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## Formulation and Evaluation of Herbal Toothpaste Containing *Anacardium occidentale* Bark Extract



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### ABSTRACT

The Herbal Cosmetics have been the first choice of customers, for being more potent, easily available and thought to be less side effective. Herbal cosmetics are Fastest growing field of personal care products. Cosmeceuticals is the fastest-growing segment of the personal care products; these are cosmetic preparations that contain biologically active principles or ingredients of plant origin. In recent years there has been an increased demand for the use of herbs in cosmetics due to their mild action and less toxic in nature and they are found to be more effective. The aim of current research is to formulate and evaluate herbal toothpaste utilizing plant extracts like *Anacardium occidentale* commonly known as cashew tree. Recently the plant extract has been used to treat various diseases. The plant extract ingredient possesses the anti-bacterial and anti-inflammatory activity. The herbal toothpaste formulated which can satisfy all the required conditions to keep the mouth fresh and prevent tooth decay by bacteria. The anti-bacterial activity against *Staphylococcus aureus* and *E-coli* reveals that the toothpaste formulated from the extract of *Anacardium occidentale* showed broad spectrum antibacterial activity and high inhibitory potency compared with standard Dabur toothpaste and also shows good anti-inflammatory activity also.



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## INTRODUCTION

Herbal Cosmetics, referred as Products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide defined cosmetic benefits only, shall be called as Herbal Cosmetics. Herbal cosmetics are preparations containing phytochemical from a variety of botanical sources, which influences the functions of skin and provide nutrients necessary for healthy skin or hair. The natural herbs and their products when used for their aromatic value in cosmetic preparation are termed as herbal cosmetics [1].

### Advantages of Herbal Cosmetics over Synthetic

- Naturally available
- Safer to use
- Less side effects
- Economical to use

### Herbal Toothpaste

Herbal toothpaste with natural ingredients is more acceptable in public opinion than chemical-based synthetic formulations in the current oral dental care scenario due to their safety and efficacy in reducing dental caries and preventing other dental disorders to which this generation is prone. Toothpaste is a dentifrice that is used to keep teeth clean, maintain their health, and improve their appearance. Toothpaste is primarily used to maintain oral hygiene, but it also functions as an abrasive, removing dental plaque and food particles from the teeth, assisting in the removal and/or veiling of halitosis, and releasing active chemicals like fluoride to help prevent tooth and gum disease (Eg.Gingivitis). The majority of the cleaning is done by the toothbrush's mechanical action, with the help of excipients included in toothpaste. Many herbal formulations are particularly successful because they contain active chemical components like polyphenols, gums, alkaloids, glycosides, and other compounds. Different biological functions have also been explored for these formulations. This expands the possibilities for developing and testing new herbal toothpaste formulations. The main goal is to make herbal toothpaste and evaluate it. Herbal toothpaste were evaluated to determine important physical characteristics such as pH, stability, extrudability,

spreadability, foamability, and homogeneity in order to develop a more effective and stable product [2,3,4].

### **Ideal Properties of Toothpaste**

- Good abrasive effect
- Non-irritant and non-toxic
- Impart no stain in tooth
- Keep the mouth fresh and clean
- Prolonged effect
- Cheap and easily available

The cashew (*Anacardium occidentale*) is a member of the *Anacardium* genus of the Anacardiaceae family. It is a small tree, with leaves that are alternate, simple, entire, obtuse, and borne on short leaf stalks. The flowers are abundant, small, and fragrant, and are produced in terminal, loose panicles. The enlarged juicy peduncle that bears the nut is known as the “cashew apple.” When ripe, it is of a golden-yellow color, obovate in shape, has a pleasant, acid flavor, and is somewhat astringent. The cashew nut hangs from the end of the cashew apple and is kidney-shaped and about 2.5 cm long. It consists of an edible kernel, surrounded by two shells. The outer shell is smooth and of a bright brown color. Between the two shells, there is a very caustic oily substance. The cashew kernel is considered to be of high nutritive quality and is covered with a thin reddish-brown skin.[5]

