SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

# FORMULATION AND EVALUATION OF HERBAL TOPICAL DRUG DELIVERY

**Shital Jadhav, Poonam Papule.Shrddha Phatak**

**ABSTRACT**

*Herbal therapy and herbal drug predominates in traditional medicine practiced in developed world plant derived substances and herbal medicines have recently attracted the great interest towards their versatile application. The main objective the present study is to formulate and evaluate herbal ointment with antimicrobial activity by using Azadirachta Indica and Bombax Ceiba polymer. The ointment base was prepared and formulation of ointment was done by incorporation of the polymer in the base by levigation method. Ointments were prepared by using different concentration of the polymer such as using 1% Azadirachta Indica, 1% Bombax Ceiba and their combination (0.5% Azadiracta indica and 0.5% Bombax ceiba) w/w. After completion of formulation it was evaluated for its Physicochemical parameter like colour, odour ,pH, Homogenity, solubility, Consistancy, washability, Spreadability, viscosity, extrudability, skin irritation test, diffusion study. The herbal formulations were evaluated for its Antimicrobial activity against Staphylococcus aureus and prepared formulations were also stable at 5˚C and Room temperature. Overall result of this study reveals that this is an effective herbal ointment.*

**KEYWORDS:** *Azadirachta Indica, Bombax Ceiba, Staphylococcus aureus*

## INTRODUCTION [1, 2,3,41]

Herbal medicine is making dramatic comeback and increasing number of patients are visiting alternative medicine clinics. Side effects of synthetic medicine are alarming and recent time has seen risk of herbal and herbal-synthetic drug interaction. Traditional medicines if used judiciously can save a lot of time spent in the treatment and thus reducing global burden. Uses of plants and traditional practices will continue to play a significant role in the socio-cultural life of village communities. The herbal drugs and Excipients have more precise action and have no side effects and are economic. Herbal medicine refers to the use of any plants seeds, berries, roots, leaves, bark or flowers for medicinal purposes. Herbal medicine, also called botanical medicine or phyto-medicine, refers to the use of any plant's seeds, berries, roots, leaves, bark or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more main stream as up-to-date analysis and research show their value in the treatment and prevention of disease. Plants had been used for medicinal purposes long before recorded history.

Natural remedies are more acceptable in the belief that they are safer with fewer side effect that the synthetic one. Herbal formulations have growing demand in the world Market. Recently World Health Organization estimated that 80% of people worldwide rely on herbal medicines for some aspect of their primary healthcare. Whole herbs contain many ingredients, and it is likely that they work to produce the desired medical effect. In earlier study, medicinal plants have been reported to be very beneficial in wound care, promoting the rate of wound healing with pain, discomfort, and scarring to patient.

## MATERIALS AND METHODS

### Chemicals and reagent

Paraffin Wax (Molychem Mumbai), Cetostearyl Alcohol (SDFCL Mumbai), Lanolin (Oxford Laboratory), Parrafin soft yellow (Dipa chemicals Chhikalthana), Molish Reagent (Oxford Laboratory, Palghar), Ethanol ( Molychem Mumbai), Acetone( Molychem Mumbai), Azadirachta Indica (Cidco New Nanded), Bombax Ceiba (Usmannagar Nanded).

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**Equipments**
Digital pH-Meter, Digital Balance, Brookfield viscometer UV-Visible Spectrophotometer, Autoclave, Incubator, Hot air oven, Digital colony counter, Centrifugation machine, Sonicator, DSC, FTIR

**Collection of Plant:**
The leaves of Neem plant were collected from cidco New Nanded (Maharashtra). And the Bark of Bombax Ceiba Were collected from the local areas of Usmannagar, Dist. Nanded (Maharashtra)

**Preparation of Neem Extract[18]**
The leaves were dried at 40-45˚C under shade for 5 days. After drying, the leaves were ground into powder by using grinder. Then take 50 g of dried leaf powder were electronically weighed into 250 ml of conical flask. To this 250 ml of methanol was added and kept for 24 hr with periodic shaking. Filtered and filtrate was collected. The procedure was repeated three times. The collected filtrate was collected.

**Preparation of Bombax Ceiba Extract[20]**
The bark was collected and peeled off from branches and stem and wash it carefully to remove the foreign particles then cut into small piece with the help of sharp knife. Then wash with water and the small piece of Bark were soaked in cold water, then kept it overnight and crushed with the help of mortar and pestle. Then the sample is centrifugated for 10 min, after centrifugation the particle not settled down because it was clear solution. Then the sample was precipited with acetone. The precipited were separated by using muslin cloth then it was dried in a hot air oven at 50˚C. After drying the sample crushed with the help of mortar and pestle then the powder obtained and it was passed through the sieve no.22

**Phytochemical Analysis**
The methanolic extract obtained after extraction procedure was subjected to various Phytochemical screening as per the standard procedure to reveals the presence of various active phyto-constituents.

**Formulation of Ointment**

**Table No.1 Formulation of Ointment Base**

| Sr.No | Name of Ingredient | Quantity to be taken |
|---|---|---|
| 1 | Wool fat | 1.5 |
| 2 | Cetostearyl Alcohol | 1.5 |
| 3 | Hard paraffin | 1.5 |
| 4 | Yellow soft paraffin | 24.5 |

**Table No.2 Formulation of Herbal ointment**

| Sr.No | Name of Ingredient | Quantity to be taken | | |
|---|---|---|---|---|
| | | F1 | F2 | F3 |
| 1 | Azadirachta Indica Powder | 1 | 0 | 0.5 |
| 2 | Bombax ceiba powder | 0 | 1 | 0.5 |

**Procedure for preparation of ointment**
a) Initially the Ointment base was prepared by weighing accurately grated hard paraffin which was placed in evaporating dish on water bath. After melting of hard paraffin remaining ingredients were added and stirred gently to aid melting and mixing homogenously followed by cooling of ointment base.
b) Herbal Ointment was prepared by mixing accurately weighed Neem and Bombax ceiba powder to the Ointment base by levigation method to prepare a smooth paste with 2 or 3 times its weight of base, gradually incorporating more bases until to form homogenous ointment, finally transferred in a suitable container.

