



## FORMULATION AND EVALUATION OF BODY LOTION USING SENNA ALATA LEAF EXTRACT

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**Abstract** - Bacterial and fungal skin infections are some of the most prevalent dermatological conditions globally, especially in tropical and humid regions. Ringworm, candidiasis, dermatitis, and secondary bacterial infections not only impact the skin but also the quality of life of patients. Although synthetic antimicrobial agents are widely used in the treatment of these infections, their long-term use is often linked to side effects, skin irritation, and the development of microbial resistance. This has led to a growing interest in plant-based topical preparations that are safe, inexpensive, and effective. Senna alata, a medicinal plant used in the traditional management of fungal skin infections, has recently gained scientific attention owing to its high phytochemical content and established antimicrobial properties. The leaves of Senna alata are rich in a number of bioactive compounds such as anthraquinones, flavonoids, tannins, saponins, phenolic compounds, and sterols. These compounds are responsible for its antibacterial, antifungal, antioxidant, and anti-inflammatory properties. The use of the leaf extract in a body lotion formulation offers a convenient and patient-friendly approach to topical therapy. A properly formulated lotion ensures a uniform distribution of the extract, enhanced skin absorption, ease of application, and improved therapeutic compliance. The formulation process involves careful consideration of the extraction techniques, emulsifying agents, stabilizers, preservatives, and humectants to ensure product stability and efficacy. The formulated lotion is evaluated for physicochemical properties such as pH, viscosity, spreadability, homogeneity, and stability under various storage conditions. Antimicrobial activity is also determined using agar diffusion and minimum inhibitory concentration assays to confirm its efficacy against selected bacterial and fungal strains. Microbial limit tests and skin irritation studies are also important safety evaluations to ensure that the product is safe for human use. In conclusion, the development of a body lotion formulation containing Senna alata leaf extract offers a promising herbal approach to the management of bacterial and fungal skin infections. With proper standardization and quality control, such preparations may offer an effective natural alternative in dermatological and cosmeceutical practices

**Key Words:** Senna alata, Herbal body lotion, Antibacterial activity, Antifungal activity, Topical formulation

### 1. INTRODUCTION

Skin is the largest organ in the human body and acts as the main protective mechanism against environmental pollutants, allergens, and pathogenic microorganisms. However, the skin is often prone to infections by bacteria and fungi, especially in tropical and humid climates where the warm and moist environment favors the growth of microorganisms. Ringworm, candidiasis, impetigo, and dermatitis are some of the common infections that are widely prevalent and often cause discomfort, inflammation, itching, and complications if left untreated. The rising cases of antimicrobial resistance and adverse reactions to synthetic topical drugs have created an emergent need for alternative and safer therapies.

Herbal plants have long been used in traditional medicine for the treatment of skin conditions. Among these, Senna alata has received special attention for its remarkable reputation in traditional medicine for the treatment of fungal and inflammatory skin conditions. The leaves of this plant have been especially prized and used in the form of pastes and extracts for the treatment of ringworm and other skin conditions. Scientific studies have confirmed that the medicinal properties of Senna alata are largely due to its high phytochemical content, including anthraquinones, flavonoids, tannins, saponins, and phenolic compounds that possess antimicrobial, antioxidant, and anti-inflammatory properties.

The use of plant extracts in modern topical preparations improves their stability, acceptability, and efficacy. A body lotion is an ideal preparation for this purpose as it is easily spreadable, moisturizing, and allows for the uniform distribution of the active ingredients. The formulation of a lotion preparation containing Senna alata leaf extract requires special care to ensure compatibility, stability, safety, and efficacy. Thus, this article aims to provide the scientific rationale for the formulation and evaluation of a body lotion preparation using Senna alata leaf extract for the treatment of bacterial and fungal skin infections.

