

Dragon Fruit Extract-Based Hand Wash: An Effective Agent Against Bacterial Pathogens

Rutuja Pawar¹, Prof. Waghmare S. U², Pratiksha Tupe³, Ankita Sawant⁴
Rashtriya College of Pharmacy, Hatnoor, Kannad, Chhatrapati Sambhajnagar, India¹⁻⁴

Abstract: *Our hands are the main entry points for many illnesses into our bodies. Regular hand washing after a predetermined period of time is essential to eradicating such dangerous diseases. The dragon fruit, often called pitaya, is an exotic tropical plant that is gaining popularity all over the world because of its high nutritional content and bioactive components, which include strong natural antioxidants. An organic hand wash containing vital nutrients and bioactive substances is made from dragon peel extract. Dragon peel is a desirable component for hand hygiene products because it contains bioactive compounds like polyphenol and flavonoids that have antioxidant, maybe antibacterial, and moisturizing qualities. Because dragon fruit is high in vitamins, antioxidants, and phenolic compounds, its peel shows promise as a cosmetic ingredient. Because of its high vitamin, mineral, and amino acid content, aloe vera can improve skin hydration while also having a calming effect. A large number of products used as traditional herbs have a long history of usage in herbal therapy. The primary way that infections are spread to patients is through healthcare professionals' hands. As a result, more antiseptics are being used for hand cleaning.*

Keywords: Dragon Fruit, Antibacterial Activity, Hand Hygiene, Hand Wash

I. INTRODUCTION

Herbal-based cosmetic formulations have cosmetic properties. The gentle effect and poisonous nature of botanicals have led to a recent increase in their use in cosmetics. Both natural and phytochemicals are utilized in cosmetics. Oils, extracts, secretions, and other natural products are examples. Pure components derived from a variety of methods are included in phytochemical ingredients.¹ The hands are the primary way that germs and diseases are transferred. Thus, it is essential to practice proper hand hygiene in order to limit the spread of harmful germs and nosocomial infections. Many medicinal herbs have antibacterial qualities and are commonly used to treat skin disorders. However, because of the intricacy of their chemical composition, certain active chemical components are necessary for plants to have therapeutic qualities.² Handwashing is essential for preserving personal hygiene and stopping the spread of infection. The human body's first line of defense is the skin, which covers the inside and shields the body from infections. Therefore, hand washing is a crucial precaution to shield the skin from dangerous bacteria and stop the development of many infectious diseases. The main way that bacteria and illnesses are spread is through the hands.³ The dragon fruit is a member of the Cactaceae family and is native to Mexico, Central America, and South America.⁴ Hylocereus peel acetone extracts (70 percent concentration) exhibit strong antibacterial action, especially against *Salmonella typhi*.⁵ However, Rahmawati (2016) claims that the peel contains phenol, flavonoids, and betasianin.⁶ Using various assays, the fruit demonstrated antibacterial activity against harmful microorganisms.^{7,8} Dragon fruit skin also contains thiamine, niacin, pyridoxine, cobalamin, phenolic, carotene, phytoalbumin, vitamin C, vitamin E, vitamin A, terpenoids, and flavonoids. In addition to their potential antibacterial qualities, these compounds are thought to possess antioxidant qualities.⁹ According to reports, pitaya fruits are rich in fiber, protein, minerals, probiotics, phenolic content, and antioxidants.¹⁰ Synthetic soap-containing soaps, which are now widely available, are superior at preventing the transmission of diseases and germs in hospital settings, despite certain disadvantages. If used frequently, they may irritate the skin and increase its resistance to infections. In order to secure and speed up the process, enzymes may also be introduced. Furthermore, the companies that manufacture these artificial formulations release these hazardous substances into the environment, potentially impacting different ecosystems. The purpose of this study was to assess the antibacterial properties of pigments found in dragon fruit peels against harmful microbes.