## MATERIALS AND METHOD

### PLANT PROFILE

#### *Anacardium occidentale*



**Fig 1: *Anacardium occidentale***

### VERNICULAR NAMES

English: Cashew

Hindi: Kaju

Tamil: Mundiri, Andima

Telugu: Munthamamidi

Kanada: Godambi

Malayalam: Kashumavu

**Table 1: Taxonomical classification *Anacardium occidentale***

Kingdom	Plantea
Sub kingdom	Tracheobionta
Phylum	Tracheophyta
Class	Magnoliopsida
Sub class	Rosidae
Order	Sapindales
Family	Anacardiaceae
Genus	Anacardium
Species	<i>Anacardium occidentale</i>

## METHODOLOGY

### PREPARATION OF EXTRACT OF *Anacardium occidentale*

The bark of *Anacardium occidentale* was collected washed with distilled water and air dried under shade. 10g of powdered plant material were weighed out and extracted using the decoction method with 60 ml of distilled water by boiling for 1 hr. The boiled extract was taken and separated by filtration.

### FORMULATION OF HERBAL TOOTHPASTE

#### Trituration method

The herbal toothpaste was formulated by using an aqueous extract of *Anacardium occidentale*. The solid ingredients calcium carbonate, SLS, Sodium CMC, Sodium benzoate, and Sodium saccharin were weighed accurately as mentioned in the formula and sieved through sieve no. 84, so as to maintain the particle size. Further, these are subjected to mixing in mortar and pestle and triturated with glycerine until a semisolid mass is formed. Accurately weighed herbal extract in the form of concentrated liquid is added to the base along with peppermint oil as a flavoring agent[6]. A formulation chart with all ingredients with their quantities is given in the table 2.

**Table 2: Formulation chart of Herbal toothpaste**

SL NO.	CONTENT	QUANTITY
1	Extract	2 ml
2	Sodium CMC	1g
3	Calcium Carbonate	10g
4	Glycerine	7ml
5	Sodium Saccharin	0.2g
6	Sodium Lauryl Sulphate	1.5g
7	Sodium Bicarbonate	0.1g
8	Sodium Chloride	0.2g
9	Sodium Benzoate	0.01g
10	Peppermint Oil	q.s

## EVALUATION STUDIES

### a) Organoleptic evaluations

#### Colour

Colour of the prepared toothpaste was evaluated for its colour. The colour was checked visually.

#### Odour

Odour was found by smelling the product.

#### Taste

The taste was checked manually by tasting the product.

### **b) Determination of pH**

Take 1 gm of the toothpaste in a 150 ml beaker and add 10 ml of freshly boiled and cooled water (at 27°C). Stir well to make a thorough suspension. The pH of the suspension within 5 minutes was determined using a digital pH meter.[7]

### **c) Viscosity Evaluation**

Viscosity of toothpaste was determined by using Brookfield viscometer, with the spindle speed of 2.5 rpm. The viscosity of toothpaste was measured by using spindle no. 64.

### **d) Foaming Ability**

The cylinder shake method was used to determine foaming ability. A 50 ml of 1% toothpaste solution was put into a 100 ml graduated cylinder and covered the cylinder with hand and shaken for 10 times. The total volumes of foam contents after 1 minute of shaking were recorded. The foam volume was calculated only. Immediately after shaking the volume of foam at 1 minute intervals for 4 minutes were recorded.

### **e) Spreadability**

The Spreadability is term express to denote the extent of the area to which the paste readily spreads on the application area. One of the criteria for a paste to meet ideal quality is that it should possess good spreadability. About 1 gm of medicated dental paste was weighed and kept at the center of the glass plate (10 x 10 cm) and, another glass plate was placed over it carefully. 1kg weight was placed at the center of the plate (avoid sliding of the plate). The diameter of the paste in cm, after 15 minutes was measured [8]. The Spreadability (S) can be calculated using the formula:

$$S = m \times l/t$$

Where, S–Spreadability.

m- Weight tied to upper glass slide.

l- Length moved glass slide.

t- Time taken.

