Sample was poured in funnel from top till a heap of powder formed and touched the lower tip of the funnel. T hen the circle was drawn around the graph paper. The average diameter and radius of the circle followed by height was recorded and calculated by using given formula

$\Theta = \tan^{-1} H/R$

H=Height of the powder cone, R=Radius of the powder cone

7. RESULT AND DISCUSSION

The formulated herbal teeth whitening powder containing natural ingredients such as neem, clove, activated charcoal, baking soda, and mint was successfully prepared and evaluated for various parameters. The results obtained from the experimental studies are discussed below:

1. Physical Evaluation: The prepared powder showed a fine, smooth, and free-flowing texture with a pleasant herbal odour due to the presence of clove and mint. The colour of the formulation was greyish to light brown, indicating proper blending of all herbal ingredients. No lump formation or grittiness was observed, confirming the uniformity and good quality of the powder.
2. pH Determination: The pH of the formulation was found to be in the range of 6.5–7.5, which is close to the natural pH of the oral cavity. This indicates that the powder is safe for dental use and does not cause irritation to teeth or gums.
3. Cleaning Ability: The herbal tooth powder showed good cleaning properties, effectively removing surface stains and plaque from teeth. The presence of mild abrasives like charcoal and baking soda contributed to the whitening effect.
4. Antimicrobial Activity: The formulation exhibited significant antimicrobial activity due to the presence of neem and clove, which help in reducing oral bacteria and preventing dental infections.
5. Stability Study: The prepared powder was found to be stable under normal storage conditions. There were no significant changes in colour, odour, or texture during the study period, indicating good stability of the formulation.

Antibacterial Activity

Agar well diffusion method was used to determine the antimicrobial activity which was recorded by measuring the zone of inhibition using the radius scale appeared after the

International Journal of Research and Technology (IJRT)

International Open-Access, Peer-Reviewed, Refereed, Online Journal

ISSN (Print): 2321-7510 | ISSN (Online): 2321-7529

| An ISO 9001:2015 Certified Journal |

incubation period of the organisms. In this study the antibacterial activity of formulated herbal tooth powder were investigated against Gram positive bacteria (*Staphylococcus sp., Streptococcus sp.,*) and Gram negative bacteria (*Escherichia sp.,, Pseudomonas sp.,*). The zone of inhibition against selected bacterial pathogens against formulated tooth powder was compared with the standard antibiotic penicillin and the results were presented in (Table-1, 2 and 3), Fig- 2, 3, 4 and 5) shows the zone of inhibition of selected bacterial pathogens against formulated tooth powder.

Fig. 2 Staphylococcus sp

Fig. 3 Pseudomonas sp

Fig. 4 Streptococcus sp

Fig. 5 Escherichia sp

Table 1: Zone of Inhibition of *Pseudomonas sp.,*

Concentration of sample (µg/ml) & Antibiotic	Zone of Inhibition (mm)	Result
25	11	Resistant
50	12	Sensitive
75	13	Sensitive
100	14	Sensitive
Penicillin	15	Sensitive

Table 2: Zone of Inhibition of Pseudomonas sp.,

Concentration of sample (µg/ml) & Antibiotic	Zone of Inhibition (mm)	Result
100	15	Sensitive
Penicillin	17	Sensitive

Table 3: Zone of Inhibition of *Streptococcus sp.,* and *Escherichia sp.,*

Test organisms	Zone of Inhibition	Result
Streptococcus sp.,	No	Resistant
Escherichia sp.,	No	Resistant

In the present study, antibacterial activity of formulated herbal tooth powder exhibited the significant inhibition against the tested pathogens and observed higher activity against *Staphylococcus sp.,* and *Pseudomonas sp.,* compared with all other bacteria. The antibacterial study confirmed that the prepared herbal tooth powder possesses significant antibacterial activity. It was found to be effective against common oral pathogenic bacteria and can be used for preventing oral infections.

The formulation showed activity against bacterial strains such as Escherichia sp., Staphylococcus sp., and Streptococcus sp., which are commonly associated with oral diseases. The results indicated that these microorganisms were sensitive to the antimicrobial properties of the prepared formulation.

