



Design and Evaluation of Medicated Derma Sticks of *Azadirachta indica* For Antimicrobial Activity

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Abstract

Topical skin infections commonly occur in person in worldwide level. Plants reported to possess activity or used in traditional systems of medicine for prevention and treatment of skin disorders. Hence, present study was aimed to design and evaluate medicated sticks of *Azadirachta indica* extract which is very well known for the antibacterial and antifungal activity. The petroleum ether and ethanol (70%) extracts were prepared. Medicated derma sticks of *Azadirachta indica* extract were prepared by heating and congealing and evaluated for thickness, length and weight. The medicated derma sticks of *Azadirachta indica* were screened for antimicrobial activity against *S. aureus*, *E. coli* and *C. albicans*, and further stability studies was performed. The prepared medicated derma sticks of *Azadirachta indica* obtained were of uniform length, thickness and weight respectively. The zones of inhibition of medicated derma sticks of *Azadirachta indica* against all the microorganisms were nearer to pure drugs. The stability study of medicated derma sticks of *Azadirachta indica* exhibited that the formulations were safe to use in tropical application.

1 Introduction

Topical skin infections commonly occur and often present therapeutic challenges to practitioners, despite the numerous existing antimicrobial agents available today. The synthetic medicine available in the market but are associated with lots of side effects. Hence the necessity for developing new antimicrobial means has increased significantly due to growing concerns regarding multidrug-resistant bacterial, viral, and fungal strains. Consequently, attention has been devoted to safe, new, and/or alternative antimicrobial materials in the field of antimicrobial chemotherapy¹. The herbal ointments are best option to overcome the above problems.

Formulation of an effective and efficient topical preparation is the need of the hour and consideration must be given to the intended purpose. This is directly concerned with the site of action and the desired effect of the preparation. Many patients express difficulty in application of ointments, creams, gels etc. results in noncompliance and ineffective therapy. Recent advances in Novel Drug Delivery Systems (NDDS) aims to enhance safety and efficacy of drug molecules by formulating a

convenient dosage form for application and to achieve better patient compliance. One such approach is medicated sticks. An advantage of this drug delivery system includes patient compliance; convenience and comfort for efficient treatment include application without fingertip, immediate onset of action, reduced dosage regimen and economy².

Azadirachta indica incorporating different phytoconstituents including nimbin, nimbidin, nimbolide, and limonoids in plant parts. These chemical constituents play role in diseases management through modulation of various genetic pathways and other activities. Quercetin and β -sitosterol were first polyphenolic flavonoids purified from fresh leaves of neem and were known to have antifungal and antibacterial activities. The various biological and pharmacological activities have been reported including antibacterial, antifungal and anti-inflammatory. Earlier investigators have confirmed their role as anti-inflammatory, antiarthritic, antipyretic, hypoglycemic, antigastric ulcer, antifungal, antibacterial, and antitumour activities³.

Azadirachta indica has antibacterial and antifungal activity commonly used in the treatment of several skin disorders not available in medicated stick dosage form. The aim of the study was to develop medicated derma sticks of *Azadirachta indica* extract by heating and congealing method.

2 Materials and Methods

2.1 Plant material

The leaves of *Azadirachta indica* were collected from outskirts of Gulbarga, Karnataka, India. Further, it was identified by the taxonomist. The leaves were shade dried, reduced to coarse powder and stored in airtight container till further use.

2.2 Preparation of extract

The powdered leaves of *Azadirachta indica* about 250 gm were packed in Soxhlet apparatus and extracted with petroleum ether and ethanol (70%) separately, until the completion of the extraction. The extract was filtered while hot, and the resultant extract was distilled in vacuum under reduced pressure in order to remove the solvent completely, and later dried in a desiccator.

2.3 Preparation of medicated derma sticks of *Azadirachta indica*

Medicated derma sticks were prepared by heating and congealing according to the formulae (Table 1). Depending upon the weight, thickness and length of medicated derma sticks, the formulae was chosen for the incorporation of the drug. Stearyl alcohol / Cetyl alcohol and white petroleum were melted in a china dish and heated this mixture up to 70 °C.

Table 1: Composition of medicated derma sticks of *Azadirachta indica*

Ingredients	Quantity (gm)
<i>Azadirachta indica</i> Extract	1.00
Stearyl alcohol	15.00
White petrolatum	20.00
White Beeswax	5.00
Sodium lauryl sulfate	1.50
Propylene glycol	12.50
Purified water (Q.S.)	100.00

Dissolve sodium lauryl sulfate, propylene glycol in purified water and heat the solution to 70 °C separately. Add the oleaginous phase slowly to the aqueous phase, stirring constantly and then the drug was added slowly with continuous stirring in order to get a uniform mixture in optimized formulation. The hot mixture was poured into the glass mould and cooled to get the desired shape of sticks. The stick was removed from the mould after 24

hours with the help of plunger and inserted into the medicated derma stick container^{4,5}.