#### **f) Tube extrudability**

The formulation under study was filled in a clean, lacquered aluminum collapsible tube with a nasal tip of 5mm opening and applied the pressure on the tube with the help of finger. Tube extrudability was then determined by measuring the amount of paste extruded through the tip when a pressure was applied on tube paste. [9]

#### **g) *In-vitro* Anti-inflammatory Study**

##### **Protein denaturation using egg albumin method:**

The reaction mixture (5ml) consisted of 0.2 ml of egg albumin (from fresh hen's egg), 2.8 ml of phosphate-buffered saline (PBS, pH 6.4) and 2 ml of varying concentrations (10, 30, 50, 70 and 100 µg/ml) of extract. A similar volume of double-distilled water served as the control. Next, the mixtures were incubated at  $37 \pm 2^\circ\text{C}$  in a BOD (Bio Oxygen Demand) incubator for 15 minutes and then heated at  $70^\circ\text{C}$  for five minutes. After cooling, their absorbance was measured at 660 nm by using the vehicle as a blank. Mefenamic acid in concentrations of 10, 30, 50, 70 and 100 µg/ml was used as the reference drug and treated similarly for the determination of absorbance. The percentage inhibition of protein denaturation was calculated by using the following formula:

$$\% \text{ inhibition} = 100 \times [V_t / V_c - 1]$$

Where,  $V_t$  = absorbance of the test sample

$V_c$  = absorbance of control. [10]

#### **h) Antibacterial activity of herbal toothpaste**

The antimicrobial activity of the toothpaste was determined by the modified agar well plate method. In this method, 2 nutrient agar plates were seeded with 0.5 ml of broth cultures of each isolate (*E. coli* and *S. aureus*). The plates were allowed to dry for 1 h. A sterile 8 mm cork-borer was used to cut the wells at equidistance in each of the plates. The toothpaste was introduced into one of the three wells and compared with the standard marketed formulation (Dabur toothpaste). While the same amount of the base was introduced into the other well as control. The plates were incubated at  $37^\circ\text{C}$  for 24 h (48 h for yeast species). The antimicrobial activity was evaluated by measuring the diameter of zones of inhibition (in mm)[11].

## RESULTS AND DISCUSSION

### FORMULATION OF HERBAL TOOTHPASTE

Formulation of herbal toothpaste was prepared by using *Anacardium occidentale*, calcium carbonate and glycerin.



**Fig 2: Toothpaste formulation**

### EVALUATION STUDIES

#### a) Organoleptic Evaluation

**Table 3: Organoleptic evaluation**

Sl.No.	Parameters	Observation
1.	Colour	Pink
2.	Odour	Characteristic
3.	Taste	Sweet

#### 6.5.2 Determination of pH

The pH of formulated toothpaste was found to be 7.86, which falls within the ideal pH range for toothpaste which is between 5 and 8.

#### 6.5.3 Viscosity Evaluation

The results of the rheological evaluation showed that the viscosity of sample changes gradually with the increase in rpm, therefore the toothpaste formulation was time-dependent. The viscosity of formulated herbal toothpaste was found to be 15790 cp at 2.5rpm.



**Fig 3: Brookfield viscometer- viscosity determination**

#### **6.5.4 Foaming Ability**

The results showed that the toothpaste is capable of producing high foaming properties, and it was found that the forming ability of toothpaste is 35 ml.



**Fig 4: Foaming action**

#### **6.5.5 Spreadability**

The spreadability of herbal toothpaste was done and it was found to be that the herbal toothpaste has good spreadability and was found to be 7.5 cm.

#### **6.5.6 Tube extrudability**

The tube extrudability of the formulated herbal toothpaste was found to be good.

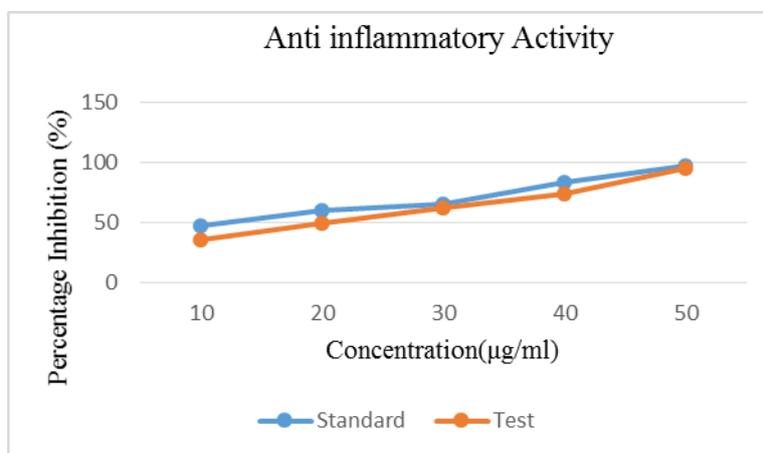
#### **6.5.7 *In-vitro* anti-inflammatory assay**

