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# Formulation And Evaluation OfAntimicrobial Herbal Cream

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Abstract:- Herbal products containing essential oil as antimicrobial agent are undoubtedly growing trend. Clove oil is reported to have antimicrobial activity against *staphylococcus aureus, escherichia coli, streptococcus pyogenes, propionibacterium acne, staphylococcus epidermidis* and *candida albicans*. One of the most establish property of cinnamon eo is antibacterial activity against gram positive and gram-negative bacteria which is responsible for human infectious disease. Cinnamon oil can increase the blood flow to the affected area and fade away the blemishes, helps in lightening the skin. Hence the present study is aims to formulate and develop antimicrobial cream containing clove oil and cinnamon oil. The eo of clove and cinnamon is extracted by hydro-distillation method and formulation were develop with the various concentration of both the oils.

**Key words:** clove, cinnamon, antimicrobial.

**Introduction:-**

**1. Skin:**

The skin is the largest organ of the human body and serves as a protective barrier between the internal organs and the external environment. It has several important functions and consists of multiple layers, each with its own unique characteristics.

**Structure and layers:**

**A) epidermis**: the epidermis is the outermost layer of the skin and acts as a protective barrier. It is composed of several sublayers, including the stratum corneum, stratum granulosum, stratum spinosum, and stratum basale. The epidermis contains melanocytes, which produce the pigment melanin responsible for skin coloration.

**B) dermis**: the dermis lies beneath the epidermis and provides support and nourishment to the skin. It contains blood vessels, hair follicles, sweat glands, sebaceous glands, nerve endings, and collagen and elastin fibres that contribute to the skin's strength, elasticity, and flexibility.

**C) hypodermis (subcutaneous tissue):** the hypodermis is the deepest layer of the skin and consists mainly of adipose (fat) tissue. It helps insulate the body, store energy, and provide cushioning.

**Functions of the skin:**

**I. Protection**: the skin acts as a physical barrier, protecting the body from harmful substances, microorganisms, uv radiation, and mechanical injuries.

**Ii. Sensation**: the skin contains numerous nerve endings that detect sensations such as touch, temperature, pain, and pressure.

**Iii. Thermoregulation**: through sweat production and dilation or constriction of blood vessels, the skin helps regulate body temperature.

**Iv. Synthesis of vitamin d**: the skin plays a crucial role in the synthesis of vitamin d when exposed to sunlight.

**V. Immune défense**: specialized cells in the skin, such as langerhans cells and immune system components, help defend against pathogens and initiate immune responses

**Skin conditions and disorders:**

**A) acne**: a common skin condition characterized by the formation of pimples, blackheads, and whiteheads.

**B) eczema**: a chronic inflammatory condition that causes dry, itchy, and inflamed skin.

**C) psoriasis**: a chronic autoimmune condition that leads to the rapid build-up of skin cells, resulting in thick, scaly patches.

**D) dermatitis**: inflammation of the skin caused by irritants or allergens.

**E) skin cancer**: various forms of skin cancer, including melanoma, basal cell carcinoma, and squamous cell carcinoma, can develop due to excessive sun exposure or genetic factors.

**Skin care:**

I. Regular cleansing, moisturizing, and protection from excessive sun exposure are essential for maintaining healthy skin.

Ii. Adequate hydration, a balanced diet, and a healthy lifestyle contribute to skin health.

Iii. Using sunscreen, wearing protective clothing, and avoiding tanning beds can help prevent skin damage and reduce the risk of skin cancer.

The skin is a complex and vital organ with numerous functions. Understanding its structure, functions, and common disorders is crucial for maintaining skin health and seeking appropriate care when needed.

**Microbial skin infection:**

Microbial skin infections, also known as skin infections caused by microorganisms, are common conditions that affect the skin. They are typically caused by bacteria, viruses, fungi, or parasites. Here is some information about different types of microbial skin infections:

**A.** Bacterial skin infections:

Bacteria can cause various skin infections, including

I. Impetigo: commonly affects children and is characterized by red sores that burst and develop honey-colored crusts.

Ii. Cellulitis: a bacterial infection that affects the deeper layers of the skin, causing redness, swelling, and pain.

