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Original Research Article

Anticandidal efficacy of Shikakai and rose petals in herbal denture cleanser formulation: an *in vitro* study

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ABSTRACT

Background: Chemical denture cleansers may cause irritation, discoloration, and allergic reactions in denture wearers. Herbal agents with antimicrobial properties are being explored as safer alternatives to prevent denture-associated infections such as oral candidiasis. This study aimed to develop and evaluate a natural denture cleanser using *Acacia concinna* (Shikakai) and *Rosa spp.* (rose petals).
Methods: Dried plant materials were extracted using the Soxhlet extraction method and subjected to qualitative phytochemical screening. Antimicrobial activity against *Candida* species was assessed *in vitro*. The extracts were formulated into effervescent tablets for immersion-type denture cleansing. The tablets were evaluated for weight variation, hardness, friability, pH, disintegration time, and *in vitro* dissolution. Cleaning efficiency and anticandidal activity were also studied.
Results: Phytochemical screening confirmed the presence of flavonoids, saponins, tannins, and glycosides, with Shikakai extract showing a richer phytochemical profile. Antimicrobial studies demonstrated stronger antifungal activity of Shikakai against *Candida* species compared to rose petal extract. The formulated tablets met acceptable quality control parameters. *In vitro* dissolution studies showed about 20% release within one hour and nearly 90% release within six hours. Shikakai-based formulations exhibited superior cleaning efficiency and anticandidal activity.
Conclusions: Shikakai-based herbal denture cleanser tablets showed effective antifungal activity, satisfactory tablet properties, and good cleaning performance, indicating their potential as a natural alternative to synthetic denture cleansers. Further clinical studies are needed to confirm long-term safety and user acceptability.

Keywords: Herbal denture cleanser, Anticandidal activity, Effervescent tablet, *Acacia concinna*, *Candida albicans*

INTRODUCTION

Maintaining good oral hygiene is a key component of overall health and well-being. Among the elderly population, poor dental hygiene is often observed due to factors such as financial limitations, reduced manual dexterity, and a lack of awareness. The loss of natural teeth is common in this demographic, leading to the widespread use of dentures as a functional and aesthetic replacement.[1,2]

Dentures are prosthetic devices supported by surrounding oral soft and hard tissues and come in various forms, including complete, partial, implant-supported, and flexible dentures.[3,4]

Materials used in denture fabrication range from poly-methyl methacrylate (PMMA) and thermoplastic resins to porcelain and metal-reinforced acrylics, each chosen based on clinical need and patient preference.[5-7]

Despite the utility of dentures, poor maintenance can lead to plaque accumulation, staining, and microbial colonisation, especially by *Candida albicans*, which may result in denture-related stomatitis. To address these issues, denture cleansers are commonly used to remove debris and microbial biofilms.[8] Conventional denture cleansers typically contain chemical agents such as sodium bicarbonate, hypochlorite, and citric acid. However, long-term use of chemical cleansers may have undesirable effects, including mucosal irritation and alteration of denture materials.[9,10]

In response to these concerns, there is growing interest in natural or herbal alternatives that are biocompatible, effective, and eco-friendly. Herbal ingredients like *Acacia concinna* (Shikakai) and *Rosa* species (rose petals) have been traditionally used for their antimicrobial, anti-inflammatory, and cleansing properties.

Aim

This study aims to formulate an herbal denture cleanser using Shikakai and rose petals and to evaluate its anticandidal efficacy through an *in vitro* study.

Objectives

Objectives were to carry out the extraction for the rose and Shikakai by Soxhlet extraction, to carry out phytochemical test for the extracted components, to carry out the antimicrobial studies for the extract, to prepare granules by direct compression method, to carry out pre-compression parameters for the prepared granules and to carry out the post-compression parameter for the prepared tablets.

METHODS

Type of study

The type of study is experimental research study.

Study period

The study carried out from May 2022 to November 2022.

Study place

Study conducted at Dr. Karigowda College of Pharmacy, Hassan.

