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# FORMULATION AND EVALUATION OF LIPOSOME LOADED ANTI-TUBERCULAR TRANSDERMAL PATCH OF *CLERODENDRUM INFORTUNATUM (L.)*

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## ABSTRACT

Cutaneous tuberculosis (CTB) is a difficult skin infection that requires targeted and long-lasting drug delivery to improve treatment results. *Clerodendrum infortunatum* (Lamiaceae) has shown strong antitubercular and anti-inflammatory properties due to its flavonoids, alkaloids, and terpenoids. In this study, we extracted the plant leaves using Soxhlet extraction with petroleum ether at 60–80 °C to create a defatted, lipophilic extract rich in antitubercular compounds. We added the petroleum ether extract to liposomes made by the solvent evaporation method using soya lecithin and cholesterol to enhance skin absorption and reduce overall toxicity. We characterized the liposomal dispersion by measuring particle size, zeta potential, and using scanning electron microscopy (SEM). We then loaded the optimized liposomal formulation into a polymeric transdermal patch made from a hydrophilic polymer matrix such as HPMC, ensuring steady delivery at the infection site. We evaluated the physical and mechanical properties of the patch, including thickness, appearance, spreadability, pH test, and absorbency

**KEYWORDS:** *Clerodendrum infortunatum*, petroleum ether extract, Soxhlet extraction, liposomes, transdermal patch, cutaneous tuberculosis.

## INTRODUCTION

Cutaneous tuberculosis (CTB), a rare but significant form of extrapulmonary tuberculosis affecting the skin, requires prolonged systemic therapy with resultant systemic toxicity and poor patient compliance. Transdermal drug delivery systems hold promise in the localized and sustained delivery of antitubercular drugs at the infection site, maximizing the therapeutic concentration with minimal systemic toxicity. *Clerodendrum infortunatum* is a medicinal plant with antimicrobial, anti-inflammatory, and antitubercular activity primarily because of flavonoids and terpenoids. Soxhlet extraction with petroleum ether is an efficient method to extract the biofraction, which is most suitable to be incorporated in lipid-based carriers like liposomes. The incorporation of drugs in liposomes acts as a carrier, which improves the penetration of the drug into the stratum corneum, prolongs the residence time, and protects labile phytochemicals from degradation. The study aims to formulate and evaluate a liposome-loaded antitubercular transdermal patch containing *C. infortunatum* petroleum ether extract, which is extracted by Soxhlet extraction, to treat cutaneous tuberculosis with optimized drug release,

## MATERIALS AND METHODS

### 2.1 Plant material and extraction

Fresh leaves of *Clerodendrum infortunatum* were collected, shade-dried, and coarsely powdered. 30g of coarsely powdered leaves was loaded into a Soxhlet apparatus and extracted with petroleum ether (60–80 °C) for 8–10 hours to obtain a petroleum ether extract (PE extract), which was concentrated under reduced pressure and stored for further use.

**2.2 preparation of liposomes**

- Soya lecithin (300mg) and cholesterol(100mg) were dissolved in the chloroform-ethanol (1:1) and 100 mg extract was added to the solution
- Then the mixture was evaporated in a magnetic stirrer when the thin film was formed in the round bottom flask; it was hydrated with phosphorus buffer(10ml) (PH:7.4)
- The suspension was agitated for 30 minutes in a mechanical stirrer and then sonicated for 10-60 minutes.

| S l no. | INGREDIENTS | QUANTITY |
|---|---|---|
| 1 | Soya lecithin | 300mg |
| 2 | Cholesterol | 100mg |
| 3 | Extract (pet ether) | 100mg |
| 4 | Chloroform and ethanol | 10ml |
| 5 | PBS (7.4) | 10ml |


**Fig. 1: Magnetic Stirrer.**

**2.3 Evaluation of liposomes**

- Particle size
- ZETA potential
- Scanning Electron Microscopy

**Particle Size**

Particle size of liposomes was determined using a particle size analyzer.

**Zeta Potential**

Zeta potential measure the surface charge of liposome influencing the stability interaction in biological environment for liposomes typical value ranges from -30 mv to +30 mv zeta potential value beyond ± 30mv general indicate stable liposomes the zeta potential of the optimized liposomes was measured using zeta sizer.

**SEM (Scanning Electron Microscopy)**

SEM (Scanning Electron Microscopy) was done to determine liposomes surface morphology and shape. it was subjected for scanning electron microscopy and photographed.

