



DEVELOPEMNT AND EVALUATION OF BIOGENIC AGNPs CONTAINING ANTIDANDRUFF SHAMPOO

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Abstract:

Present study describes the formation of biogenic AGNPs containing Antidandruff shampoo with minimum side effects which provides a simple, rapid and economical route will have a great potential in cosmetic field.

Nanoparticles were prepared by green method by using neem leaves using magnetic stirrer. These prepared nanoparticles was identified by particle size , UV spectroscopy , FTIR , Zeta potential and these prepared NPs were used for the preparation of antidandruff herbal shampoo.

The herbal ingredients such as Amla , Shikakai , aloe vera , Reetha , turmeric, lemon oil were used and the prepared herbal shampoo was evaluated by using various test such as visual examination , foaming ability , pH , viscosity , detergency .

From the above evaluations it is concluded that herbal shampoo was found to be safe and effective without any side effect.

Index terms - Neem extract, nanoparticles, herbal antidandruff shampoo, biogenic AGNPs, herbal ingredients, antidandruff.

1. Introduction

Dandruff is a typical incessant scalp condition set apart by chipping of the skin on scalp. Dandruff isn't contagious or serious, but it can be embarrassing and sometime difficult to treat .It is easy that dandruff usually can be controlled .mild cases of dandruff may need nothing more than daily shampooing with a cleanser. More stubborn cases of dandruff often respond to medicated shampoos.¹

For most teens and adults, dandruff symptoms are easy to spot like white, oily flakes of dead skin which dot the hair and shoulders with itchy, scaly scalp. The condition may worsen during the fall and winter, when indoor heating contributes to the dry skin and which improve during the summer.

Cradle cap which is a type of dandruff can affects babies. But this is not dangerous and usually clears up on its own.²

Dandruff have several causes which includes:

- Irritated , oily skin (seborrheic dermatitis)
- Not shampooing often enough
- A yeast like fungus (Malassezia)
- Dry skin
- Microorganisms (mainly propionibacterium and staphylococcus which are bacteria)

SHAMPOO

Shampoo is a restorative hair care item, ordinarily as a thick fluid, that is utilized for cleaning hair. ¹¹Shampoo is utilized by applying it to wet hair, rubbing the item into the hair, and afterward flushing it out. A few people may follow a shampooing with the utilization of hair conditioner. The common explanation of utilizing cleanser is to expel the undesirable develop of sebum in the hair. ¹²

Manufactured Shampoo is commonly made by joining a surfactant, regularly sodium lauryl sulfate with a co-surfactant, frequently cocamidopropyl betaine in water.¹²The sulfate fixing is go about as a surfactant basically rock solid cleanser that makes it simpler to trap oil and oil. Strength shampoos are showcased to individuals with dandruff, shading treated hair, gluten or wheat sensitivities, an enthusiasm for utilizing a natural item, and babies and little youngsters ("child cleanser" is less aggravating). There are likewise shampoos expected for creatures that may contain bug sprays or different drugs to treat skin conditions or parasite invasions, for example, insects.

Manufactured antidandruff cleanser contains fungicides such as ketoconazole, zinc pyrithione and selenium disulfide or coal tar and salicylate derivatives which diminish free dander by killing fungi like Malassezia furfur.³

Presently a-days home grown shampoos are favored over engineered shampoos to maintain a strategic distance from symptoms of manufactured fungicides. Such shampoos regularly use herbal concentrates or basic oils and having synergistic impacts.³

BIOGENIC SILVER NANOPARTICLES:

Biogenic

These are produced by living organisms. A biogenic substance is produced by life processes. It may be either constituents, or secretions of plant or animals, more specifically called as biomolecule. They can be biosynthesized using bacteria, fungi and yeast as well as their potential application in biomedicine. The synthesis of nanoparticles using microbes is eco-friendly which results in reproducible metal nanoparticles of well defined sizes, shapes and structures. Biogenic synthesis of silver nanoparticles (AGNPs) by using various plant material is an exploring field and considered green nanotechnology as it involves cost effective, simple and ecofriendly procedures. Flavonoids and terpenoids present in the neem leaves extract act as both reducing and capping agent.¹⁷

Nanoparticles

NPs are particles which exists on a nanometer scale i.e. below 100nm. They possess physical properties such as uniformity, conductance.

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2. Materials and methods:

2.1 Materials:

Neem leaves were collected from Government College of Pharmacy, Amravati and all other herbal ingredients of shampoo were purchased from local market, Amravati.

Distilled water was used throughout the research work.

2.2 Methods:

2.2.1 Preparation of neem leaves extract:

Firstly neem leaves were washed twice with tap water and again with distilled water.