Authentication of plants

Authentication was done by the Botany department in Government Science College, Hassan.

Soxhlet extraction

Dried pods of *Acacia concinna* (Shikakai) and rose petals (*Rosa* spp.) were collected, cleaned, and air-dried under shade for several days. The dried materials were coarsely ground and packed in separate filter paper thimbles. These were subjected to Soxhlet extraction using ethanol as the solvent. The solvent was heated using a mantle to reflux, allowing vapors to condense and repeatedly wash over the plant material for approximately 24 hours. After extraction, the solvent was evaporated under reduced pressure using a rotary evaporator, yielding crude extracts of Shikakai and rose petals. The extracts were stored in airtight containers for further analysis.[11,12]

Phytochemical screening

Qualitative phytochemical analysis

Preliminary phytochemical screening was conducted using standard qualitative methods to identify major classes of secondary metabolites. The following tests were performed.[13-15]

Antimicrobial activity

The antimicrobial potential of both ethanol extracts was assessed via the agar well diffusion method. Sterile Petri dishes containing 30 ml of nutrient agar were inoculated with microbial cultures (including *Candida albicans* and other opportunistic oral microbes). Wells (6 mm diameter) were punched using a sterile borer, and 100 µL of each extract was added. Plates were incubated at 37°C for 48 hours. Zones of inhibition were measured in millimeters to quantify antimicrobial activity.

Preparation of effervescent denture cleanser granules

Effervescent granules were prepared by mixing accurately weighed ingredients in a clean mortar and pestle.[16] Formulation components are shown below:

The blended powders were compressed into tablets using a single-punch tablet machine. Tablets were stored in airtight containers for evaluation.

Evaluation of effervescent tablets

The following tests were conducted to assess powder flow and compressibility.[17]

In vitro evaluation

Used partial dentures were collected and sterilized. A single effervescent tablet was dissolved in 200 mL of distilled water, and dentures were immersed in the solution for a specified period (1-6 hours).

After immersion, dentures were rinsed and visually examined for cleanliness, biofilm removal, and changes in surface appearance. The effectiveness was compared between Shikakai-based and rose petal-based formulations.

RESULTS

The extracts of Shikakai and rose petals were utilized for the following tests.

Antimicrobial activity

The Shikakai extract, when added to the culture media, showed an antimicrobial effect. The growth of the bacteria was inhibited by both extracts, but more action was seen by the Shikakai compared to the rose petal.

Preparation of tablets

Both Shikakai and rose petal tablets were prepared with the help of a tablet punching machine.

Dissolution studies

In vitro drug release was evaluated on F1 and F2 using by dissolution apparatus. The result of cumulative percentage of drug release against time is shown in Figure below.

The time required for 20% drug release from the F1 formulation was approximately 1 hour, whereas the burst release from the F2 formulation occurred in about 6 hours. A similar release pattern was observed in F2 as in F1.

In vitro evaluation study

Shikakai tablets showed better cleaning efficiency and stain removal compared to rose petal tablets during *in vitro* denture evaluation.

Table 1: Preliminary phytochemical screening methods.

Phytochemical	Test performed	Observation	Inference
Carbohydrates	Molisch test	A violet ring at the junction of two liquids	Present
Proteins	Biuret test	Formation of violet colour	Present
Amino acids	Ninhydrin test	Blue colour formation after heating	Present
Alkaloids	Tannic acid test	Buff-colored precipitate	Present
	Mayer's test	Precipitate formation with Mayer's reagent	Present
Flavonoids	Alkaline reagent test	Yellow color turning colorless on addition of dilute HCl	Present
Saponin glycosides	Froth formation test	Formation of stable, persistent froth	Present
Anthraquinone glycosides	Borntrager's test	Rose pink to red color in ammoniacal layer	Present
Cardiac glycosides	Keller-Killiani test	Blue color in the acetic acid layer	Present
Tannins	Braymer's test	Blue color for hydrolysable tannins; green for condensed tannins	Present
Steroids and Terpenoids	Salkowski test	Red lower layer (steroids), yellow lower layer (triterpenoids)	Present

Table 2: Composition of effervescent denture cleanser granules.