**2.4 Formulation of Transdermal patch**

| SI.NO | INGREDIENTS | QUANITY | ROLE |
|---|---|---|---|
| 1 | Liposomes | 50 mg | Active pharmaceutical ingredient |
| 2 | Chloroform | 6ml | Dissolution of polymer |
| 3 | Ethylcellulose | 50mg | Patch forming polymer |
| 4 | HPMC | 450mg | Film former |
| 5 | Ethanol | 6ml | Solvent |
| 6 | Glycerin | 0.001ml | Improves elasticity |
| 7 | PEG400 | 0.3ml | Plasticizer |
| 8 | Menthol | 15mg | Permeation enhancer |

**2.5 Formulation of transdermal patch using liposomes**

**Preparation of liposome transdermal patch base:** HPMC was dissolved in ethanol and chloroform in the ratio 1:1 using magnetic stirrer. Then menthol and ethyl acetate were added to HPMC solution and homogenized using a magnetic stirrer. Then PEG 400 was added to the mixture. 10 mg of liposome were added to the solution and glycerin is added and the mixture was homogenized using magnetic stirrer for 15 min until the dope solution formed10 ml resulted solution was then poured into a plate and oven-dried at 30 °C for 24 hrs.

**Incorporation of liposomes complex into transdermal patch**: Prepare liposomes using solvent evaporation Reduce particle size by sonication. Store the dispersion at 4°C until use. Pour the mixture into a petri plate. Allow solvent evaporation. Cut into desired size.

### 2.6 Evaluation of transdermal patch

**Physical Appearance**

The prepared patch was evaluated for appearance colour, odour by visual observation.

**PH**

The ph evaluation of a transdermal patch is performed to ensure skin compatibility and formulation stability by measuring the surface ph of the patch material. A small patch sample (1 cm) is placed in contact with a few drops of distilled water 1-2 hours at room temperature. The Ph of the equilibrated solution is measured using calibrated Ph meter.

**Moisture content**

The percentage of moisture content of the patches was evaluated by cutting the patches into uniform pieces (1cm) and accurately weigh them as initial weight. place the patches in a desiccator at a defined relative humidity for 24 hours. Remove the patches, immediately reweigh them as final weight and calculate moisture uptake.

Moisture uptake (%) = (initial weight –final weight) / initial weight ×100

## 3. RESULTS AND DISCUSSION

The liposome was prepared by using magnetic stirrer

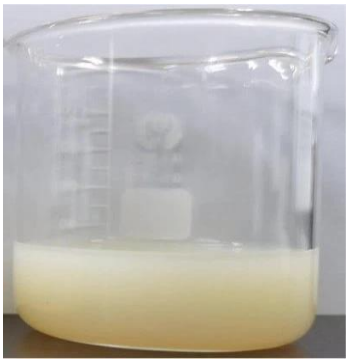
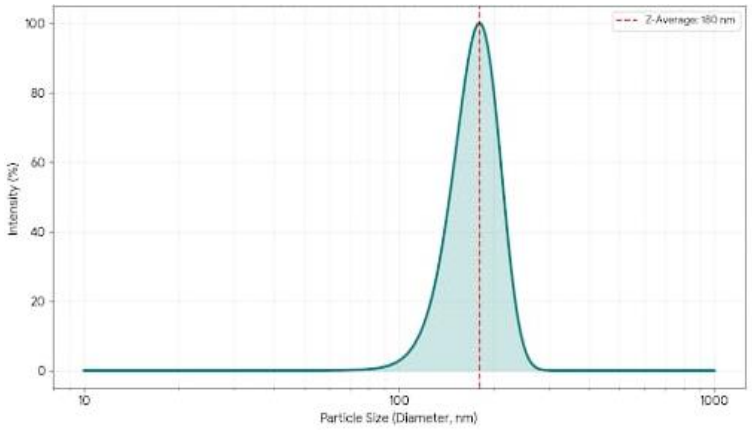