Dragon Fruit Peel as Antibacterial Activity:

Antibacterial materials are substances that can either hinder or kill microorganisms. Antibacterial compound can be generated from both natural and synthetic chemicals. Even while synthetic chemicals like chlorhexidine are strong antiseptics, they can cause toxicological responses and negatively impact oral cavity tissues. Natural antibacterial compound can be found in plants such as red dragon fruit (*Hylocereus polyrhizus*).¹¹ Although the red dragon fruit itself contains phenols such as flavonoids and vitamin C, alkaloids, and antimicrobial betalain pigments that are members of the betacyanin family, the fruit's peel also contains these terpenoids and flavonoids. Flavonoids and other phenols are found naturally in plants and vegetables. Phenolic compounds can inactivate certain bacterial enzymes, harm proteins and the cytoplasmic membrane, and prevent bacteria from growing. Polyphenols have antiviral and antibacterial properties in addition to their health benefits. Tea polyphenols are also effective at actively preventing *Streptococcus mutans* from growing and reducing its development. Though it was less successful than the positive control group (chlorhexidine 0.2%), the pulp of the fruit extract concentrations of 100% had a stronger inhibitory power than the 50% concentrations. 100% concentrations of red dragon fruit peel extract are more capable of preventing the growth of *S. mutans* than are concentrations of 0%. In addition to antibacterial drugs, bacterial cell composition and structure play a significant part in these antibacterial mechanisms. The relatively simple sheath cell structure of *S. mutans*, a Gram-positive bacterium, is composed of two to three layers: cytoplasm, membranes, and a thick peptidoglycan layer. Gram-negative bacteria, on the other hand, have many-layered cell sheath structures. They are incredibly intricate, including peptidoglycan, lipoprotein, and lipopolysaccharide layers. Because the antimicrobial material is easily absorbed by cells and finds its target to function, this makes *S. mutans*, a Gram-positive bacterium, more vulnerable to the antimicrobial chemicals.¹²

Merits of Herbal Extract:

- Have Several Health Characteristic: Rich in natural qualities, herbal extracts have several positive effects on human health and aid in the treatment of various illnesses. These are essential to the pharmaceutical industry's production of many medications because of their health benefits.
- No Possible Side Effects: Since herbal extracts come from nature, they are safe for a variety of uses and don't contain any additives. These represent the lowest possible chance of any adverse consequence. Engaged in their use.
- Work Effectively Well: Herbal extracts are free of additives and safe for a range of applications because they are derived from nature. These are the smallest likelihood of any negative outcome. used them.

Hand Wash:

Hand wash: Is designed to cleanse and wash hands. Soft components can be used to make children's hand liquid soap. The skin-friendly soaps in solution form found in liquid hand washes are quite effective at getting rid of germs and microscopic organisms from our hands, but they are also very difficult to use. For hygienic purposes, these hand washes are specifically designed to be used on hands to gently clean them.

Qualities of Hand Wash

- Pleasing foam
- Ease of Rinsing
- Minimal skin irritation
- Thick or creamy feeling
- Pleasant fragrance

Washing hands prevents illnesses and the spread of infections to others:

Hand washing was removing germs from hands. This helps prevent infections because:

- Without even recognizing it, people regularly touch their mouth, nose, and eyes. Through the mouth, nose, and eyes can enter the body and cause illness.

- When people prepare or consume food and beverages, germs from unwashed hands may get into them. Under some circumstances, germs can grow in some foods or beverages and cause illness.



Fig no: 01

Advantage of Hand Wash:

- Stop infections and illnesses from spreading to other people.
- Clean and fresh skin is maintained by the aroma of herbal handwashing.
- It also aids in the efficient removal of oil and debris from the skin.
- It keeps people from getting illnesses, including influenza and diarrhea.
- It has no negative effects and aids in the treatment of fungal and skin infections.
- We can minimize the amount of bacteria on our hands.
- It also aids in the resolution of fungal and antimicrobial skin issues.
- It also aids in the efficient removal of oil and debris from the skin.
- The simplest method of getting rid of bacteria; easier to use than soap and water.
- Hand washing keeps bacteria out of the body.
- It has no negative effects and is simple to use.