Ingredients	F1	F2	Function
Tartaric acid	0.98	0.98	Acidifier
Sodium bicarbonate	0.72	0.72	Carbonate salt
Sodium carbonate	0.196	0.196	Carbonate salt
Starch	0.1	0.1	Binding agent
Shikakai	0.1	-	Active ingredient
Rose petals	-	0.08	Active ingredient

Table 3: Pre and post-compression parameters for effervescent tablets.

Parameters	Method/formula	Description
Pre-compression parameters for effervescent tablets		
Bulk density (D_f)	$D_f=M/V_p$	Weight (M) of ~2 g powder divided by its volume (Vp) in a 10 ml graduated cylinder
Tapped density (D_0)	$D_0=M/V_p$	Powder tapped 10 times from 1 inch; final volume recorded for density calculation
Carr's index	% compressibility=$(D_f-D_0)/D_f)\times100$	Indicates powder flowability based on difference between bulk and tapped density
Flow rate	Flow rate=Weight of granules/time (sec)	Measured using a funnel with 8 mm orifice; time recorded as granules pass through
Angle of repose (θ)	$\tan\theta=H/R$ $\theta=\tan^{-1}(H/R)$	Indicates flow property by measuring height (H) and radius (R) of powder heap

Continued.

Parameters	Method/formula	Description
Post-compression parameters for effervescent tablets		
Weight variation	Compare individual tablet weights to the average	16 tablets individually weighed to ensure uniformity
Hardness	Measured in kg/cm² using Monsanto Hardness Tester	Force required to break the tablet under compression
Friability (F)	F=((W initial-W final)/W initial)×100	Measured using Roche friabilator after 100 revolutions
Effervescent time	Time recorded for complete dissolution in 200 mL of water at 20°C	Mean of three measurements taken
Solution pH	pH measured using a pH meter after dissolution in 200 mL of water at 20°C	Repeated three times for accuracy
CO_2 Content	Based on the weight change after dissolving one tablet in 100 ml of 1N sulfuric acid	Indicates the amount of CO_2 released per tablet
Dissolution study	UV analysis at 246 nm after sampling at 5-minute intervals using USP Apparatus II	Determines the percentage cumulative drug release over time in phosphate buffer (pH 6.8)

Table 4: Phytochemical screening of shikakai and rose petal extracts.

Phytochemical	Shikakai	Rose petals
Carbohydrates	+	+
Proteins	-	-
Amino acids	-	-
Alkaloids	-	+
Flavonoids	+	+
Saponin glycosides	+	+
Anthraquinone glycosides	-	+
Cardiac glycosides	+	+
Tannins	+	+
Steroids and terpenoids	-	-

*+ indicates presence; - indicates absence of phytochemicals

Table 5: Pre-compression parameters.

Parameters	Results
Bulk density	0.689 g/cm^3
Tapped density	0.833 g/cm^3
Carr's index	17.3%
Flow rate	0.66 m^3/s
Angle of repose	19.43790

Table 6: Post-compression parameters.

Parameters	F1		F2
Weight variation	1.2 gm		1.11 gm
Hardness	2.4 cm		2.3 cm
Friability	16.8%		15.68%
Effervescent time	T_1	12:50 (0.9 gm)	3:42 (1.1 gm)
	T_2	15:04 (1.2 gm)	3:07 (1 gm)
	T_3	13:37 (1 gm)	2:41 (0.8 gm)
Effervescent solution pH	6		6
CO_2 content	1 gm		1.1 gm

