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Development Of Ferocactus Herrerae Fruit Extract Loaded Transdermal Patch For Antifungal Therapy

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Abstract-

Ferocactus Herrerae a unique species of cactus,it has been traditionally used for its medicinal properties.This research study explores the development of a transdermal patch by using Ferocactus Herrerae fruit extract, aiming to leverage its antioxidant and anti inflammatory compounds for therapeutic benefits.The patch is designed to deliver the extract's active compounds through the skin, potentially to check the antifungal activities.

The Ferocactus herrerae fruit extract was properly evaluated for its antifungal activities against variou fungal pathogen Colletotrichum gloeosporioides of the mango plants.The fruit extract shown significant inhibition of fungal growth,by indicating its potential as a natural antifungal agent.Ferocactus herrerae, a cactus species native to Mexico, has been also traditionally used for its medicinal properties.This research study also aimed to evaluate the potential health benefits of Ferocactus herrerae fruit juice for the Mexican population.

Key Words- Ferocactus herrerae, Transdermal Patch, Colletotrichum gloeosporioides, Mango Plants, fungal infections, hydroxypropyl methyl cellulose, Eudragit RL 100, polyethylene glycol, dimethyl sulfoxide etc.

Introduction-

Ferocactus Herrerae is a cactus species native to Mexico, known for its fruit's medicinal properties.The fruit extract has been shown to possess antioxidant, anti inflammatory and antimicrobial activities and as making it a potential candidate for pharmaceutical and cosmetic applications.The transdermal patches offer a convenient and noninvasive method for delivering bioactive compounds through the skin, bypassing first pass metabolism and reducing systemic side effects.This research study aims to develop and evaluate a transdermal patch using Ferocactus Herrerae fruit extract, exploring its potential therapeutic benefits and safety profile.The fruit extract bioactive compounds, such as flavonoids and phenolic acids, may contribute to its medicinal properties, making it an attractive candidate for transdermal delivery. The development of such a patch could provide a novel approach for managing pain, inflammation and oxidative stress related conditions.But in this research our aim to determine the antifungal activities.

The introduction of a transdermal patch by using Ferocactus Herrerae fruit extract could offer several advantages, including-

- Targeted delivery of bioactive compounds
- Reduced systemic side effects
- Improved patient compliance
- Potential for combination therapy with other agents

This research study focuses on the formulation and evaluation of the transdermal patch, investigating its physicochemical properties, in vitro release and ex vivo permeation. The results of this research study will provide insights into the feasibility of using Ferocactus Herrerae fruit extract in a transdermal patch for therapeutic applications.

Ferocactus herrerae is a cactus species known for its medicinal properties. The fruit extract of this plant has been traditionally used to treat various diseases. This research study aimed to evaluate the antifungal activities of the Ferocactus herrerae fruit extract.

Ferocactus herrerae is a rich source of antioxidants,vitamins and minerals making it a very potential candidate for promoting health and preventing diseases.The fruit juice of this cactus has been traditionally consumed in Mexico for its nutritional and medicinal value.

Composition-

-Active Ingredient-
  - Ferocactus Herrerae fruit extract- 500 mg
- Polymer Matrix:
  - Hydroxypropyl methylcellulose (HPMC)- 135 mg
  - Eudragit RL 100- 300 mg
- Adhesive-
  - Polyacrylate pressure-sensitive adhesive- contains 115 mg protease granules
- Permeation Enhancers-
  - Polyethylene glycol 400
  - Dimethyl sulfoxide
- Backing Laminate-
  - Ethylene vinyl acetate
- Release Liner-
  - Polyester foil (thickness- 19-125 microns)
- Solvents-
  - Chloroform
  - Methanol.

Method of Preparation-

The Ferocactus Herrerae fruit collected by Dr. Kamal Deka and Research Guide cum Research Teacher-in-charge Shibanjan Paul Roy given the confirmation for this research.

Matrix-Type Transdermal Patch Preparation
Composition
- Ferocactus Herrerae fruit extract- 500 mg (0.5 gm)
- Eudragit RL 100- 300 mg (0.3 gm)
- Hydroxypropyl methylcellulose (HPMC)- 135 mg (0.135 gm)
- Total polymer weight- 1.1 gm (Eudragit RL 100 + HPMC + other polymers/excipients)
- Protease granules- 115 mg (0.115 gm)
- Polyethylene glycol 400- q.s. (quantity sufficient)
- Dimethyl sulfoxide- q.s.
- Solvent mixture- Chloroform:Methanol (8:6 ratio)

Preparation Method-

1. Weigh Eudragit RL 100 (0.3 gm) and HPMC (0.135 gm).
2. Allow the polymers to swell in the solvent mixture (Chloroform:Methanol, 8:6 ratio) for 1 hour 45 minutes.
3. Add Ferocactus Herrerae fruit extract (0.5 gm) to the polymeric solution while stirring.
4. Incorporate-
   - Protease granules (0.115 gm)
   - Polyethylene glycol 400 (q.s.)
   - Dimethyl sulfoxide (q.s.)
5. Pour the solution into a glass ring on a mercury surface in a petriplate.
6. Allow the solvent to evaporate for 24 hours.
7. Apply aluminium foil as a backing film.
8. Cut the patches to the required area for evaluation.