2.4 Evaluation of prepared medicated derma sticks

Three sticks were selected randomly and weighed individually. The individual weights were compared with the average weight for determination of weight variation. As the shape of the stick is cylindrical the thickness and length was determined with the help of screw gauge and vernier calipers, respectively. The average thickness was measured, by observing thickness at three different parts of the stick.

2.4 Antimicrobial studies of prepared formulations

The antimicrobial activity of prepared formulation evaluated against bacterial and fungal strains by using agar well diffusion method. Nutrient agar plates were prepared for all extracts, 50µl inoculums of each selected bacterium (*S. aureus*, *E. coli* and *C. albicans*) was uniformly spreaded on agar plates with the help of glass spreader, after five minutes three wells approximately 5mm diameter was bored with the help of borer. The plant extract were poured into the wells. The plates were incubated at 37 °C for 24 hrs. Petri plates containing 20 ml of agar medium were seeded with a 24 hours culture of the bacterial strains. In each plate, hole of 6-mm diameter was made using a sterile borer.

The sample solution at concentration (100 µg/ml) was poured into hole of the inoculated agar. The inoculums size was adjusted so as to deliver a final inoculums of approximately 10⁸ colony-forming units (CFU)/ml. Incubation was performed for bacteria and fungus at 37 °C for 24 hrs and 37 °C for 72 hrs respectively⁶⁻⁸.

The assessment of antibacterial activity was based on measurement of the diameter of the inhibition zone formed around the well. A standard gentamycin and fluconazole were used as a positive control. All assays were carried out in triplicate.

2.5 Stability studies

Stability studies for the formulations were carried out by storing at 27±2 °C for a period of three months. At intervals of one month the sticks were visually examined for any physical changes.

3 Results and Discussions

In the past, many researchers has evaluated the pharmaceutical importance of different parts of *Azadirachta indica* plant and found that the plant possesses natural healing capacity in curing many ailments along with anti-inflammatory, antipyretic, anti-diarrhoeal, anti-diabetic, analgesic, antimicrobial, antibacterial and antiviral properties.

Thus the antimicrobial activity against pathogenic microbes was evaluated. The medicated derma sticks of *Azadirachta indica*

were prepared and screened for antimicrobial activity using the agar well diffusion method.

Steryl alcohol and Cetyl alcohol as stiffening agent while petrolatum used as emollient, propylene glycol and sodium lauryl sulphate were used as humectants and emulsifying agent respectively. A total of six formulations were designed. As the material was uniformly filled in mould with uniform Medicated sticks of *Azadirachta indica* were prepared by heating and congealing method.

The prepared medicated derma sticks of *Azadirachta indica* obtained were of uniform length, thickness and weight respectively (Table 2).

Table 2: Data of weight, thickness and length of medicated derma sticks of *Azadirachta indica*

Medicated sticks	Weight (gm)	Thickness (mm)	Length (cm)
<i>Azadirachta indica</i> Extract	2.01±0.28	6.57±0.71	4.21±0.36

All values are in triplicate and expressed in mean±SD

The present investigation shows the efficacy of medicated derma sticks of *Azadirachta indica* against the selected pathogenic microbes (Table 3).

Antimicrobial activity of medicated derma sticks of *Azadirachta indica* were investigated against *S. aureus*, *E. coli*, and *C. albicans*. The zones of inhibition of medicated derma sticks of *Azadirachta indica* against all the microorganisms are displayed in table 3.

Table 3: Antimicrobial studies of medicated derma sticks of *Azadirachta indica* showing the comparative zone of inhibition with pure drug

Formulation	Zone inhibition (mm)		
	<i>S. aureus</i>	<i>E. coli</i>	<i>C. albicans</i>
Sticks of <i>A.indica</i>	21.82±0.39	19.74±0.47	27.63±0.19
Gentamycin	23.15±0.82	20.36±0.61	--
Fluconazole	--	--	29.43±0.35

All values are in triplicate and expressed in mean±SD

The stability study of medicated derma sticks of *Azadirachta indica* exhibited that the formulations were safe to use in tropical application (Table 4).

4 Conclusion

The medicated derma sticks of *Azadirachta indica* and evaluated for antimicrobial activity. The findings demonstrated that the antimicrobial activity of prepared medicated stick was neared to pure drug i.e. Gentamycin and Fluconazole. The continuation of these work clinical studies is in progress.

Table 4: Stability studies of medicated derma sticks of *Azadirachta indica*

Duration	Temperature	Physical appearance	pH
After 1 month	27±2 °C	No change	6.9
After 2 month	27±2 °C	No change	7.1
After 3 month	27±2 °C	No change	7.0

5 Conflict of interests

None

6 Authors contributions

MGKM and KPR carried out research work and drafted the manuscript.

7 References

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