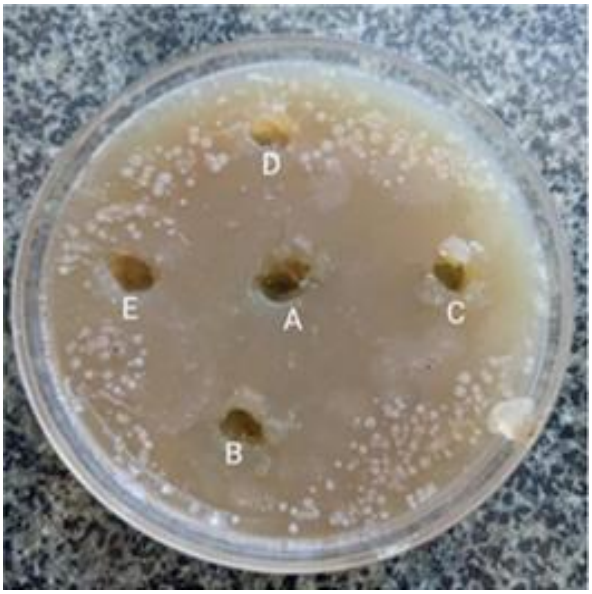

Figure 1: Antimicrobial activity of extracts. A: Mixture of both Shikakai extract and rose petal extract; B and C: Shikakai extract; D and E: Rose petal extract.

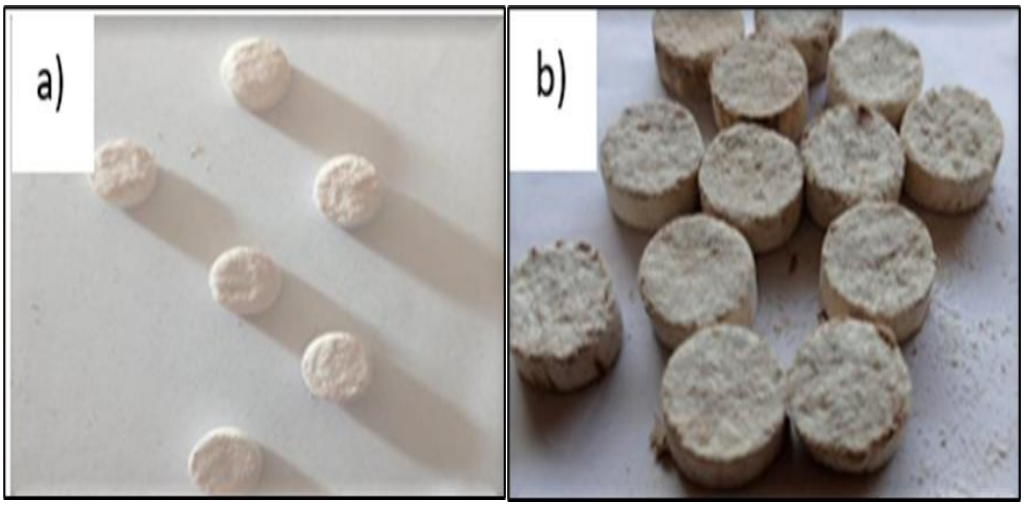

Figure 2: (A) Rose petal tablets and (B) Shikakai tablets.

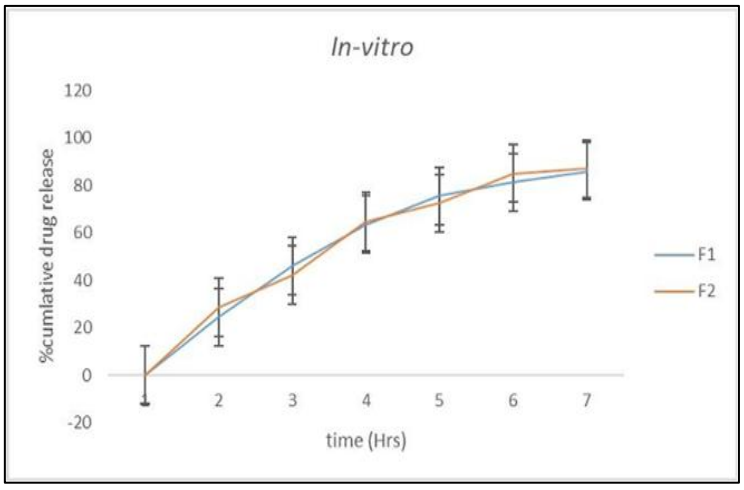

Figure 3: Cumulative percentage of drug release against time.