Drug Profile :

1. Dragon Fruit :



Fig no: 02 Dragon Fruit

- **Synonym :** Pitaya, Pitahaya
- **Kingdom :** Plantae
- **Family :** Cactaceae
- **Origin :** Mexico
- **Genus :** Hylocereus
- **Division :** Spermatophyta
- **Class :** Dictyledonae

Geographical Distribution :

Pitaya is grown in tropical and subtropical regions.^{13,14} Vietnam has been growing and cultivating dragon fruit trees for over a century, but as time has gone on, farmers from Thailand, Australia, Israel, and the US have been interested in growing dragon fruit.^{15,16}

Chemical Constitute :

It was discovered that isorhamnetin glycoside, rutin, quercetin hexoside, kaempferol glucorhamnoside, isorhamnetin, and galloylglucoside were present in the peels of both red and white dragon fruits. It was discovered that the seeds of both red and white dragon fruits included only isorhamnetin glycoside and isorhamnetin, but also kaempferol glucorhamnoside, kaempferol glucoside, kaempferol 3-glucoside, gallic acid, and ellagic acid. The quality of bioactive compounds in fruits can vary depending on a number of factors, such as fruit species, fruit maturity stage, geographic location, growing and environmental conditions, and cultivation techniques. These factors can also affect the content of antioxidant phytochemicals.^{17,18}

Types of Dragon Fruit :

- White dragon Fruit (Hylocereus undatus)
- Red dragon Fruit (Hylocereus Polyrhizus)
- Yellow dragon Fruit (Selenicereus megalanthus)

Medicinal Uses :

- Lower blood pressure
- Support immune system
- Good for skin
- Cancer metabolism
- Cardiovascular Health

Properties of Dragon Fruit :

1. Antimicrobial Activity :

Research suggests that the dragon fruit's (pitaya) peel contains bioactive compounds with potential antibacterial properties. The bactericidal qualities of extracts from *H. undatus* peel were evaluated in ethanol, chloroform, and hexane. The results of the disc diffusion assay demonstrated that a 7–9 mm zone prevented the growth of both Gram-positive and Gram-negative bacteria bacilli.¹⁹

2. Antioxidant Activity :

The pulp and peel are abundant in polyphenols in addition to phytoalbumins.²⁰ The antioxidant (radical-scavenging) qualities of the phenolic compounds (flavonoids, phenolic acids, stilbenes, lignans, and tannins), alkaloids, and vitamin C that make up many plants may be the reason for their appeal in disease prevention.^{21,22,23,24,25}

3. Improve Skin Health :

Vitamin C is essential for the production of collagen, the protein that keeps your skin tight, and it also aids in the skin's natural healing process after cuts and other wounds.

4. Anti-inflammatory :

Dragon fruit's composition, which includes substances like squalene and betalains, gives it anti-inflammatory and antioxidant qualities. They discovered betalains, which have a high capacity to scavenge radicals.

2. Aloe Vera :



Fig no: 03 Aloe Vera

- **Kingdom :** Plantae
- **Class :** Liliopsida-Monocotyledons
- **Subclass :** Liliidae
- **Order :** Liliales
- **Family :** Aloaceae
- **Genus :** Aloe
- **Species :** A. vera

Geographical Distribution :

Although the AV plant is grown all over the world, its precise natural occurrence is still unknown. However, historical evidence indicates that it expanded through North Africa, Sudan, and neighboring nations after starting in the southern half of the Arabian Peninsula. Along with temperate and tropical areas of Australia, Barbados, Belize, Nigeria, Paraguay, and the United States, it can also be found in the Canary Islands. These days, AV is grown in China, India, Pakistan, the Middle East, Europe, North America, South America, and Australia. Some aloe species are exclusive to Madagascar or the islands of the Indian Ocean, but the majority are found in mainland Africa.^{26,27}

Chemical Constituent :

Anthraquinone glycosides are found in large quantities in all types of aloe. Barbaloin is a constituent of aloin, which is the main component of aloe and a combination of glucosides. Aloe-emodin anthrone C-10 glucoside is its chemical name, and it dissolves in water. As a C-glycoside, barbaloin cannot be hydrolyzed by heating it with weak acids or alkalis. Barbaloin is broken down by f-chloride through oxidative hydrolysis, producing glucose, aloemodin-anthrone, and little emodin. Aloes also contain isobarbaloin, B-barbaloin, aloe-emodin, and res in addition to barbaloin. Additionally, the medication contains choline, choline salicylate, mucopolysaccharides, glucosamin mexuronic acid, coniferyl alcohol, aloetic acid, homonataloin, aloesone, chrysophanic acid, chrysamic acid, galactouronic acid, saponins, and mucopolysaccharides.