### 1.1 Taxonomy of *Senna alata*

- ✓ Medicinal Importance in Skin
- ✓ chemical composition
- ✓ Antioxidant and anti-inflammatory properties
- ✓ Antibacterial and Antifungal activity
- ✓ Components of Body lotion
- ✓ Preparation method
- ✓ Evaluation of Physicochemical properties of body lotion

#### Taxonomy

Rank	Classification
Kingdom	- Plantae
Subkingdom	- Tracheobionta (Vascular plants)
Superdivision	- Spermatophyta (Seed plants)
Division	- Magnoliophyta
Class	- Magnoliopsida (Dicotyledons)
Order	- Fabales
Family	- Fabaceae (Leguminosae)
Subfamily	- Caesalpinioideae
Genus	- <i>Senna</i>
Species	- <i>Senna alata</i> (L.) Roxb.

*Senna alata* (L.) Roxb., a species of the family Fabaceae, is a widely known medicinal shrub found in tropical and subtropical areas of the world. The plant is also known as candle bush or ringworm bush based on the distinctive shape of its bright yellow, candle-like flowers and its traditional use in the treatment of fungal infections of the skin. It is a fast-growing perennial shrub that grows up to a height of 1 to 4 meters, having a strong taproot system and erect, semi-woody stems. The leaves are large, paripinnate, and alternate, consisting of several pairs of oblong leaflets that have smooth margins. One of the most distinguishing characteristics of the plant is its erect terminal raceme with densely packed yellow flowers that eventually turn into flat, winged pods containing many hard seeds. Originally from South America, *S. alata* has been naturalized in India, Southeast Asia, Africa, and other tropical areas of the world, where it grows profusely in roadsides, gardens, and open fields under full sunlight.

The medicinal value of *Senna alata* can be attributed to its high phytochemical content. Several studies have shown the presence of anthraquinones, flavonoids, tannins, saponins, alkaloids, glycosides, and phenolic compounds in the leaves of the plant. Of these compounds, the anthraquinones chrysophanol, rhein, and aloe-emodin

have been identified as the main active ingredients of the plant. The plant has been used in traditional medicine to treat dermatological conditions such as ringworm, eczema, scabies, and fungal infections by crushing the leaves and applying them topically. The antifungal properties of the plant are thought to be mediated by the disruption of fungal cell membranes and the inhibition of vital metabolic pathways. In addition to its antifungal properties, the plant has been shown to possess antibacterial, anti-inflammatory, antioxidant, and mild laxative properties. Ethanol or methanol extracts of the plant have been shown to possess enhanced antimicrobial properties due to their ability to extract higher amounts of the active compounds. Pharmaceutically, *Senna alata* has been of interest for use in topical preparations such as creams, gels, ointments, and lotions for the treatment of skin infections. The plant has been standardized using thin layer chromatography and high-performance liquid chromatography for the identification and quantification of its active ingredients. Although the plant is considered safe for external use, excessive oral intake has been associated with gastrointestinal irritation due to the presence of anthraquinones. Further clinical studies are needed to establish the standardized dosage, safety, and efficacy of the plant for medicinal use. *Senna alata* is a promising medicinal plant that has immense potential for the development of modern herbal dermatological drugs.

#### MEDICINAL IMPORTANCE IN SKIN

The leaves of *Senna alata* have been traditionally used in various traditional medicine systems for their medicinal properties in treating various dermatological disorders. In the tropical parts of Asia, Africa, and South America, *Senna alata* is traditionally used in the treatment of fungal infections of the skin, hence its common name, "ringworm bush." The medicinal value of the leaf extract is primarily due to its high phytochemical content, including anthraquinones, flavonoids, tannins, and other phenolic compounds that possess antimicrobial, anti-inflammatory, and antioxidant properties. The most important dermatological use of *Senna alata* leaf extract is in the treatment of superficial fungal infections such as ringworm (dermatophytosis), athlete's foot, and pityriasis versicolor. Dermatophytes such as *Trichophyton*, *Microsporum*, and *Epidermophyton* infect keratinized tissues of the skin, hair, and nails. Leaf extracts of fresh or dried leaves have been shown to possess inhibitory properties against these pathogens in several in vitro studies. The antifungal properties of *Senna alata* leaf extracts have been attributed to the anthraquinone derivatives chrysophanol and rhein. These compounds have been shown to affect fungal cell membrane



integrity, ergosterol biosynthesis, and essential fungal cellular metabolism, ultimately causing growth inhibition or cell death. The use of crushed leaves directly on the infected skin areas in traditional medicine is a reflection of the knowledge of these antifungal properties.