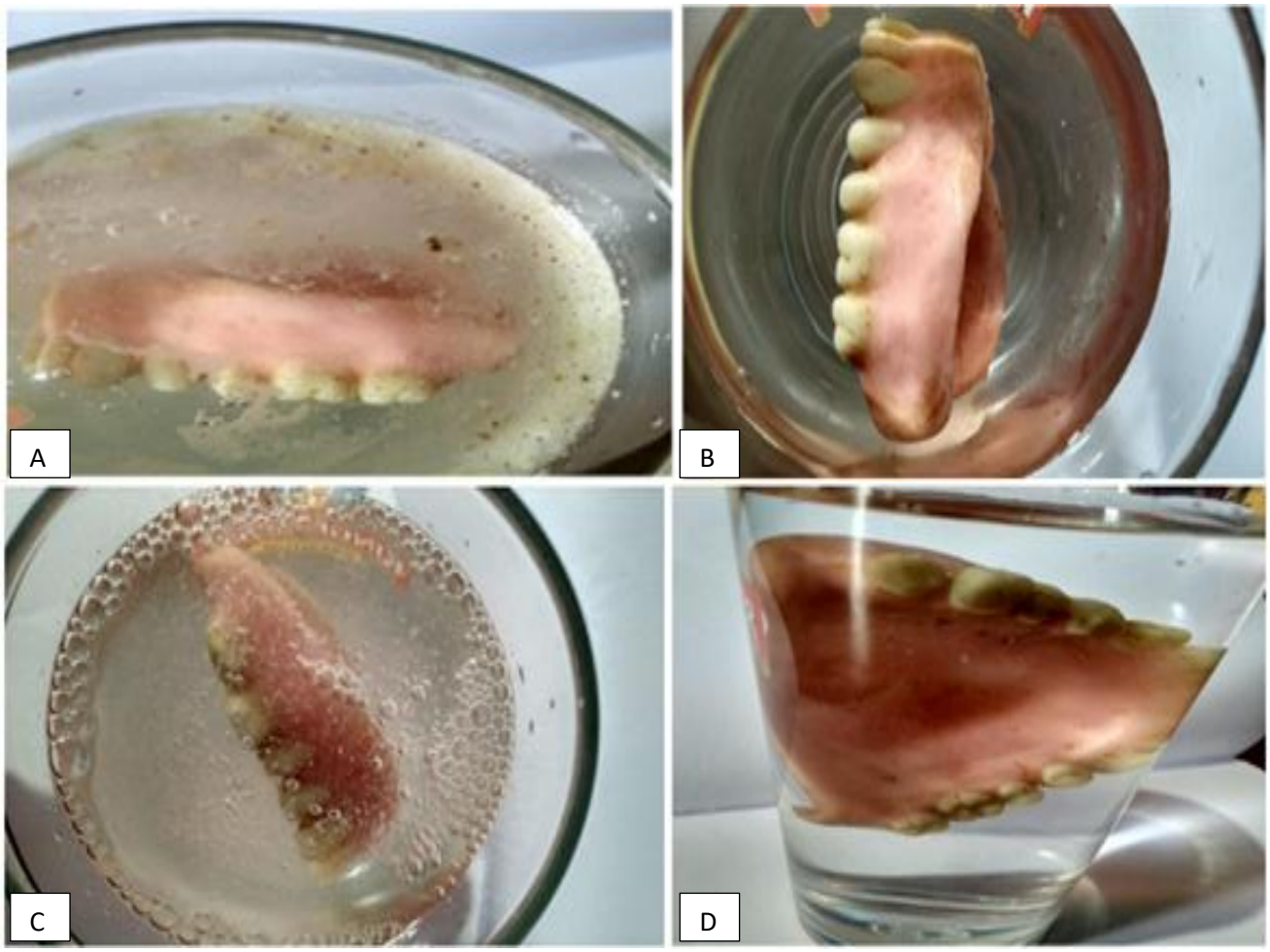

Figure 4: *In vitro* evaluation of herbal denture cleanser tablets. (A) Denture before treatment with Shikakai tablet, (B) Denture after treatment with Shikakai tablet, (C) Denture before treatment with rose petal tablet and (D) Denture after treatment with Rose petal tablet.