500 gm of leaf were taken and exaction was done by using soxhlet apparatus using 1000ml distilled water at 70^oc.⁵The extract was filtered by using whatman no.1 filter paper and concentrated to avoid the growth of micro-organism. The prepared solidified extract of neem was placed at room temperature.¹⁵



Figure 1. neem leaves



Figure 2. soxhlet extraction process

2.2.2 Synthesis of biogenic AGNPs:

AGNPs were prepared using green method. In this synthesis reducing and protecting both roles played by extract. 250 mg/dm³ silver nitrate was used in aqueous form as silver precursor. 10% solution of neem extract was taken. The extract was prepared using 1gm of concentrated extract in 100ml dist. Water.

100ml of aqueous solution silver nitrate (250 mg/dm³) was stirred at high speed on magnetic stirrer and to it 10% of neem extract was added drop by drop using burette until color of solution changes from white to red which indicates the formation of silver nanoparticles.

2ml, 2.5ml, 3ml, 3.5 ml, 3.5ml, 4.5 ml and 6ml of extract was added separately and evaluations of all these AGNPs was done to get proper sized AGNPs.¹

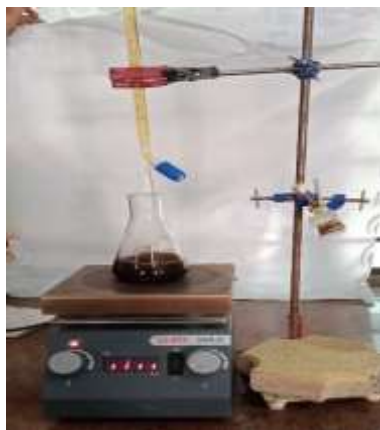


Figure 3. AGNPs synthesis using magnetic stirrer

2.2.3 Preparations of Antidandruff Shampoo:

All herbal ingredient were measured. These ingredients were mixed according to ascending order.

Then prepared AGNPs was added in it. It was well mixed stirred and then homogenized to get uniform size and viscosity was also maintained.⁶

Composition:

Amla – 10g

Aloe vera -10g

Henna -5g

Turmeric -5g

Reetha- 20g

Lemon oil-10 ml

AGNPs prepared from neem leaves – 10ml

Glycerin- 10g

Sodium hydroxide – to adjust the PH

Water – qs upto 100ml

3 Characterization of AGNPs:

3.1 UV Characterization:

The measurement was carried out using UV spectroscopy apparatus Shimatzu-1800 having operational wavelength of 200-1200nm. The wavelength was set between 200-800 nm.

The synthesized AGNPs were characterized after different time intervals ie.5 hours, 24 hours, 72 hours and after a month.⁷

3.2 FTIR:

The Fourier-transform (FTIR) was performed to identify the functional group present in the synthesized nanoparticles. This was done using KBR pellet technique. The spectra were scanned over a frequency range between 400- 4000 cm^{-1} .⁷

3.3 particle size

The particle size distribution of the nanoparticles was measured by photon correlation spectroscopy using Malvern Zetasizer Nano ZS laser particle size analyzer.⁸

3.4 Zeta potential:

Zeta potential was performed to predict the stability of the nanoparticles and to determine the surface charge of the nanoparticles in the solution.

4 Evaluations of shampoo:

4.1 Visual Appearance

Clearance, Smoothness, fluidity of the shampoo was evaluated.⁶

4.2 Determination of pH

The pH of 10% shampoo in distilled water was determined at temperature 25 $^{\circ}\text{C}$.⁶⁻¹⁰

4.3 determination of percent of solid contents

4gm of shampoo was taken in evaporating dish which is separately weighted. Then evaporating dish with shampoo was also measured and placed on the hot plate until the liquid portion of shampoo was evaporated. The solid portion of the shampoo remained after evaporation was calculated.⁹

4.4 foaming ability and stability

This is performed using the measuring cylinder. 1 ml of shampoo was taken in 10 ml of the distilled water. The cylinder was covered by hand and shaken 10 times.²⁶The total volume of the foam was measured after 1 min of shaking. Then upto 5 min the foaming volume was measured for determining the stability of the foam.⁹

4.5 Antimicrobial test

The MIC of the extract was carried out against the E-coli. The antidandruff shampoo was screened against bacterial strains of E coli using agar disc- diffusion assay. The zone of inhibition was measured. The prepared antidandruff shampoo was compared with the marketed formulation of antidandruff shampoo for antimicrobial activity.⁵

5 Result and discussion:

5.1 Results and discussion of AGNP

5.1.1 UV analysis of AGNPs

UV Spectrum of AGNPs the Maximum wavelength was found to be 423nm.