## CHEMICAL COMPOSITION

### Alkaloids

Alkaloids are organic compounds that contain nitrogen and are found in medicinal plants. In *Senna alata*, the alkaloids are found in low to moderate amounts in the leaves. Alkaloids are usually basic in nature and display varied biological activities. Alkaloids have been shown to interact with microbial DNA and enzymes, hence inhibiting replication and protein synthesis. This property is attributed to their antimicrobial activity. Apart from antibacterial activity, some plant alkaloids have been shown to possess anti-inflammatory and analgesic properties by modulating biochemical mediators. Although alkaloids are not the main active compounds in *S. alata*, their presence increases the overall therapeutic activity of the leaf extract by synergistic effects with other phytochemicals.

### Tannins

Tannins are polyphenolic compounds of high molecular weight that are found in plant tissues. *Senna alata* leaves contain appreciable amounts of tannins, especially in aqueous and hydroalcoholic extracts. Tannins display strong astringent effects because of their ability to precipitate proteins. In antimicrobial activity, tannins interact with microbial cell wall proteins and enzymes, causing damage to the cell wall and inhibiting microbial metabolism. Tannins also inhibit tissue inflammation by forming a protective barrier over the damaged skin, hence accelerating the healing process. In dermatological use, tannins cause tissue contraction and reduction of exudation in infected skin lesions. Their antioxidant properties also confirm their role as protective agents against oxidative damage.

### Saponins

Saponins are glycosides that form soap-like foams when agitated in water. They are amphiphilic, with hydrophilic and lipophilic regions. In *Senna alata* leaves, saponins contribute largely to antimicrobial and antifungal properties. Their mechanism appears to involve binding to membrane sterols, increasing the permeability of microbial membranes until they

lyse. In fungi, saponins can alter membranes rich in ergosterol, leading to leakage of cellular contents. Saponins also have mild anti-inflammatory and immunomodulatory properties. In topical preparations, saponins can facilitate the diffusion of active compounds across the skin barrier.

### Flavonoids

Flavonoids are a prominent class of polyphenolic compounds with potent antioxidant and anti-inflammatory properties. *Senna alata* leaves contain flavonoid compounds such as quercetin and kaempferol. These compounds counteract reactive oxygen species by donating hydrogen atoms or electrons. In inflammation, flavonoids can inhibit enzymes like cyclooxygenase and lipoxygenase, which decrease the production of inflammatory mediators. Their antimicrobial properties may arise from their ability to bind to bacterial cell walls and external proteins to form complexes. Flavonoids also improve capillary wall strength and tissue repair, which helps in the healing of skin infections and wounds.