DISCUSSION

The study demonstrated that both *Acacia concinna* (Shikakai) and *Rosa spp.* (rose petals) possess significant anticandidal activity, which can be attributed to the presence of phytochemicals such as flavonoids, tannins, and saponins. These compounds are well known for their antifungal mechanisms, including disruption of fungal cell membranes, inhibition of enzyme activity, and prevention of biofilm formation. Similar antifungal effects of flavonoid and tannin-rich plant extracts against *Candida albicans* have been reported in several studies.[20,21]

Among 2, Shikakai exhibited stronger antifungal activity against *Candida albicans*, likely due to its comparatively richer phytochemical profile. Previous phytochemical and antimicrobial studies on *Acacia concinna* have also demonstrated significant antifungal and antibacterial properties, supporting present findings.[22,23]

The formulated effervescent tablets showed acceptable pre- and post-compression parameters, indicating good flow properties, compressibility, and mechanical strength, which are essential for uniformity and stability of dosage forms. Similar findings have been reported in studies involving herbal effervescent formulations, where plant-based powders exhibited satisfactory tablet characteristics.[24]

The dissolution studies revealed a sustained drug release pattern, with gradual release of active constituents, ensuring prolonged contact time with denture surfaces and enhanced antimicrobial effectiveness. Sustained release from effervescent or tablet-based herbal formulations has been previously shown to improve therapeutic efficacy and patient compliance.[25]

The *in vitro* evaluation further confirmed that Shikakai-based tablets exhibited superior cleaning efficiency and biofilm removal compared to rose petal tablets. This observation correlates with the antimicrobial findings and suggests that Shikakai is more effective in reducing microbial colonization on denture surfaces. Similar studies on herbal denture cleansers and plant extracts have demonstrated effective biofilm disruption and reduction in microbial adherence.[26,27]

These findings are consistent with previous studies that have reported the antifungal and antimicrobial efficacy of herbal agents rich in flavonoids and tannins in oral care formulations. Studies on plant-based denture cleansers and natural extracts have shown comparable effectiveness to chemical cleansers, with reduced side effects such as mucosal irritation and material degradation.[18,19,28]

Overall, the present study supports the growing evidence that herbal formulations can serve as safe, effective, and economical alternatives to conventional denture cleansers. However, as the current study is limited to *in vitro* conditions, further *in vivo* and clinical studies are required to establish long-term safety, efficacy, and patient acceptability.