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

## RESULT AND DISCUSSION

**Phytochemical characterization of Azadirachta Indica polymer and Bombax Ceiba polymer**

**Table No. 3 Phytochemical Characterization of polymer**

| Sr.No | Test | Azadirachta Indica | Bombax Ceiba |
|---|---|---|---|
| **1** | **Test for carbohydrates** | | |
| a) | Molish's test | -ve | +ve |
| b) | Fehling Test | -ve | -ve |
| c) | Benedict Test | -ve | -ve |
| d) | Barford Test | -ve | -ve |
| **2** | **Test for protein Amino acid** | | |
| a) | Biuret Test | -ve | -ve |
| **3** | **Test for Phenolic compound** | | |
| a) | Ferric chloride Test | -ve | +ve |
| b) | Lead Acetate Test | -ve | +ve |
| c) | Iodine test | -ve | -ve |
| **4** | **Test for steroids** | | |
| a) | Salkowski Test | +ve | +ve |
| **5** | **Test for terpenoids** | | |
| a) | Libermann-burchard test | +ve | +ve |

**Physicochemical Characterization**

1. **Organoleptic Characteristics:**

**Table No 4: Organoleptic Characteristic of powder**

| Sr. No | Parameter | Observation | |
|---|---|---|---|
| | | Azadirachta Indica leaves polymer | Bombax ceiba bark polymer |
| 1 | Physical Appearance | Smooth | Smooth |
| 2 | Colour | Greenish | Brownish |
| 3 | Odour | Bitter | Characteristic |
| 4 | Taste | Bitter | Characteristics |
| 5 | Nature | Powder | Powder |
| 6 | Melting point | 154-158 | 121˚C |
| 7 | pH | 5.6 | 5 |

**Micromeritics Properties of Azadirachta Indica & Bombax Ceiba**

**Table No.5: Micromeritics Properties**

| Sr.No | Property | Observation(n=3) | |
|---|---|---|---|
| | | Azadirachta Indica | Bombax ceiba |
| 1 | Bulk Density | 0.376±0.04 | 0.659±0.03 |
| 2 | Tapped density | 0.576±0.009 | 0.844±0.04 |
| 3 | Angle of Repose | 22.45±37.71 | 25.63±44.32 |
| 4 | Hausner's Ratio | 1.436±0.028 | 1.118±0.29 |
| 5 | Carr's Index | 30.47±1.30 | 22.13±2.85 |

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**Determination of Microbial Load**

**Table No.6: Total Viable Aerobic count**

| Micro-organism | Media used | Sample | Microbial count (CFU) | Total count/gm (CFU/GM) |
|---|---|---|---|---|
| Bacteria | Casein soya bean digest agar | Bombax Ceiba | 44 | 440 |
| | | Azadirachta Indica | 6 | 60 |

**Instrumental Analysis**

**1) Identification by FTIR spectroscopy:**

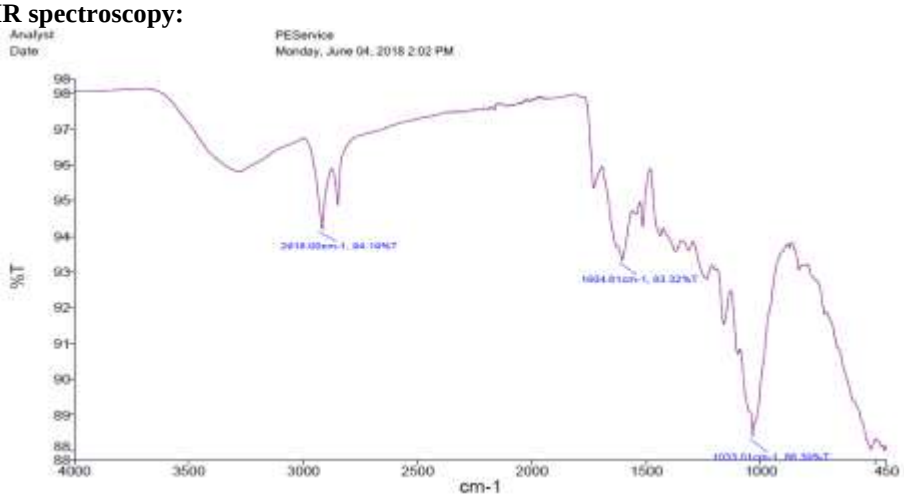


**Fig no. 1 FTIR spectrum of Azadirachta Indica polymer**

**Table No.7 Chracteistics peak of Azadirachta Indica Polymer**

| Functional Group | Characteristic peak($cm^{-1}$) | Obtained peak($cm^{-1}$) |
|---|---|---|
| CH-streaching | 2600-3000 | 2918.0 |
| C=C | 1600-1700 | 1604.81 |
| CH-O | 1000-1200 | 1033.01 |


**Fig no.2 FTIR spectrum of Bombax Ceiba polymer**

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**Table No.8 Characteristic peak of Bombax Ceiba Polymer**

| Functional Group | Characteristic peak($cm^{-1}$) | Obtained peak($cm^{-1}$) |
|---|---|---|
| CH-streaching | 2600-3000 | 2801 |
| C=C Aromatic | 1600-1700 | 1613.49 |
| CO-C streaching | 1050-1150 | 1029.98 |
| CO-streaching | 900-1300 | 1316.09 |
| CH Bending | 680-860 | 780.05 |