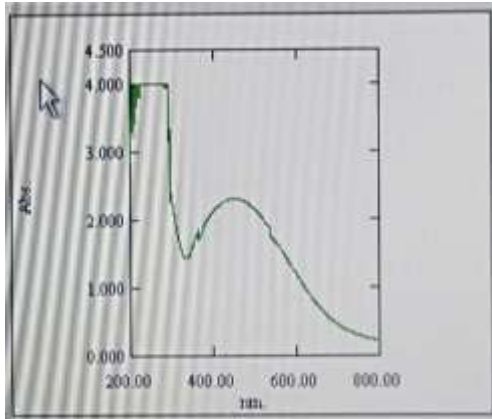


Figure 4: UV spectrum of AGNPs

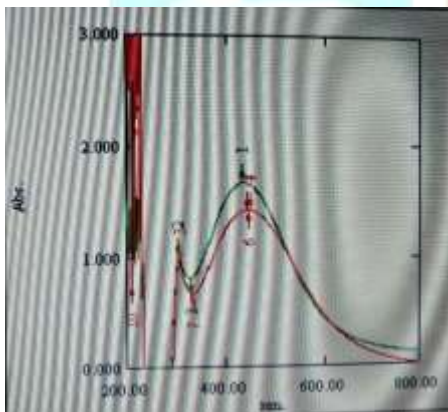


Figure 5: UV spectrum of AGNPs of Extract 2ml and 3ml

5.2.2 FTIR Spectroscopy:

Bands between $1103-1045\text{ cm}^{-1}$ (C-OH Stretching) was observed which is the characteristics of polysaccharide. 1612 cm^{-1} is characteristics of amide. The bond present between $1045-1055\text{ cm}^{-1}$ correspond the vibrational frequency of CO and the strong bond between $3000-3600\text{ cm}^{-1}$ are the characteristics of N-H stretching vibration.

The peak at 671 cm^{-1} showed that Ag^+ ions was reduced to AGNP by hydroxyl group in flavonoid , polyphenol and also other biomolecule . This FTIR spectra shows high similarity with the actual neem leaves extract and also there are no excess peaks between $500-50\text{ cm}^{-1}$ which corresponds to silver metal ions. Thus we conclude that all the silver ions get participated in the synthesis of nanoparticles.

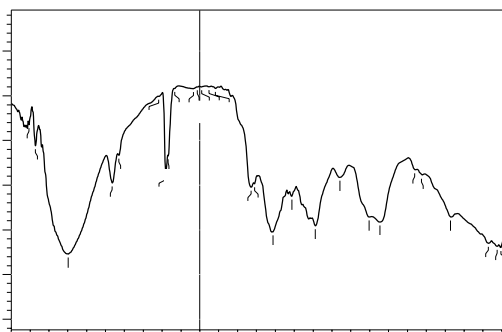


Figure 6: FTIR spectra of AGNPs

5.3.3 Particle size distribution

Particle size should be between 1 – 100 nm range.

Z –average (r.nm): 90.40

Pdl: 0.448

Intercept: 0.798

Table no 1: particle size, intensity and width of all peaks

Peaks	Size (rpm)	% intensity	Width
Peak 1	75.20	51.8	29.15
Peak 2	240.2	44.4	103.7
Peak 3	2407	3.8	360.0