Hence, it can be concluded that the herbal tooth powder is effective in inhibiting the growth of oral bacteria and can be safely used as a natural antimicrobial agent for maintaining oral hygiene.

7. CONCLUSION

The formulation and evaluation of the herbal tooth powder yielded promising results, suggesting its potential as a natural and effective dental care product. The use of carefully selected herbal ingredients provided antimicrobial properties, helping to maintain oral hygiene and prevent common oral health issues. The fine texture and pleasant aroma of the tooth powder enhance its user- friendliness and consumer appeal. Overall, herbal tooth

powders offer a natural and chemical-free alternative for maintaining oral hygiene. They can be an excellent option for individuals who prefer natural products and are looking to incorporate herbal remedies into their oral care routine. Further research and testing can be conducted to optimize the formulation and assess long-term effects.

REFERENCES

1. Anitha, A., & Praveen, G. (2015). Use of herbs in preventive dental care. Journal of Education and Ethics in Dentistry, 5(2), 55.
2. Arshad, Z., Abrar, A., Nosheen, S., & Mughal, T. (2020). Determining cadmium levels in herbal tooth powders purchased from streetmarkets in Lahore, Pakistan. Kuwait Journal of Science, 47(1).
3. Asnotikar, G., Shetty, A. S., Mithun, C., Nayak, R., & Shilpashree, V. K. (2022). Development, Standardization and Microbiological appraisal of Herbal Dentifrice prepared from Achyranthes aspera Linn.(Apamarga) leaves. World Journal of Current Medical and Pharmaceutical Research, 131-138.
4. Bharathi, M., Rajalingam, D., Vinothkumar, S., Artheeswari, R., Kanimozhi, R., & Kousalya, V. (2020). Formulation and evaluation of herbal tooth powder for oral care. International Journal of Pharmaceutical Research and Life Sciences, 8(1), 1- 5.
5. Chidi, P. C., Isima, P. C., Ikpa, C., Udumebraye, R. O., Ekwem, O. S., Obasi, T. O., ... & Agwu, C. O. (2022). Antibacterial activity of chewing stick, dental powder sold in Umuahia, Abia State, Nigeria. GSC Advanced Research and Reviews, 13(1), 039-049.
6. Dakhurkar, S. P., Mijgar, P. V., Wani, S. D., & Murkute, P. M. (2019). Preparation and Evaluation of Herbal Tooth Powder. World Journal of Pharmaceutical Research, 8(10), 944-948.
7. Devi, N., Parashar, B., & Kaushal, M. (2019). Preparartion, evaluation and comparision study of herbal tooth powder with marketed toothpowder.
8. Ganesan, S. (2008). Traditional oral care medicinal plants survey of Tamil Nadu.
9. Kadam, A., Prasad, B. S., Bagadia, D., & Hiremath, V. R. (2011). Effect of Ayurvedic herbs on control of plaque and gingivitis: A randomized controlled trial. Ayu, 32(4), 532.
10. Ledder, R. G., Latimer, J., Humphreys, G. J., Sreenivasan, P. K., & McBain, A. J. (2014). Bacteriological effects of dentifrices with and without active ingredients of natural origin. Applied and environmental microbiology, 80(20), 6490-6498.
11. Ojha, S. (2018). Formulation and evaluation of antibacterial herbal mouthwash against oral disorders. Indo Glob. J. Pharm. Sci, 8, 37-40.
12. Prabha, M. S., Aruna, M. S., Gulshan, M. D., Radhika, S., & Ramarao, N. (2014). Preparation and Evaluation of Herbal Tooth Composed of Herbal Products. International Journal of Innovative Pharmaceutical Sciences and Research, 2(4), 817-826.
13. Saloni, S., & Shailedra, W. (2016). Preparation & evaluation of herbal tooth powder Asian Journal of Pharmaceutical Research and Development, 1-05.

14. Shukla, K. V., & Kumari, D. (2019). Formulation Development and Evaluation of Herbal Tooth powder for Treatment of Oral Disease. Journal of drug delivery and Therapeutics, 9(4-s), 98-104.
15. Valkenburg, C., Van der Weijden, F. A., & Slot, D. E. (2019). Plaque control and reduction of gingivitis: The evidence for dentifrices. Periodontology 2000, 79(1), 221-232.