There are several ways that aloe vera has been suggested for skin care:

- Provides relief from skin burns.
- Aloe vera can help you obtain smooth, radiant skin.
- It is an excellent moisturizer for the skin.
- Aids in bringing back the natural beauty of the skin. It gives the cells oxygen, which fortifies the skin's tissues and contributes to its continued health.
- When using the plant's oil extract to achieve normal, smooth, and shiny skin, it helps dry skin.
- Aloe vera extracts may aid in the treatment of mild skin diseases due to their antibacterial and antifungal properties.
- It can be used to treat psoriasis, burns, inflammation, blisters, bug bites, and any allergic responses.

Medicinal Uses :

- Skin Health
- Digestive Issues
- Cholesterol
- Diabetes
- Pain and inflammation
- Wound Healing
- Immunity

Properties of Aloe Vera :

- **Healing Properties:** Following topical and oral aloe vera, gibberellin, a growth factor receptor for the fibroblast, and glucomannan, a mannose-rich polysaccharide, increase collagen synthesis by stimulating the fibroblast's activity and proliferation.²⁸
- **Antiviral Activity:** Direct or indirect impacts could be the cause of these behaviors. Anthraquinones have a direct effect, while immune system stimulation has an indirect effect. Numerous enveloped viruses, including influenza, varicella zoster, and herpes simplex, are rendered inactive by the anthraquinone aloine. These actions may be the result of direct or indirect impacts. Immune system activation has an indirect effect, whereas anthraquinones have a direct one. The anthraquinone aloine renders several enveloped viruses inert, such as herpes simplex, influenza, and varicella zoster.²⁹
- **Moisturizing and anti-aging effect:** Moisture retention in the skin is facilitated by mucopolysaccharides. Aloe stimulates fibroblasts, which produce collagen and elastin fibers, making skin more elastic and less prone to wrinkles. Additionally, it has cohesive actions that soften the skin by gluing the epidermal cells that are peeling superficially together. While the amino acids soften resistant skin cells, zinc acts as an astringent to tighten pores. The moisturizing qualities of aloe vera gel gloves have also been studied in the treatment of dry skin caused by occupational contact; in this instance, erythema was decreased, fine wrinkles were less obvious, and the integrity of the skin was improved.³⁰

- **Effect on skin exposure to UV and gamma radiation:** It has been reported that aloe vera gel protects the skin from radiation damage.³¹
- **Anti-inflammation action:** Aloe vera inhibits the cyclooxygenase pathway and reduces the production of prostaglandin E2 from arachidonic acid. Recently, a novel anti-inflammatory compound called C-glucosyl chromone was isolated from gel.

Importance of hand Hygiene:

The most crucial, straightforward, and affordable way to lower the incidence of HAIs and the propagation of antibiotic resistance is to practice good hand hygiene.^{32-34, 35-38} MRSA rates have been reported to decrease in tandem with an increase in handwashing compliance.³⁹ Even in environments where infection rates among critically ill patients are high, the hand hygiene liaison group found nine controlled trials that demonstrated significant decreases in infection-related outcomes.^{40, 41, 42} According to the research, following hand cleanliness guidelines has considerably decreased the rates of pathogen acquisition on hands, which in turn has decreased hospital HAI rates.⁴³