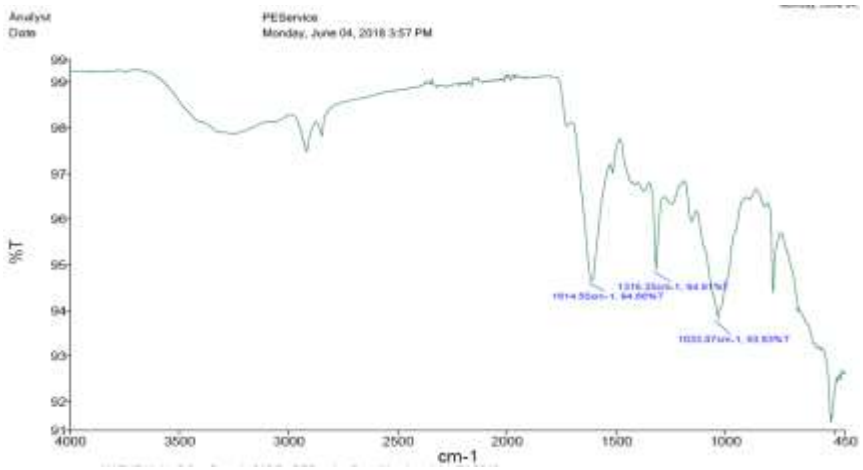


**Fig no.3 FTIR spectrum of Azadirachta Indica + Bombax Ceiba Polymer**

**Table No.9 Characteristic peak of Azadirachta Indica and Bombax Ceiba polymer**

| Functional Group | Characteristic peak($cm^{-1}$) | Obtained peak($cm^{-1}$) |
|---|---|---|
| C=C Aromatic streaching | 1600-1700 | 1614.50 |
| CO-streaching | 900-1300 | 1316.25 |
| CO-C streaching | 1050-1150 | 1033.07 |

**2) UV Spectrophotometric analysis**

**a) Determination of λ max:**(Azadirachta Indica):10 mg of powder dissolved in 100 ml phosphate buffer pH 6.8 to get the 100µg/ml stock solution. The ultraviolet spectrum was determined by scanning stock solution of 100µg/ml from 200-800 nm. The λ max of solution was found at 215 nm. as shown in fig

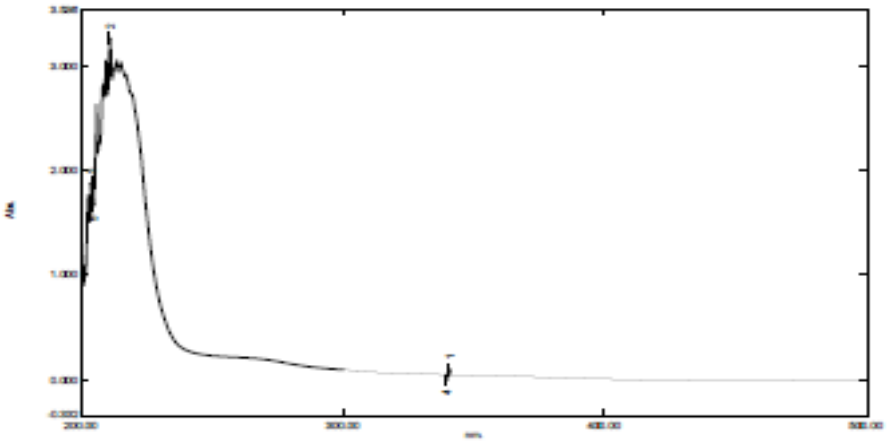

**Figure 4: UV Spectrum of Azadirachta Indica**

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**3) XRD Analysis**

The XRD techinique was used to determine the crystal structure of polymer. Azadirachta Indica polymer shows well defined characteristics peak which is in amorphous form and the Bombax Ceiba polymer was show crystalline form.

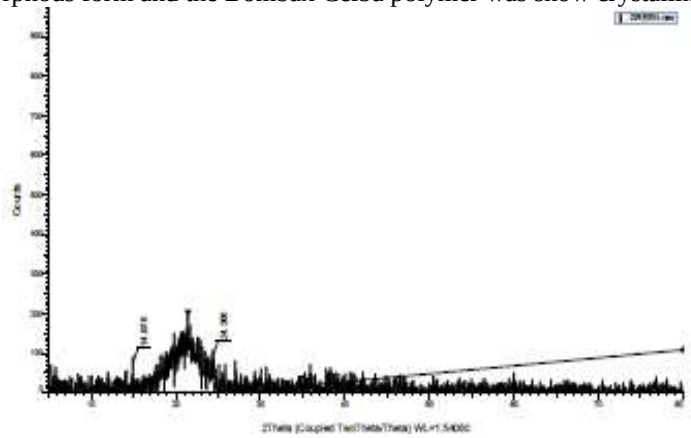

**Fig no 5: XRD result for Azadirachta Indica polymer**

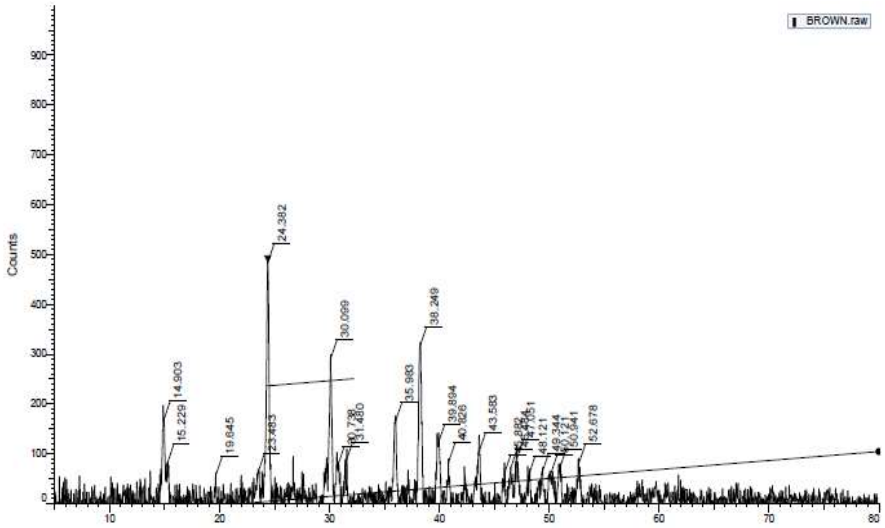


**Fig no 6: XRD result for Bombax Ceiba polymer**

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**4) Diffential Scanning Colorimetry (DSC)**