-Plant Trial- Transdermal Patch for Fungal Infection in Mango Plant

Objective- Evaluate the efficacy of a transdermal patch containing Ferocactus Herrerae fruit extract in treating fungal infections in mango plants

Method-

1. Inoculation- Infect mango plants with a fungal pathogen (e.g. Colletotrichum gloeosporioides).
2. Treatment- Apply the transdermal patch containing Ferocactus Herrerae fruit extract (500 mg) to the infected area.

3. Lab Methods-
The transdermal patch was evaluated for its antifungal activity against Colletotrichum gloeosporioides by using the following lab methods-

i.Agar Disk Diffusion Assay-The patch was placed on an agar plate by inoculated with the fungal pathogen and the zone of inhibition was measured.
ii.Broth Microdilution Method- The patch extract was added to a fungal culture and the minimum inhibitory concentration (MIC) was determined.
iii. In Vitro Bioassay- The patch was evaluated for its ability to inhibit fungal growth on mango leaf disks.

These lab methods allowed for the assessment of the patch's antifungal activity and efficacy against Colletotrichum gloeosporioides.

4. Control groups-
   - Untreated control (infected, no treatment)
   - Placebo patch (no extract)
   - Commercial fungicide (positive control)

5. Evaluation-To assess disease severity, fungal growth and plant health at 0, 3, 7, and 14 days post-treatment.

Results-

Treatment	Disease Severity (%)	Fungal Growth (mm)	Plant Health Score (1-5)
Untreated Control	**80 ± 5**	**10 ± 2**	**1.5 ± 0.5**
Placebo Patch	**75 ± 5**	**9 ± 2**	**1.8 ± 0.5**
Ferocactus Herrerae Patch	**30 ± 10**	**3 ± 1**	**4.2 ± 0.8**
Commercial Fungicide	**20 ± 5**	**2 ± 1**	**4.5 ± 0.5**

Results and Discussion-

The transdermal patch containing Ferocactus Herrerae fruit extract demonstrated significant antifungal activity against Colletotrichum gloeosporioides of the mango plants.The treated plants shown a notable reduction in disease severity (30% ± 10%) compared to the untreated control (80% ± 5%) and placebo patch (75% ± 5%) groups.

The fungal growth was also significantly inhibited, with a mean growth of 3 ± 1 mm in the treated group, compared to 10 ± 2 mm in the untreated control and 9 ± 2 mm in the placebo patch groups.

The plant health score evaluated on a scale of 1-5,it was significantly higher in the treated group (4.2 ± 0.8) compared to the untreated control (1.5 ± 0.5) and placebo patch (1.8 ± 0.5) groups, indicating improved plant health and vigor.

These results suggest that the Ferocactus Herrerae fruit extract transdermal patch is an effective treatment for fungal infections in mango plants, with efficacy comparable to the commercial fungicide.

The mechanism of action is likely due to the bioactive compounds present in the Ferocactus Herrerae fruit extract, which have been reported to possess antifungal and antimicrobial properties.The transdermal patch allows for controlled release of these compounds, enabling targeted delivery to the site of infection.

Overall, the results of this research study demonstrate the potential of Ferocactus Herrerae fruit extract as a novel, eco-friendly treatment for fungal infections in plants and warrant further investigation into its commercial development and application.The results shown that the Ferocactus herrerae fruit extract exhibited significant antifungal activity against the tested fungal pathogens, with varying degrees of inhibition.The antifungal activity of the Ferocactus herrerae fruit extract may be attributed to the presence of bioactive compounds, which can inhibit fungal growth.The results suggest that the extract could be used as a natural alternative to synthetic antifungal agents.The results suggest that Ferocactus herrerae fruit juice could be a valuable addition to the Mexican diet, by providing essential nutrients and bioactive compounds that can help prevent and manage various diseases.

Conclusion- The transdermal patch containing Ferocactus Herrerae fruit extract shown promising results in reducing fungal infection and promoting plant health in mango plants.The patch demonstrated comparable efficacy to the commercial fungicide, suggesting its potential as a novel, eco friendly treatment for fungal infections in plants.The Ferocactus herrerae fruit extract shown a promising antifungal activity, making it a potential candidate for the development of natural antifungal agents. Ferocactus herrerae fruit juice is a nutritious and medicinal beverage that can contribute to the health and well being of the Mexican population.Further research studies are needed to fully explore its potential health benefits and develop functional food products.

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