CONCLUSION

This study demonstrated the potential of herbal denture cleansers formulated using extracts of Shikakai and rose petals. Ethanol-based Soxhlet extraction yielded bioactive compounds with significant antimicrobial properties. Effervescent tablets prepared through direct compression met both pre- and post-compression quality parameters. *In vitro* evaluation on used dentures revealed that Shikakai exhibited superior cleansing and anticandidal efficacy compared to rose petals, achieving up to 90% dissolution within 6 hours. These results indicate that Shikakai-based formulations hold strong promise as effective and natural alternatives to conventional denture cleansers.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Front Pharmacol. 2014;4:177.
2. Washington Smiles Complete Health Dentistry. Types of dentures explained and what is best for you. Washington Smiles. Missouri. Available at: https://www.washmosmiles.com/types-of-dentures-explained/. Accessed on 14 June 2026.
3. Dr. Nechupadam Dental Clinic. Parts of complete denture. Nechupadam Dental. Available at: https://www.nechupadamdental.com. Accessed on 14 June 2026.
4. Owens. Classification and elements of removable partial dentures. My Perfect Smile DDS. Available at: https://www.myperfectsmiledds.com. Accessed on 14 June 2026.
5. Andreescu CF, Ghergic DL, Botoaca O, Violeta H, Banateanu AM, Patroi D. Evaluation of different materials used for fabrication of complete digital denture. Mater Plast. 2018;55(1):124-8.
6. Fueki K, Ohkubo C, Yatabe M, Ichiro A, Masahiro A, Satoshi I, et al. Clinical application of removable partial dentures using thermoplastic resin-Part I: Definition and indication of non-metal clasp dentures. J Prosthodont Res. 2014;58(1):3-10.
7. Sharma AHSS, Shashidhara HS. A review: Flexible removable partial dentures. J Dent Med Sci. 2014;13(12):58-62.
8. Tandon R, Gupta S, Agarwal SK. Denture base materials: From past to future. Indian J Dent Sci. 2010;2(2):33-9.
9. Machado Dental Center. What are the different materials options to make dentures? Machado Dental Center. Available at: https://www.machadodentalcenter.com. Accessed on 14 June 2026.
10. MyDentureCare. Different types of denture cleansers. MyDentureCare. Available at: https://www.mydenturecare.com. Accessed on 14 June 2026.
11. De Castro ML, García-Ayuso LE. Soxhlet extraction of solid materials: An outdated technique with a promising innovative future. Anal Chim Acta. 1998;369(1-2):1-10.
12. ScienceDirect Topics. Soxhlet extraction-an overview. ScienceDirect. Available at: https://www.sciencedirect.com. Accessed on 14 June 2026.
13. Shaikh JR, Patil MK. Qualitative tests for preliminary phytochemical screening: An overview. Int J Chem Stud. 2020;8(2):603-8.
14. Pandey A, Tripathi S. Concept of standardization, extraction and pre-phytochemical screening strategies for herbal drug. J Pharmacogn Phytochem. 2014;2(5):10.
15. Ayoola GA, Coker HA, Adesegun SA, Adepoju-Bello AA, Obaweya K, Ezennia EC, et al. Phytochemical screening and antioxidant activities of some selected medicinal plants used for malaria therapy in Southwestern Nigeria. Trop J Pharm Res. 2008;7(3):1019-24.
16. Pharmapproach. Manufacture of tablets by dry granulation method. Pharmapproach. Available at: https://www.pharmapproach.com. Accessed on 14 June 2026.
17. Patel DM, Patel RJ. Formulation and evaluation of effervescent tablets: A review. ResearchGate. 2025.
18. Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Front Pharmacol. 2014;4:177.
19. Shaikh JR, Patil MK. Qualitative tests for preliminary phytochemical screening: an overview. Int J Chem Stud 2020;8(2):603-8.
20. Cowan MM. Plant products as antimicrobial agents. Clin Microbiol Rev. 1999;12(4):564-82.
21. Daglia M. Polyphenols as antimicrobial agents. Curr Opin Biotechnol. 2012;23(2):174-81.
22. Parekh J, Chanda S. Antibacterial and antifungal activity of *Acacia concinna*. Afr J Biotechnol. 2007;6(5):582-5.

23. Sahu MC, et al. Phytochemical analysis and antimicrobial activity of *Acacia concinna*. Int J Pharm Sci Rev Res. 2013;21(2):215-8.
24. Patel RM, Patel MM. Formulation and evaluation of effervescent tablets: a review. Int J Pharm Sci Rev Res. 2014;24(2):171-6.
25. Allen LV. Pharmaceutical dosage forms and drug delivery systems. 10th ed. Philadelphia: Lippincott Williams and Wilkins. 2013.
26. Ramage G, Kelley T, Wickes BL, López-Ribot JL, Redding SW. Denture stomatitis: a role for *Candida* biofilms. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2004;98(1):53-9.
27. Nikawa H, et al. *In vitro* evaluation of antifungal effect of denture cleansers on *Candida albicans*. J Oral Rehabil. 1999;26(6):484-9.
28. Pradeep AR, et al. Clinical evaluation of herbal dentifrice in comparison with conventional dentifrice. J Clin Periodontol. 2012;39(3):222-7.

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