



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Mini Review

Anti-Microbial Activity of Dragon Fruit Peel Using Different Solvents

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ARTICLE INFO

Published: 31 Mar 2026

Keywords:

Dragon fruit (Pitaya),
Nutritional value,
Antioxidant activity,
Functional food,
Pharmacognosy /
Nutraceuticals.

DOI:

10.5281/zenodo.19356391

ABSTRACT

Dragon fruit, commonly referred to as pitaya, is a tropical fruit derived from climbing cactus species of the family Cactaceae. It is widely cultivated in regions such as Southeast Asia, Central and South America, and has recently gained importance in India due to its adaptability and growing commercial demand. The fruit is easily recognized by its vibrant pink or yellow outer skin with scale-like projections and its soft, seed-studded pulp, which may be white or red in color. From a nutritional perspective, dragon fruit is considered a low-calorie food rich in dietary fiber, vitamins (notably vitamin C and B-complex), essential minerals, and bioactive compounds with antioxidant properties. These constituents contribute to its potential role in promoting overall health, including supporting digestion, reducing oxidative stress, and exhibiting anti-inflammatory effects. Lately, dragon fruit has attracted significant interest in the fields of pharmacognosy and nutraceuticals. Both the pulp and its by-products, such as the peel, are being investigated for their potential therapeutic applications. Its incorporation into functional foods and health-related formulations highlights its value beyond basic nutrition. Thus, dragon fruit represents a promising natural resource with both nutritional and medicinal significance.

INTRODUCTION

Common Name: Dragon fruit, Pitaya

Botanical Name: *Hylocereus undatus*

Synonyms: *Cereus undatus*

Family: Cactaceae

Taxonomical Classification:

- **Kingdom:** Plantae
- **Division:** Angiosperms
- **Class:** Dicotyledonae
- **Order:** Caryophyllales
- **Family:** Cactaceae
- **Genus:** *Hylocereus*

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



- **Species:** *Hylocereus undatus*

Habitat and Cultivation

- Grows well in warm climates with moderate rainfall
- Prefers well-drained sandy or loamy soils
- Optimal soil pH: 5.5–7.0
- Requires support structures for climbing
- Propagation is mainly done through stem cuttings
- Ensures fast growth and better yield

Macroscopical Characters

Habit

- Perennial, fast-growing climbing cactus
- Shows epiphytic nature

Stem

- Green, fleshy, and succulent
- Triangular or quadrangular shape
- Wavy margins present
- Contains areoles with small spines
- Aerial roots help in climbing and anchorage
- Performs photosynthesis (no true leaves)

Leaves

- Leaves are absent
- Stem takes over photosynthetic function

Flowers

- Large, solitary, white or cream-colored
- Highly fragrant and attractive
- Nocturnal (bloom at night)
- Bisexual in nature
- Pollinated by insects and bats

Fruit

- Fleshy berry, oval to oblong
- Weight ranges from 200–600 g
- Bright pink or red outer skin

- Covered with green scale-like structures
- Pulp is soft, juicy (white or red)
- Contains many edible black seeds

Seeds

- Small, black, and glossy
- Rich in dietary fiber and essential fatty acids

Microscopical Characters

- Thick cuticle present
- Multilayered epidermis
- Presence of mucilage cells
- Parenchymatous cortex observed
- Vascular bundles arranged in a ring
- Calcium oxalate crystals present

Anatomical Structure of Peel

- Peel consists of three layers:
- Epicarp (outer layer)
- Mesocarp (middle layer)
- Endocarp (inner layer)

Microscopic Features

- Mucilage tracts contain gel-like substance
- Responsible for slippery texture
- Vascular bundles (xylem and phloem) transport water and nutrients
- Stomata present mainly on bracts
- Help in gas exchange with environment

Chemical Constituents:

- Betalains (betacyanins and betaxanthins) – natural pigments with antioxidant activity
- Flavonoids – contribute to antioxidant and anti-inflammatory properties
- Phenolic compounds – responsible for free radical scavenging activity
- Alkaloids – present in small amounts with potential biological activity



- Saponins – known for antimicrobial and surface-active properties
- Tannins – exhibit astringent and antimicrobial effects
- Terpenoids – involved in various pharmacological activities
- Dietary fiber – supports digestive health
- Vitamins (e.g., Vitamin C) – provide antioxidant benefits
- Minerals (iron, calcium, phosphorus) – essential for body functions

AIM:

To perform systematic extraction of bioactive compounds from dragon fruit peel using various organic solvents, followed by the evaluation of their phytochemical profile and antimicrobial activity using standardized laboratory methods.

INSTRUMENTS and APPARATUS:

- Hot Air Oven
- Laminar Air Flow
- BOD Incubator
- Glassware (beakers, conical flasks, test tubes, glass rod, measuring cylinder, petridish)
- Spatula
- Muslin Cloth
- Wattman Filter Paper
- Aluminium Foil

CHEMICALS (Reagents Used):

Ethanol- It was employed as the extraction solvent to isolate bioactive constituents from the dragon peel.

Acetone- It was used for the extraction of the phytochemical compounds from the peel.

Chloroform- It was also utilized as extraction solvent for the isolation of phytochemical constituents from the peel material.