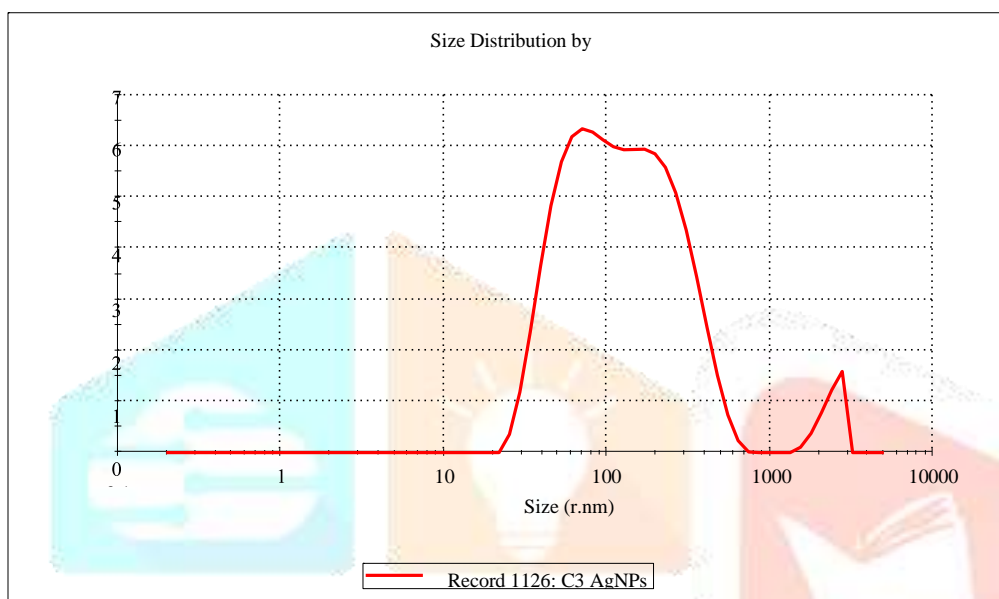


Figure 7: particle size distribution curve

5.4.4 Zeta potential:

Zeta potential (mV): - 9.66

Zeta deviation (mV): 5.26

Conductivity (mS/cm): 0.0220

Table no 2: mean, area and width of all peaks

Peaks	Mean (mV)	Area (%)	Width (mV)
Peak1	-9.66	100.0	5.26
Peak 2	0.00	0.0	0.00
Peak 3	0.00	0.0	0.00

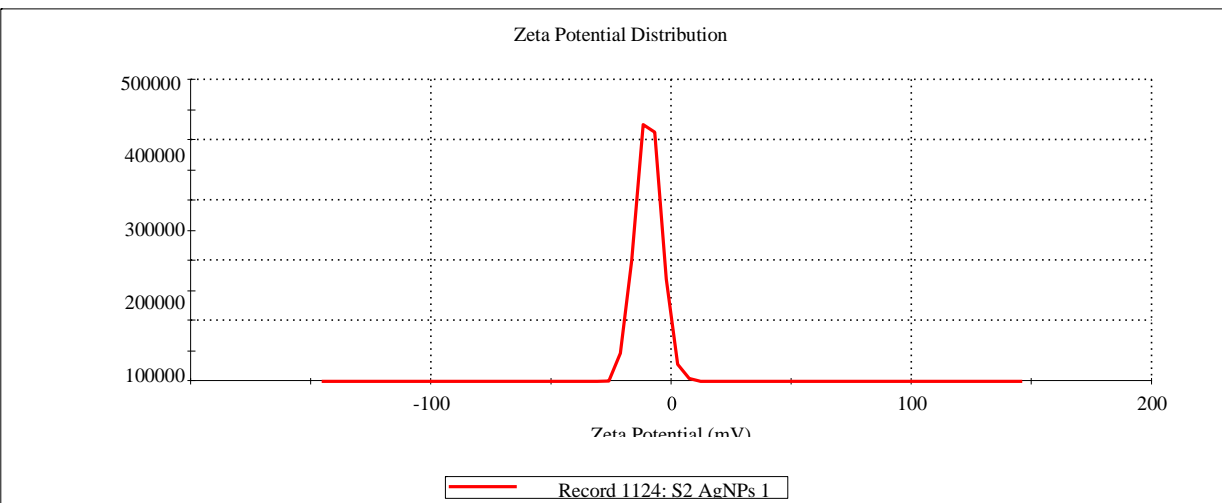


Figure 8: zeta potential distribution curve

5.2 Results and discussion of Antidandruff Shampoo:

5.2.1 Visual appearance :

Color – dark brown, thick, having great foaming ability and fluidity.

5.2.2 Determination of pH:

The pH = 6.2

5.2.3 Determination of percent of solid

The 0.02 g weight of the shampoo was retained.

5.2.4 Foaming ability and stability

Table 3: Foam observed in 5 min

Time in minute	Foam in minute
1Min	5ml
2Min	4.5ml
3Min	4ml
4Min	3.5ml
5Min	3.5ml

5.2.5 Antimicrobial test

It is important to calculate the MIC of microbes against particular microbes which may be bacteria, fungi. In this study we had used the E-coli bacterium . The MIC of extract was found to be 3.5ug/ml. The zone of inhibition for extract, silver nanoparticles, and antidandruff shampoo was found to be 12 mm, 14mm and 15mm respectively. We have also calculated the zone of inhibition of marketed Antidandruff Shampoo which was found to be 16mm.

Table no4: zone of inhibition of different samples

Sample	Zone of inhibition (mm)
Extract	12
Silver nanoparticles	14
Antidandruff shampoo	15
Marketed formulation	16



Figure 9: zone of inhibition of shampoo and extract in E-coli culture



Figure 10: The MIC of extract (3.5ug/ml)

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