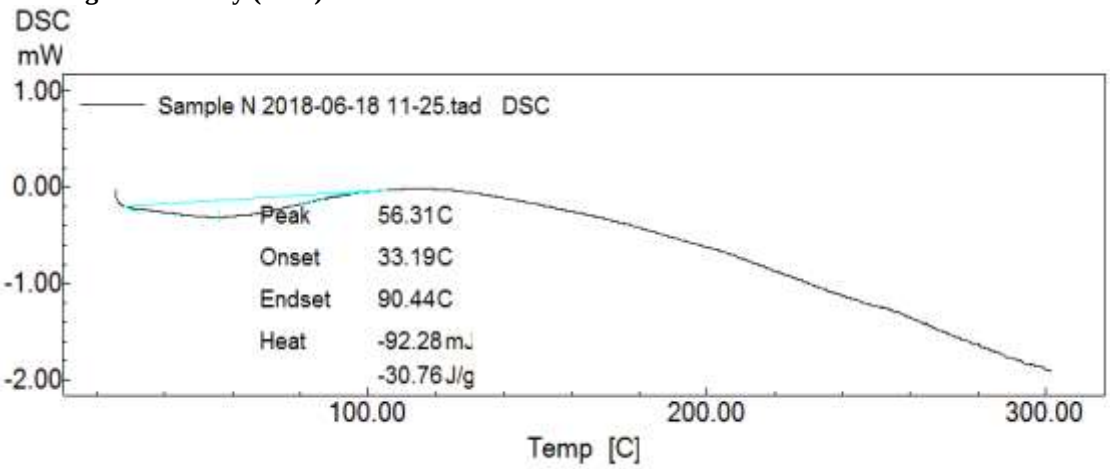


**Fig no.7: DSC thermogram of Azadirachta Indica Polymer**

**Table No.10 Thermal parameter of Azadirachta Indica Polymer**

| Sr.no | Parameter | Result |
|---|---|---|
| | Onset temperature | 56.31˚C |
| | Peak temperature | 33.19˚C |
| | End set temperature | 90.44˚C |

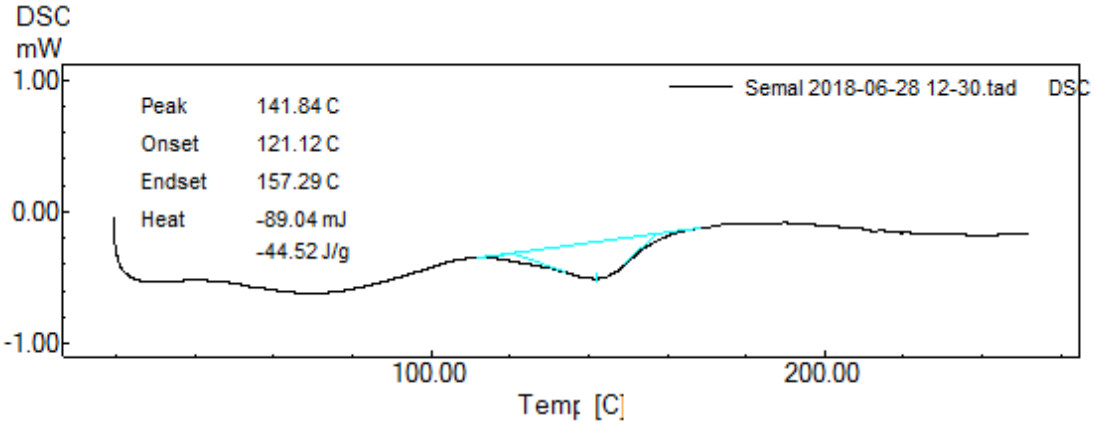


**Fig no. 8: DSC thermogram of Bombax Ceiba Polymer**

**Table no.11 Thermal parameter of Bombax Ceiba Polymer**

| Sr.no | Parameter | Result |
|---|---|---|
| 1 | Onset temperature | 121.12˚C |
| 2 | Peak temperature | 141.84˚C |
| 3 | End set temperature | 157.29˚C |