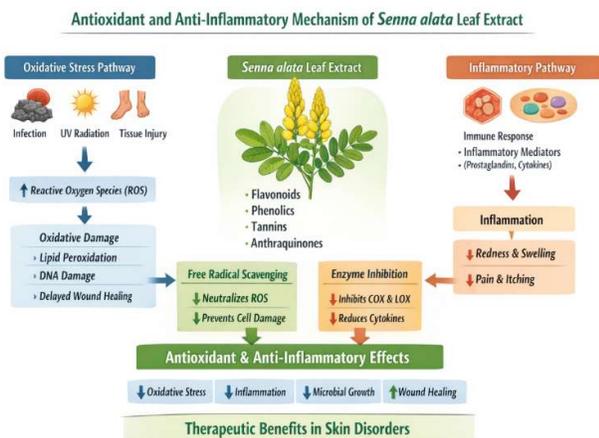
### Anthraquinones

Anthraquinones are the primary active compounds in *Senna alata*, consisting of chrysophanol, rhein, emodin, and aloemodin. They have an anthracene skeleton with quinone groups, which are responsible for their biological activity. In antimicrobial activity, anthraquinones inhibit microbial respiration and nucleic acid synthesis. In fungi, they alter membrane function and ergosterol biosynthesis, which inhibits growth. When used orally, anthraquinones exhibit a laxative effect, which stimulates intestinal motility. Topically, anthraquinones are primarily responsible for antifungal activity against dermatophytes.

### Steroids

Plant steroids, also known as phytosterols, are similar to cholesterol. In *Senna alata*, plant steroids are present in low amounts but still contribute to reducing inflammation and repairing cell membranes. Phytosterols can reduce inflammation by modulating the immune system and inhibiting the action of pro-inflammatory agents. They also contribute to protecting the skin barrier. Topically applied steroids can enhance skin conditioning and reduce irritation associated with infection.

## Antioxidant and Anti-inflammatory properties



## ANTIBACTERIAL AND ANTI FUNGAL ACTIVITY

Leaf extract of *Senna alata* has been recognized for its potent antibacterial and antifungal properties, which is a characteristic that forms the basis of its traditional medicine for treating infectious diseases. It has been demonstrated to possess broad-spectrum antibacterial properties against both Gram-positive and Gram-negative bacteria, including *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The key active compounds responsible for this property are anthraquinones, flavonoids, tannins, and phenolic acids, which target bacteria by disrupting cell wall integrity, modulating membrane permeability, and interfering with nucleic acid and protein synthesis. Tannins are known to precipitate microbial proteins, while flavonoids inhibit key bacterial enzymes, thereby slowing down growth and promoting cell death.

Regarding antifungal properties, *Senna alata* has been found to be particularly effective against dermatophytes and opportunistic fungi such as *Trichophyton* species, *Microsporum* species, *Candida albicans*, and *Aspergillus niger*. Anthraquinones such as chrysophanol and rhein have been shown to target fungal cell membranes and inhibit spore germination. This dual property of possessing antibacterial and antifungal activity can be attributed to its widespread use in treating ringworm, athlete's foot, and other superficial mycoses.

## COMPONENTS OF BODY LOTION

A lotion formulation intended to combat bacterial and fungal infections of the skin can be prepared effectively using the leaf extract of *Senna alata* due to its known antimicrobial properties. The lotion formulation employs an oil-in-water (O/W) emulsion system to enhance skin permeability and user acceptability. The lotion preparation involves melting the oil phase, consisting of stearic acid, cetyl alcohol, liquid paraffin, and emulsifying wax, at 70-75°C. Simultaneously, the aqueous phase, comprising purified water, glycerin, propylene glycol, and dissolved preservatives (methyl paraben and propyl paraben), is also heated to the same temperature. The aqueous phase is then gradually added to the oil phase with vigorous stirring to form a smooth emulsion. After homogenization, the mixture is allowed to cool to about 40°C, at which temperature the standardized leaf extract of *Senna alata* (approximately 3% w/w) is gently folded into the mixture with continuous stirring. Vitamin E is added as an antioxidant, and the pH is adjusted to 5.5-6.5 using triethanolamine to maintain the lotion's mildness on the skin. Fragrance may be added if desired, and the lotion is packed in sterile containers. The prepared lotion has been found to possess antibacterial and antifungal properties, rendering it useful for the treatment of ringworm, athlete's foot, acne, and wound infections.