**Fig. 2: Liposomes obtained.**

**Evaluation of liposomes**

**Particle Size**

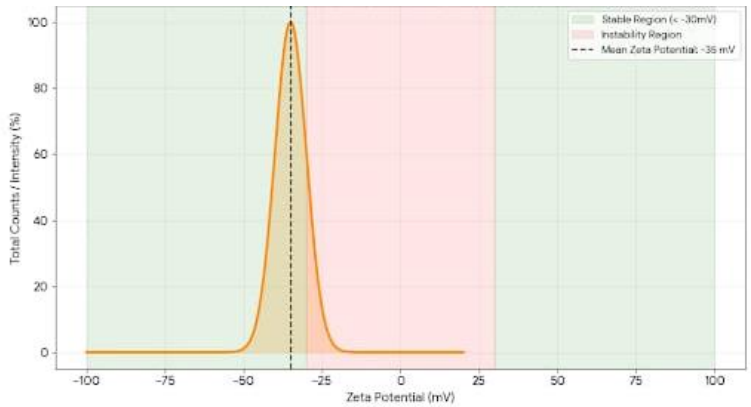



**Graph 1: Particle size of liposome.**

The above graph shows the particle size of the liposome.

Particle size = 180nm

**ZETA Potential**




**Graph 2: Zeta potential graph of liposome.**

Zeta potential of the liposomes was found to be -30.0 mV, which indicates highly stable negatively charged vesicles.

**SEM (Scanning Electron Microscopy)**

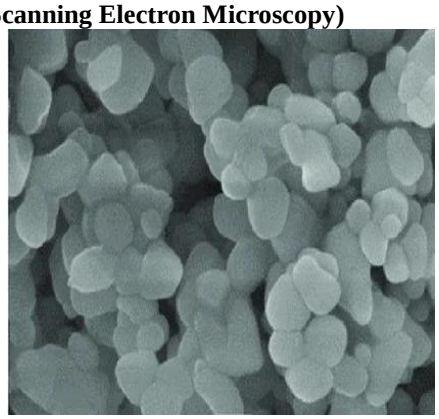


**Fig. 3: SEM image of liposome.**

The SEM image shows the surface morphology of liposomes indicates their spherical shape.

**Formulation of transdermal patch**

Formulation of transdermal patch was done by solid dispersion method.

**Evaluation parameters**

- Organoleptic evaluation
- PH Evaluation
- Percentage of Moisture Content

**Organoleptic evaluation of transdermal patch**

| Sl.no | Characteristics | Observation |
|---|---|---|
| 1 | Color | Light green |
| 2 | odor | Menthol |
| 3 | Surface | Smooth |
| 4 | Appearance | Transparent |

**Overall Evaluation of Liposomes Loaded Transdermal Patches**

PH =6.8

Moisture content =50%

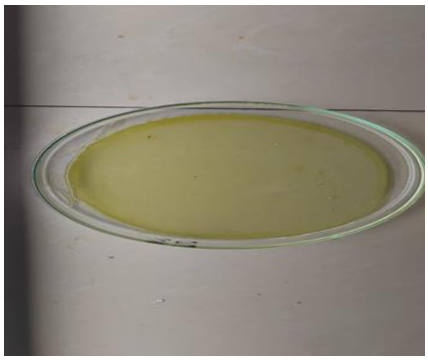


**Fig 4: Prepared patches.**

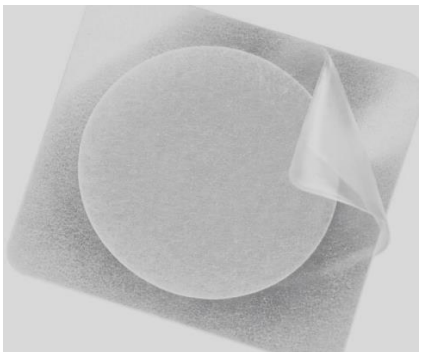


**Fig 5: liposome loaded transdermal patch.**

## 4. CONCLUSION

The current study shows that we can successfully create a quality control and standardization strategy for an anti-tuberculosis formulation using bioterpenoids from *Clerodendrum infortunatum.* Preliminary phytochemical screening confirmed that terpenoids are present, supporting the choice of this plant as a potential source of anti-tubercular bioactive compounds. Preparing liposomes as nano-delivery systems improved the solubility, protection, and bioavailability of the bioterpenoids, making them more effective for treatment. The transdermal patches achieved sustained drug release through the use of standardized nano-liposomal formulation which enhanced patient compliance while minimizing the common side effects of anti-tuberculosis medications. The transdermal patches demonstrated both adequate physicochemical characteristics and standardized drug distribution which confirmed the product's effectiveness.

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