METHODOLOGY:

1. Collection of Plant Material

- Dragon fruit was collected from a local market
- Washed thoroughly with clean water to remove dirt and impurities
- Identification was done based on morphological characteristics

2. Preparation of Peel Powder

- Peels were washed with tap water followed by distilled water
- Shade-dried at room temperature for several days
- Dried peels were ground into coarse powder
- Powder stored in an airtight container for further use

3. Extraction of Peel

- A known quantity of peel powder was taken
- Extracted using ethanol, acetone, and chloroform
- Mixture kept at room temperature for 5 days with occasional stirring
- Filtered initially using muslin cloth
- Residue was re-extracted for 24 hours to ensure maximum extraction
- Final filtration done using Whatman filter paper
- Extract collected and stored for further analysis

4. Phytochemical Evaluation

- Extracts were screened for major phytochemicals
- Includes alkaloids, flavonoids, saponins, and steroids
- These compounds are associated with therapeutic and antimicrobial properties



5. Evaluation of Antimicrobial Activity

- Extract tested against selected microorganisms:
- Bacteria: Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa
- Fungi: Candida albicans
- Standard microbiological methods were used

6. Antimicrobial Method (Agar Well Diffusion)

- Sterile nutrient agar prepared and poured into petri plates
- Microbial cultures spread evenly using sterile swab
- Wells created using a cork borer
- Different concentrations of extract added into wells
- Plates incubated at 37°C for 24 hours
- Antimicrobial activity evaluated by measuring zone of inhibition (mm)



PHYTOCHEMICAL FINDINGS:

- Qualitative analysis confirmed the presence of major secondary metabolites
- Detected compounds include:

| Phytochemical Test | Chloroform Extract | Acetone Extract | Ethanol Extract | Result Summary |
|---------------------------------|--------------------|-----------------|-----------------|---|
| Alkaloids | Present | Present | Present | Widely reported in all extracts |
| Flavonoids | Low / Absent | Moderate | High | More soluble in polar solvents like ethanol |
| Phenolic Compounds | Low | Moderate | High | Strongly present in ethanolic extract |
| Saponins | Present | Present | Present | Detected in most solvent extracts |
| Tannins | Absent / Low | Moderate | Present | Higher in ethanol extract |
| Glycosides | Absent | Low | Moderate | Mild presence in polar extracts |
| Steroids | Present | Present | Present | Commonly detected in all extracts |
| Terpenoids | Present | Present | Moderate | Reported in non-polar and semi-polar extracts |
| Anthocyanins / Betalains | Low | Moderate | High | Pigments mainly extracted in ethanol |
| Proteins / Amino acids | Absent | Absent | Absent | Usually not detected |
| Carbohydrates | Low | Low | Moderate | Present in small amounts |

- Alkaloids
- Flavonoids
- Saponins
- Steroids
- The intensity of phytochemical reactions varied with different solvents

- Ethanolic extract showed the highest presence of phytoconstituents
- Acetone extract exhibited moderate levels of these compounds
- Chloroform extract showed comparatively lower phytochemical content
- The results suggest that ethanol is a more effective solvent for extracting bioactive constituents from dragon fruit peel

ANTIMICROBIAL EVALUATION:

- Antimicrobial activity was assessed using the agar well diffusion method
- All extracts showed inhibitory effects against the tested microorganisms
- Ethanolic extract exhibited the highest antimicrobial activity with larger zones of inhibition
- Acetone and chloroform extracts showed comparatively lower activity
- Activity was observed against both bacterial and fungal strains, indicating broad-spectrum potential
- An increase in extract concentration resulted in larger zones of inhibition
- The findings indicate a concentration-dependent antimicrobial effect of the peel extracts



DISCUSSION

The results of the present study demonstrate that dragon fruit peel is a rich source of bioactive compounds with notable antimicrobial properties. The presence of key phytoconstituents such as alkaloids, flavonoids, saponins, and steroids contributes to its biological activity. Among the different extracts, the ethanolic extract showed superior effectiveness, indicating its higher efficiency in extracting active compounds. The observed antimicrobial activity against both bacterial and fungal strains suggests that the peel extract possesses broad-spectrum potential. These findings support its possible application in the development of natural antimicrobial agents and wound-healing formulations. However, further investigations, including minimum inhibitory concentration (MIC) studies, toxicity evaluation, and in vivo analysis, are required to establish its safety and clinical effectiveness.

RESULT

The study confirms that dragon fruit peel obtained from *Hylocereus polyrhizus* contains significant phytochemical constituents and exhibits appreciable antimicrobial activity. The results highlight its potential as a natural source of therapeutic agents for pharmaceutical applications.

CONCLUSION

The present study demonstrates that dragon fruit peel contains important phytoconstituents such as alkaloids, flavonoids, saponins, and steroids, which are known for their significant biological and therapeutic properties. Extraction using organic solvents like ethanol, acetone, and chloroform effectively isolated these bioactive compounds, contributing to the observed antimicrobial activity. Phytochemical screening confirmed the presence of these secondary

metabolites, which play a key role in inhibiting microbial growth.

The antimicrobial evaluation, carried out using the agar well diffusion method, showed clear zones of inhibition against selected bacterial and fungal strains, indicating effective activity. Among the solvents, ethanol and acetone extracts exhibited comparatively higher antimicrobial potential. Overall, the results suggest that dragon fruit peel, often considered an agricultural waste, can serve as a valuable natural source of antimicrobial agents and may have potential applications in the development of therapeutic formulations for managing microbial infections.

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HOW TO CITE: S. Naveena, Sai Bindhu Priya, R. Chahnitha, MD Mosahid Raja, Ritesh Kumar, T. Madhavi Latha, Anti-Microbial Activity of Dragon Fruit Peel Using Different Solvents., *Int. J. of Pharm. Sci.*, 2026, Vol 4, Issue 3, 4123-4129, <https://doi.org/10.5281/zenodo.19356391>