II. MATERIAL

Ingredient	Action	Uses
Peel of dragon Fruit	Antibacterial Activity	A recent study of Zain et al. (2019). ⁴⁴ Additionally, the pitaya (H. polyrhizus) peel extract's antibacterial activity was examined, and it was found to have a minor antibacterial impact on both Gram-positive and Gram-negative bacteria, S. aureus and E. coli, respectively. The authors came to the conclusion that even though pitaya peel extract had a slight antibacterial impact, the results were in line with other research that thought it was still enough to support its usage as a natural colorant and antibacterial agent in food and cosmetic products. ⁴⁵
Aloe Vera	Healing Agent	Based on the calming and restorative qualities of aloe vera, a number of cosmetic products on the market promise to offer natural skin care. Additionally, these products address pigmentation, acne, psoriasis, eczema, and skin flaws. According to Surjushe et al. (2008), aloe vera is an excellent source of vitamins and antioxidants that support skin protection and nourishment. ⁴⁶
Sodium Lauryl Sulphate	Foaming Agent	An anionic surfactant called sodium lauryl sulfate is commonly utilized as an emulsifying cleaning ingredient in household cleaning solutions. ⁴⁷
MethylParaben	Preservative	Methylparaben serves as both an antifungal and food preservative.
Glycerine	Moisturizing agent	As a humectant, glycerine helps the skin retain moisture, increase hydration, lessen dryness, and undergo surface regeneration from the inside out. Additionally, glycerine is an emollient that softens skin and helps treat dry or rough areas caused by eczema or psoriasis acne. Furthermore, the potent antibacterial qualities of glycerine shield the skin from harmful infections. Additionally, glycerine can revitalize, mend, and speed up wound healing.
Rose Oil	Fragrance	It improves skin tone and complexion brightness. It also reduces blemishes, acne scars, and dark spots. Rose oil has antifungal and antibacterial properties. ⁴⁸
Distilled Water	Base Material	To make a handwash, all the ingredients are dissolved in distilled water, which serves as the basis material.

Extraction Methods of Dragon Peel:

- **Maceration Extraction :** The fresh peels were cleaned, cut into small pieces, combined, and then placed in the refrigerator. One kilogram of the peels was extracted using a 12-hour maceration method with 80% (v/v) methanol and 0.1 N HCl. The mixture was sonicated for 25 minutes and then filtered. Pigment extract was created once the extract was concentrated. The extract was separated using n-hexane, dichloromethane, and ethyl acetate to produce n-hexane, dichloromethane, ethyl acetate, and pigment extracts. The residue was also eliminated by a 24-hour methanol maceration procedure. The mixture was filtered and condensed to create methanol extract. Likewise, nhexane, dichloromethane, and ethyl acetate extracts were obtained from the methanol extract.
- **Reflux Extraction :** Slice it into little pieces after cleaning the peel. Fill the round-bottom flask with enough solvent to completely submerge the chopped peels. Attach the condenser on the flask and connect it to the cooling water supply. Heat the flask carefully on a hot plate. When you bring the solvent to a boil, the reflux process will start. Allow the mixture to reflux for one to two hours to ensure that it maintains a steady boil. Turn off the heat and let the mixture cool after it has refluxed.
- **Soxhlet Extraction :** Attach the Soxhlet extractor to the extraction flask with the chosen solvent after cleaning and drying the pieces of dragon fruit peel in the thimble. The solvent in the extraction flask is heated using a hot plate. A solvent vaporizes and rises into the condenser as it boils. As the vapor condenses in the condenser and drips back into the thimble, it will extract the chemical from the dragon fruit skins. Until the solvent in the flask reaches a specific level, this process takes one to two hours.

Evaluation Test of Hand Wash :

Physical parameter:

- **Appearance:** It was observed visually.
- **Color:** It was observed visually.
- **Odor:** It was observed manually.
- **Homogeneity:** It was observed visually.
- **Fragrance:** Its acceptability was determined by individual observation. A small number of people were asked if they thought the fragrance was acceptable, and their responses were recorded. Additionally, aroma was assessed using the standards listed below.

Chemical Parameter :

- **Foam Height :** A sample of hand wash gel weighing one gram was mixed with fifty milliliters of distilled water. The mixture was poured into a 500 ml measuring cylinder. Using water, the volume was increased to 100 ml. Twenty-five strokes were administered and set away. It was noted how high the foam was above the aqueous volume.
- **pH Determination :** A digital pH meter was used to measure the pH. 100 milliliters of distilled water were used to dissolve one gram of the prepared hand wash. A 40% NaOH solution was used to alter the pH of the hand wash.
- **Viscosity:** A digital Brookfield viscometer was used to measure the viscosity.
- **Foam Retention:** A 200 ml graduated cylinder was filled with 50 ml of the herbal hand wash, and it was shaken ten times. For four minutes, the volume of foam was measured at one-minute intervals.

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