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

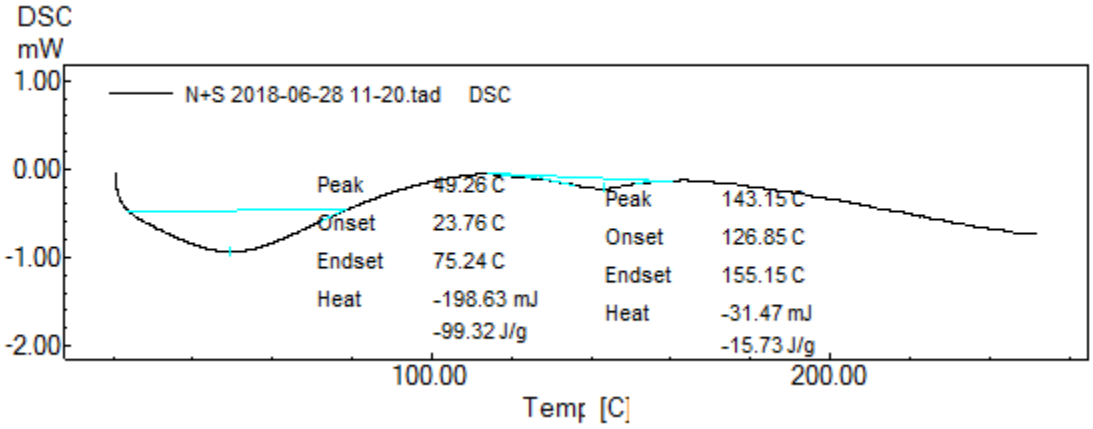


**Fig no. 9: DSC thermogram of Azadirachta Indica + Bombax Ceiba (mixture)**

**Table no.12 Thermal parameter of Azadirachta Indica + Bombax Ceiba (mixture)**

| Sr.no | Azadirachta Indica | Parameter | Result |
|---|---|---|---|
| **1** | | Onset temperature | 23.76˚C |
| **2** | | Peak temperature | 49.26˚C |
| **3** | | End set temperature | 75.24˚C |
| **1** | **Bombax Ceiba** | Onset temperature | 126.85˚C |
| **2** | | Peak temperature | 155.15˚C |
| **3** | | End set temperature | 143.15˚C |

**Evaluation of Ointment**

**1) Appearance**

**Table no.13 Appearance of Ointment**

| Sr. No | Physical Parameters | Result | | |
|---|---|---|---|---|
| | | F1 | F2 | F3 |
| 1 | Colour | Dark Green | Slightly brownish | Faint Green |
| 2 | Odour | Characteristics | Characteristics | Characteristics |
| 3 | Nature | Semisolid | Semisolid | Semisolid |
| 4 | Consistency | Smooth | Smooth | Smooth |
| 5 | Grittiness | No grittiness | No grittiness | No grittiness |

**2) pH determination:**

**Table No 14: pH of formulation**

| pH (N=3) | | |
|---|---|---|
| **F1** | **F2** | **F3** |
| 6.6±0.278 | 6.38±0.075 | 6.44±0.089 |

**3) Homogenity**

All formulations Produce uniform distribution of polymer in Ointment. It was confirmed by visual appearance and touch.

**4) Consistency**

Consistency of all formulation was checked by applying Ointment on skin and it was found that all formulation of ointment has good consistency.

**5) Washability**

All formulation was applied on skin and washing with water observe following observation

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**Table No.15 Washability of ointment**

| F1 | F2 | F3 |
|---|---|---|
| ++ | + | + |

**Easily Washable (++), washable (+)**
F1 was easily washable when applied on skin as compared to F2 and F3 formulation.

**6) Spreadability test[2]**

Spreadability was determined by the apparatus which consists of a wooden block, which was provided by a pulley at one end. One glass slide was fixed on wooden block. By this method Spreadability was measured on the basis of slip and drag characteristics of cream and ointment. The excess amount of ointment was placed on fixed ground slide, another glass slide having the same dimensions. The Ointment was sandwiched between two slides, and 50 kg weight was placed on the top of this glass slide to for 5 min to expel air and compress the glass slides of uniform thickness and excess cream and ointment was scraped off from boundaries or edges. Then the top of the slide pull 20 gm of weight with the help of thread or string attached to the one end of hook. The time (in seconds) required by the top slide to cover up a distance of 7.5 cm be noted. A shorter interval indicates better Spreadability.

Spreadability was calculated by using the formula,

**Spreadability =m*l/t**
**m = Weight tide to upper slide**
**l = length moved on the glass slide**
**t = time taken**

**Table no 16: Spreadability of Ointment**

| Sr. No | Formulation code | Spreadability (g.cm/sec) |
|---|---|---|
| 1 | F1 | 10 |
| 2 | F2 | 14 |
| 3 | F3 | 12 |

**7) Viscosity**

Viscosity of the formulation was determined by Brookfield DV-E Viscometer using spindle no 64.

**Table no.17 Viscosity of Ointment**

| Spindle No | RPM | Viscosity (cps) (N=3) | | |
|---|---|---|---|---|
| | | F1 | F2 | F3 |
| 64 | 10 | 54710±586.4 | 55096±422.53 | 54500±895.3 |
| | 20 | 28928±395.03 | 29860±215.48 | 29490±65.57 |
| | 50 | 11726±139.09 | 11796±32.15 | 11824±49.57 |
| | 60 | 9746±115.14 | 9882±21.16 | 9671±95.28 |
| | 100 | 5777±75.78 | 5982±17.89 | 5931±48.01 |

Viscosity of F3 formulation shown high viscosity as compared to F1 and F2 formulation.

**8) Extrudability study:** It is the force required to extrude material out of tube; detemining % of Extrution of Formulation.

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal


**Fig.No.10: Extrudability of formulation**

**Table No.18 Extrudability Ointment**

| Formulation | Net Weight of formulation in tube | Weight of formulation extruded | Extrudability amount% |
|---|---|---|---|
| F1 | 10 | 8.95 ± 0.14 | 89.5% |
| F2 | 10 | 8.25 ± 0.14 | 82.5% |
| F3 | 10 | 8.59 ±0.19 | 85.9% |

All formulations evaluated for Extrusion test in which F1 formulation has highest extrusion among so it indicates that F1 formulation has good extrudability.

**9) Antimicrobial test:**[49]

Loopfull of provided culture of Pseudomonas aeruginosa and staphylococcus aureus were inoculated in sterile nutrient broth and 5 ml incubated and adjusted to 0.5 by MC Ferlands standards at 37˚C for 24 hours. 0.1 ml of active culture of respective organisms was spreaded on sterile nutrient agar plates and well were cut with the help of borer. To these well labeled wells respective samples were added and also a blank of DMSO+ water was added to labeled well. These plates were kept in refrigerator for 30 min for diffusion, after 30 min plates were incubated at 37˚C for 24 hours. After incubation result were recorded as zone of clearance and well in mm.