The present study also investigated the anti-inflammatory potential of herbal teeth. An *In-vitro* assay was performed to investigate the percentage of anti-inflammatory activity of herbal toothpaste at various concentrations and results were compared with that of standard

mefenamic acid. The percentage of anti-inflammatory activity of plant extract at a concentration range of 10-50 ug/ml was found. The result is shown in table 4. The formulated toothpaste shown significant anti-inflammatory activity and the highest activity of was observed with 50ug/ml concentration of herbal toothpaste.

**Table 4: Anti-inflammatory activity**

CONCENTRATION (ug/ml)	PERCENTAGE INHIBITION (%)	
	Standard	Herbal toothpaste
10	46.86	35.34
20	59.48	48.92
30	65.51	61.61
40	83.62	73.92
50	97.42	94.81



**Fig 5: Percentage inhibition of Anti-inflammatory activity of standard drug and herbal toothpaste**

### 6.5.8 Antibacterial Activity of Herbal Toothpaste

The anti-microbial activity using the well plate method against *S. aureus* and *E-coli* was performed with the herbal toothpaste and compared with the marketed formulation (Dabur Toothpaste). From the study it was shown that the formulated herbal toothpaste has good anti-bacterial activity compared with the standard.

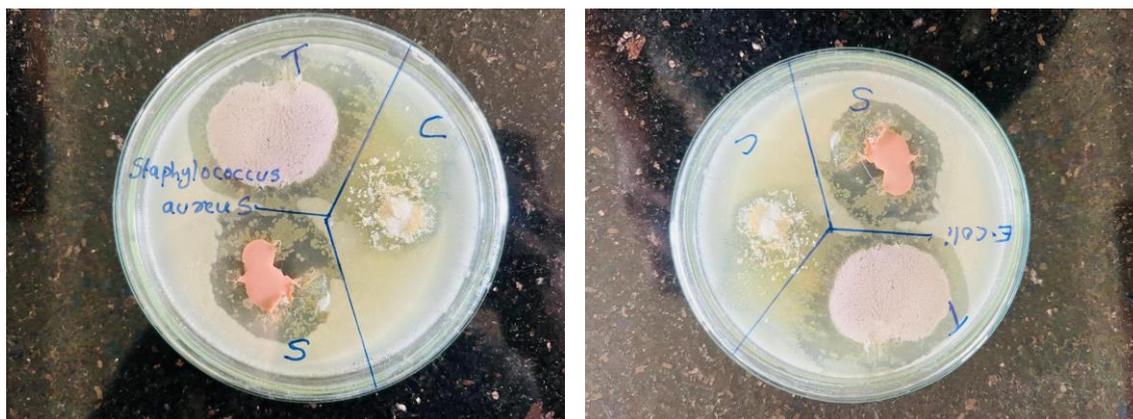


Fig 6: Anti-bacterial activity against *S. aureus* & *E. coli*

Table 5: Zone of inhibition of herbal toothpaste and standard

Microorganism	Zone of inhibition (mm)		
	Herbal toothpaste	Dabur toothpaste	Control (toothpaste base)
<i>Escherichia coli</i>	10 mm	20 mm	-
<i>Staphylococcus aureus</i>	15 mm	22mm	-

## CONCLUSION

The herbal toothpaste has having prominent function in maintaining oral hygiene and preventing dental caries and is safer with minimum side effects than chemical-based toothpaste. Formulated toothpaste is capable of maintaining tooth and oral hygiene and shows antimicrobial activity against *E. coli* and *Staphylococcus aureus*, and also showed good anti-inflammatory activity. This preliminary *in-vitro* study demonstrated that Herbal toothpaste was equally efficacious as marketed toothpastes in terms of all evaluation parameters of toothpaste. It is concluded that formulated Herbal toothpaste was found to be of good quality, antibacterial and anti-inflammatory activity and further needs *in vivo* studies.

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