## Preparation Method of Herbal Lotion Using *Senna alata* Leaf Extract

Step No.	Procedure	Description / Purpose
1	Preparation of Oil Phase	Accurately weigh stearic acid, cetyl alcohol, liquid paraffin, and emulsifying wax. Heat the mixture to 70–75°C until completely melted.
2	Preparation of Aqueous Phase	Dissolve glycerin, propylene glycol, and preservatives (methyl paraben, propyl paraben) in purified water. Heat to 70–75°C to match oil phase temperature.
3	Emulsification	Slowly add the hot aqueous phase to the oil phase with continuous stirring to form an oil-in-water (O/W) emulsion.

Step No.	Procedure	Description / Purpose	Parameter	Method of Evaluation	Acceptable Range / Purpose
4	Homogenization	Stir or homogenize continuously to obtain a uniform, smooth lotion base and ensure proper mixing.	<b>Color &amp; Odor</b>	Organoleptic evaluation	Uniform color and characteristic, pleasant odor without rancidity
			<b>pH</b>	Digital pH meter (1% dispersion in distilled water)	5.5 – 6.5 (skin-compatible range)
5	Cooling Phase	Allow the emulsion to cool gradually to approximately 40°C while stirring continuously to maintain stability.	<b>Viscosity</b>	Brookfield viscometer	Ensures proper consistency and spreadability
6	Incorporation of Active Extract	Add the standardized <i>Senna alata</i> leaf extract (e.g., 3% w/w) into the cooled emulsion and mix thoroughly for uniform distribution.	<b>Spreadability</b>	Slide method (time taken to separate glass slides)	Indicates ease of application on skin
7	Addition of Antioxidant	Add Vitamin E to prevent oxidative degradation of the formulation.	<b>Homogeneity</b>	Visual and tactile examination	No coarse particles; uniform distribution of extract
8	pH Adjustment	Adjust pH to 5.5–6.5 using triethanolamine to ensure skin compatibility.	<b>Phase Separation</b>	Storage at different temperatures (4°C, 25°C, 40°C)	No separation indicates good emulsion stability
9	Addition of Fragrance (Optional)	Add skin-safe fragrance and mix uniformly.	<b>Stability Study</b>	Accelerated stability testing (3 months)	Evaluates color, pH, viscosity changes over time
10	Filling & Storage	Transfer the finished lotion into sterile, airtight containers and store in a cool, dry place.	<b>Irritancy Test</b>	Patch test on skin	No redness, itching, or irritation
			<b>Microbial Limit Test</b>	Standard plate count method	Should comply with acceptable microbial limits

**Evaluation of Essential Physicochemical Properties of Formulated Body Lotion Containing Senna alata Leaf Extract**

Evaluation of physicochemical properties is crucial to ensure the quality, stability, safety, and efficacy of the formulated herbal body lotion. The following parameters are considered essential:

Parameter	Method of Evaluation	Acceptable Range / Purpose
<b>Physical Appearance</b>	Visual inspection	Lotion should be smooth, homogeneous, free from lumps, phase separation, and grittiness

**Conclusion**

A herbal body lotion formulated with leaf extract of *Senna alata* has great potential as a topical agent for bacterial and fungal skin infections. The oil-in-water emulsion was designed to possess skin-friendly properties: the pH value is within the ideal range for skin, it has a comfortable viscosity, it is easily spreadable, it is uniform, and it does not exhibit phase separation in stability studies. Taken together, these properties ensure that the lotion is not only cosmetically elegant but also effective as a topical agent.

On the other hand, *Senna alata* has great antimicrobial potential. The leaf extract contains bioactive compounds such as anthraquinones, flavonoids, tannins, and other phenolics that exhibit significant antibacterial and antifungal properties against skin pathogens. Moreover, the leaf extract possesses

anti-inflammatory and antioxidant properties that can accelerate healing, reduce irritation, and protect the skin from oxidative damage.

In conclusion, this herbal lotion is a safe, inexpensive, and natural alternative to commercial antimicrobial agents. With further clinical and phytochemical validation, as well as stability studies, it has great potential as a pharmaceutical and cosmetic agent for the treatment of superficial skin infections.

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