**Fig no 13 Zone of inhibition of F1, F2 and F3**

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

**Table No.19 Antimicrobial activity of formulated ointment**

| Sr. no | Formulation | Concentration (mg) | Staphylococcus aureus | |
|---|---|---|---|---|
| | | | Zone of Inhibition | |
| 1 | F1 | 66.6 mg | 11 | |
| 2 | F2 | 33.3 mg | 07 | |
| 3 | F3 | 66.6 mg | 08 | |

**10) Stability testing**

Accelerated stability testing of best batch formulation was conducted at room temperature, $5^0$C for 60 days and after 60 days formulation was evaluated for following parameters.

**Table no 20: Stability test Evaluation of F1 (after 60 days)**

| Sr. No | Parameter | Temperature conditions | |
|---|---|---|---|
| | | $5^0$C | R.T |
| 1 | Colour | Green | Green |
| 2 | pH | 6.61±0.05 | 6.78 ±0.21 |
| 3 | Viscosity | 54710±586.4 | 55096 ±422.53 |
| 6 | Washability | Easily washable | Easily washable |
| 7 | Consistancy | Good | Good |
| 8 | Skin irritation | No irritation | No irritation |

Hence the formulation is stable after 60 days.

## CONCLUSION

Present study concluded that Azadirachta Indica and Bombax Ceiba powder was successfully obtained after extraction their percent yield was found as 10.15%, 1.38 % respectively. Dried powder extract of Azadirachta Indica and Bombax Ceiba is used for formulation of ointment. Obtained powder was preliminary evaluated for various test such as Phytochemical, Physicochemical properties, FTIR, DSC, XRD and UV spectroscopy etc. Successfully prepared ointments by Levigation method, using 1% Azadirachta Indica, 1% Bombax Ceiba and their combination (0.5% Azadiracta indica and 0.5% Bombax ceiba ).Formulations are evaluated for pH, Appearance, Spreadability, extrudability, antimicrobial test, skin irritation test for 12 hrs etc. percentage of extruction of F1 was found 89.5 % which was highest as compare to F2 and F3 formulations, it may be due to less viscosity of Azadirachta Indica powder as compare to Bombax Ceiba powder. pH of all formulations within the range of 6.3 to 6.6 so formulations are compatible with skin pH no skin irritations observed. The order of antimicrobial activity observed among the formulation as follows F1 > F2 > F3. F1 was selected as best batch formulation as it shows highest Zone of Inhibition among the F2 and F3 formulation. Stability test proves that formulations are stable after 60 days F1 formulations shows approximately similar results as that of previous, it proves that F1 formulation was stable.

## REFERENCES

1. *Sawant S.E, Tajane. M.D. Formulation and Evaluation of herbal ointment containing Neem and Turmeric extract. Journal of scientific and Innovative Reseach.2016; 5(4):149-151.*
2. *H.P.Rajashree, George J, Sebastain. G, Gowda D.V. Formulation and Phytochemical screening and physico-chemical evaluation of an antiseptic ointment containing Azadirachta Indica and chromolena odorata. Internationational journal off Pharmacy and Biological Sciences.2015; 5(4):114-118.*
3. *Himaja et al. Formulation and Evaluation of Herbal cream from Azadirachta Indica Ethanolic Extract. International Journal of Research in Drug and Pharmaceutical science.2017; 1(1):23-27.*
4. *Mishra A, Panola R, Vyas B, Marothia D, Kansara H. International Journal of Pharmaceutical Erudition Review Article; Topical antibiotics and Semisolid Dosage Forms.2014; 4(3): 33-54.*
5. *Dev.A, Chodankar, Shelke.O. Emulgels: a novel topical drug delivery system Review Article: Pharmaceutical and Biological Evaluations. 2015; 2 (4): 64-75.*
6. *Prabhjotkaur et al. Topical Formulations and Hydro-Gel. International Journal of Advances in Pharmacy, Biology and Chemistry.2013; 2(1): 201-206.*
7. *Shelke Usha et al. Review on: an Ointment .International Journal of Pharmacy and Pharmaceutical Research.2015; 4 (2): 170-192.*

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

8. *Pandey A, Jagtap .V, Kuchekar.B.S. Formulation And Evaluation of Antibacterial and Antifungal Activity Herbal ointment Containing Azadirachta Indica and Curcuma Longa. Journal Of chemical and pharmaceutical Research.2010: 2(3):182-182.*
9. *Gadien.A.B, Abdel.K.M, Elamin.E.S. Antimicrobial and Wound Healing Activity of Neem Fruit Extract, Ointment and Gel Formulation. International Journal of Innovative Pharmaceutical Sciences and Research.2015; 3(8):950-960.*
10. *Charde.Y.M, Sharma.P.H. Choudhary, Avari.J.G.Development and Evaluation of herbal Formulation for the Treatment of Acne. International Journal of Pharmaceutical Science and Research.2014; 5(6):2250-2260.*
11. *Wadher.K.J, Lakhotia.C.L, Umekar.M.J. Formulation And Evalution of Azadirachta Indica Leaves Extract on skin Renewal rate. International Journal of Chem. Tech Research.2009; 1(1):88-95.*
12. *Raut.P.N, Nayak.S.V, Gotmare.S.R. Research Article on Bombax ceiba. International Journal of Advanced Research.2017; 5(2):1211-1214.*
13. *Vandana.M,Chaudhary.AK.Shalmali(BombaxCeiba):VersatilityTherapeutics.Internationl Journal on Green Pharmacy.2017;11(3):401-406.*
14. *Donipati.R.Subhasini.P. Determining the antioxidant Activity of Bombax Ceiba Flower Extracts. International Journal for Pharmaceutical Research Scholors.2016; 5(1):146-150.*
15. *Bhargava.S, Shah.M.B. Evaluation of Hypoglycemic activity of different Extracts of Bombax ceiba L.leaves.Research.J.Pharm.and.Tech.2016; 9(3):361-364.*
16. *Verma.R.Devre.K, Gangrade.T, Gore. S, Gour.S.A. Phamarcognostic &Pharmacological overview on Bombax Ceiba. Scholars Academic Journal of Pharmacy.2014; 3(2):100-107.*
17. *Soni.H, Mishra.K, Sharma.N, Singhai.A.K.Chracterization of Azadirachtin from Ethanolic Extract of leaves of Azadirachta Indica. Journal of Pharmacy Research.2012; 5(1):199-201.*
18. *Maragathavalli.S, Brindha.S, Kaviyashri.N.S, Gangwar.S.K. Antimicrobial Activity in Leaf Extract of Azadirachta Indica Linn.2012; 3(1):110-113.*
19. *Karole S.Dr.Greindra.G, Dr.Gupta.S.Pharmacognistic and Pharmacological Profile of Bombax Ceiba. Asian Journal of pharmaceutical Education and Research.2017; 6(3):16-27.*
20. *Digge.V.G.Kuthar.S.S,Hogade.M,Poul.B.N,Jadge.D.R.Screening of Antibacterial Activity of Aqueous Bark Extract of Bombax Ceiba Against some Gram Positive And Gram Negative Bacteria. American Journal of Phytomedicine and clinical Therapeutics. 2015;3(7):551-555.*
21. *Srivastava.A, Gowda.D.V.Topical Gel: A Recent Approach for Novel Drug Delivery. International Journal of Health science and Research.2015; 5(10):302-312.*
22. *Garg. N, Meena.A, Nain.J. Evaluation of Physicochemical and Preliminary Phytochemical Studies on the Root of Bombax Ceiba Linn. International Journal of Research in Ayurveda and Pharmacy.2011; 2(3):924-926.*
23. *Chaudhary.P.H, Khadabadi.S.S.Bomabax Ceiba Linn: Pharmacognosy, Ethobotony and Phyto-Pharmacology. Review Article.2012; 2(3):2-8.*
24. *Donipatti.R, Dr.M.V, Rama, Dr.Subhasini.P.Antimicrobial Activity of Flower Extracts of Bombax Ceiba On Coli Forms. World Journal of Pharmaceutical Research.2015; 4(3):1466-1470.*
25. *Rowe.C.R, Paul. S, Marian.E.Q. Handbook of pharmaceutical Excipients. Sixth Edition, London. Phamaceutical Press.2009; 4(7): 1-17.*
26. *Doshi.M, Chauhan.N, Banerjee.J.Formulation and Evaluation of Polyherbal Antiacne Cream.World Journal of Pharmacy and pharmaceuitical Sciences.2017;6(12):1318-1336.*
27. *Nalla .A, Chinnala.K.M. Formulation and Evaluation of Herbal Ointment for Antimicrobial Activity. World Journal of Pharmaceutical and Medical Research.2017; 3(7):113-117.*
28. *Panwar S., Mukhopadhyay S, Kothiyal P. Emulgel: A Novel Approach for Topical Drug Delivery System. International Journal of pharmaceutical Research and bioscience.2015; Volume 4(4): 209-223.*
29. *Sharma, Pawar.s, Jain.U.Development and evaluation of topical gel of curcumin from different combination of polymers and formulation and evaluation herbal gel. International Journal of pharmacy and pharmaceutical science.2012; 4(4):452-456.*
30. *Yadav.S, Mishra M., Tiwari A, Shukla S. Emulgel: A New Approach for Enhanced Topical Drug Delivery. International Journal of current Phamaceutical research. 2017; 9(1): 15-19.*
31. *Chauhan E. S, Singh.A and Tiwari. A. Comparative studies on nutritional analysis and Phytochemical screening of Bombax ceiba bark and seeds powder Journal of Medicinal Plants Studies. 2017; 5(2): 129-132.*
32. *Pal A., Soni. M, Patidar K. Formulation and Evaluation of Poly Herbal Cream International Journal of Pharmaceutical & Biological Archives 2014; 5(4): 67 – 71.*
33. *Shrivastava D.K. and Swarnkar K. Antifungal Activity of leaf extract of Neem (Azadirachta Indica Linn) Int.J.Curr.Microbiol.App.Sci 2014; 3(5): 305-308.*
34. *Yadav H.K.., Dr. Venkata Y. Evaluation of Topical Anti-Inflammatory Effect of Azadirachta indica Leaf Extract International Research Journal of Pharmaceutical and Applied sciences 2012; 2(5): 60-64.*
35. *Maithani.A, Parcha.V, Pant G, Dhulia. I. Azadirachta Indica (Neem) Leaf: A Review.Journal of Pharmacy Research.2011, 4(6), 1824-1827.*
36. *Cheenickal M., Dr. Margar.R. R. Phytochemical Screening and the Antimicrobial Activity of the Leaves of Azadirachta Indica, A. Juss. International Journal of Scientific & Engineering Research Volume 8, Issue 5, May-2017.721-724.*

SJIF Impact Factor 2022: 8.197| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 8 | Issue: 1 | January 2023 - Peer Reviewed Journal

37. *Panchal, Bajaj. H, Maheshwar. S Azadirachta Indica (NEEM): Antibacterial Effects Against Escherichia Coli And Salmonella Journal Of Pharmacy And Research.2013; 1(1):18-21.*
38. *Mishra.K, Panola. R, Vya.B, Marothia B, Honey Kansara Topical antibiotics and Semisolid Dosage Forms. International Journal of Pharmaceutical Erudition.2014; 4(3): 33-54.*
39. *Kokate.C.K,Purohit.A.P,Gokhle.S.B.Phamacongnosy,53rdEdition.Niraliprakashan.2017;19.1-19.3.*
40. *Mohammad Asif et.al. A Review on Spermicidal Activities of Azadirachta indica Journal of Pharmacognosy and Phytochemistry.2013; 1(5): 61-78.*
41. *Dr. Vadwala.Y Dr. Kola.N. Natural dyes extracted from bark of Bombax ceiba Linn locally known as semal and its application on various fabrics pretreated with eco-friendly and noneco-friendly mordant. International Journal of Trend in Scientific Research and Development, 2012; 1(3):37-43.*
42. *Patel.k.k, Mehta.N.J, Dhandhalia.M.C, Bhanupriy.A.K.Development and Evaluation of Herbal Anti-Acne Formulation. Research Journal of Pharmaceuitical, Biological and chemical Sciences.2012; 3(3): 334-339.*
43. *Gwana A.M , Bala.HM, Ogonna U.S, Yawuri B.B, Okoli C.M.Phytochemical Analysis and Antimicrobial Activity of Methanolic, Ethanolic and Acetonic Extracts of Stem Bark and Leaf of Neem Plant (Azadirachta indica). Journal of Diseases and Medicinal Plants.2016; 2(3): 14-25.*
44. *Rathod G.P, Kotecha.B.V, Sharma.R Amin.H. In vitro Antibacterial study of two commonly used medicinal plants in Ayurveda: Neem (Azadirachta indica L.) and Tulsi (Ocimum sanctum L.).International Journal of Pharmaceutical & Biological Archives. 2012; 3(3):582-586.*
45. *Paudel.P.N, Gyawali.R Phytochemical Screening and Antimicrobial Activities of Some Selected Medicinal Plants of Nepal. International Journal of Pharmaceutical & Biological Archives. 2014; 5(3): 84 – 92.*
46. *Dr. Pawar A, Dr. Gaud.R.S. Modern Dispencing Pharmacy. Carrier Publication.2013; 257-258.*
47. *Khandelwal.K.R.Practical Pharmacognosy.Techniquue and Experiments.Nirali Publication.19 th Edition.2008; 23-26.*
48. *Dr.Kurhekar J.V. Neem – An Invaluable Bioresource. International Journal of Pharma and Bio Sciences.2013; 4(4): 606 – 612.*
49. *Jahangieian H, et.al. 'Well diffusion method for evaluation of antibacterial activity of copper phenyl fatty hydroxylate synthesized from canola and palm kernel oils'. Digest Journal of nanomaterial and biosurfactant.2013; 8(3): 1263-1270.*
50. *Atikya F, Zerin.N, Md. Shahidul K. Antimicrobial activity of medicinal plant leaf extracts against pathogenic bacteria. Asian Pacific Journal of Tropical Disease.2014; 4(2): 920-923.*
51. *Kadhim Hashim Yaseen.Antibacterial activity of different part of Neem (Azadirachta indica) growing in Sharjah, United Arab Emirates.Iraqi Journal of Science.2016; 57(4):2617-2626.*
52. *Rasool.M, Malik.A, Arooj.M, Alam.M, Qamre A, Marium A. Evaluation of antimicrobial activity of ethanolic extracts of Azadirachta indica and Psidium guajava against clinically important bacteria at varying pH and temperature. Biomedical Research 2017; 28 (1): 1-6.*
53. *Hamid A. K., Shafiyah S., Shariq B., Jiyauddin K., M. Kaleemulla Photoprotective Activity Ethanolic Extracts And Cream Formulation Of Camellia Sinensis And Azadirachta Indica.World Journal of Pharmaceutical Research.201;4(5): 422-435.*
54. *Mendhekar.S.Y, Thorat P.B, Bodke.N.N, Jadhav S. L. and Gaikwad D. D. Formulation and Evaluation of Gel Containing Neem, Turmeric, Aloe Vera, Green Tea And Lemon Extract With Activated Charcoal And Honey. European Journal of Pharmaceutical and Medical Research.2017; 4(12): 439-443.*
55. *Dr.Nagarajappa.S, Dr. Bathija.P, Dr.Mishra.P, Antibacterial and Antifungal Activity of Neem and Clove Extract against S. Mutans and C. Albicans-An Invitro Study. World Journal of Pharmaceutical Research.2018; 7(5):1484-1493.*
56. *Itelima JU, Nwokedi VC, Ogbonna AI, Nyam M. Phytochemical screening and antimicrobial activity evaluation of aqueous and ethanolic extracts of the leaf of Azadirachta indica Juss (neem) on some microorganisms. World Journal of Microbiology.2016; 3(1):056-060.*
57. *Patel.NR, Momin HU, Dhumal RL, Mohite K L. Prepartion and Evaluation of Multipurpose Herbal Cream. Advanced Journal of Pharmacy and Life Science Research.2017; 5(1):27-32.*
58. *Bhardwaj.U, Sharma.N and Mathur.A.Evaluation of potent hydro-alcoholic extract of leaves of Azadirachta Indica for isolation and identification of anti-helminthic compound. International Journal of Medical Research & Health Sciences, 2016, 5, 5:88-95.*
59. *Prashar.P, Pruthi.H and Ahmer Akhlaq. In vitro antibacterial activity of Azadirachta indica against pathogenic bacteria. Journal of Pharmacy Research. 2012: 5(1):363-364.*
60. *Jain D, Jayaram D, Venkatraya PM, Bhat GK .Antibacterial effect of neem (Azadirachta indica) oil on multidrug resistant bacteria isolated from human infections. International Journal of Biological & Medical Research 2013; 4(4):3544-3546.*
61. *Parmar RB, Baria AH, Faldu SD, Dr. Tank.HM, Parekh DH. Design and Evaluation of Poly-herbal Formulation in Semisolid Dosage Form for its Antibacterial Activity.2009; 2(6):1095-1097.*