Iii. Folliculitis: infection of the hair follicles, resulting in small, inflamed bumps or pustules.

Iv. Boils (furuncles): infections that occur in hair follicles or oil glands, leading to painful, pus- filled lumps.

V. Carbuncles: clusters of interconnected boils, often accompanied by fever and fatigue.

**B. Viral skin infections:**

Viruses can cause different types of skin infections, including:

I. Herpes simplex: caused by the herpes simplex virus, it results in painful blisters or cold sores, commonly around the mouth or genitals.

Ii. Varicella-zoster: causes chickenpox during the initial infection and later reactivates as shingles, resulting in a painful rash.

Iii. Molluscum contagiosum: characterized by small, pink or flesh-colored bumps with a central indentation caused by the poxvirus.

Iv. Warts:

**Fungal skin infections:**

Fungi can cause various skin infections, including:

I. Athlete's foot (tinea pedis): affects the feet, causing itching, redness, and cracked skin, often between the toes.

Ii. Ringworm (tinea corporis): presents as a ring-shaped, itchy rash with raised edges and a clear centre on the body or scalp.

Iii. Jock itch (tinea cruris): affects the groin area, resulting in a red, itchy rash.

Iv. Candidiasis: caused by the candida fungus, it can lead to diaper rash, oral thrush, or vaginal yeast

**Parasitic skin infections:**

Parasites can cause skin infections, such as:

I. Scabies: caused by tiny mites, it leads to intense itching and a rash that often appears as thin, wavy lines.

Ii. Pediculosis (lice infestation): infestation with lice, resulting in itching and the presence of lice or their eggs (nits) on the hair or body

**Topical drug delivery system:**

Topical drug delivery systems are formulations designed to deliver medication directly to the skin for local or systemic effects. These systems provide a convenient and targeted approach to treat various skin conditions and deliver therapeutic agents, such as drugs, ointments, creams, gels, lotions, and patches.

**Applications of topical drug delivery:**

I. **Dermatological conditions:** topical systems are widely used to treat skin disorders such as eczema, psoriasis, acne, and fungal infections.

Ii. **Analgesia:** topical analgesics provide localized pain relief for conditions like arthritis, muscle sprains, and minor injuries.

Iii. **Hormone replacement therapy:** transdermal patches are employed for systemic delivery of hormones such as oestrogen and testosterone.

Iv. **Motion sickness:** transdermal patches can deliver medications to alleviate symptoms of motion sickness

Creams:

Creams are a type of topical drug delivery system that consists of a semi-solid emulsion of water and oil. They are widely used in dermatology and other medical fields for their ease of application and ability to deliver medications to the skin. Creams are typically composed of three main components: water, oil, and an emulsifying agent.

**Classification of creams:**

**1) oil-in-water (o/w) creams:** these creams have water as the continuous phase and oil droplets dispersed within. They are commonly used for hydrating and moisturizing the skin. O/w creams are easy to spread, non-greasy, and can be easily washed off.

**2) water-in-oil (w/o) creams:** these creams have oil as the continuous phase and water droplets dispersed within. They provide occlusive effects, forming a protective barrier on the skin and reducing water loss. W/o creams are greasier and are suitable for dry or damaged skin.

**3) multiple emulsion (w/o/w or o/w/o) creams:** these creams contain two sets of emulsion systems, combining the properties of both o/w and w/o creams. They can be used to deliver medications with different solubilities or to provide enhanced drug stability and prolonged release.

**4) emulsion-microemulsion creams:** these creams utilize microemulsion systems, which are thermodynamically stable mixtures of oil, water, surfactants, and co-surfactants. Microemulsion creams improve drug solubility and skin penetration, allowing for effective drug delivery.

**Properties and advantages of creams:**

I. Creams are easy to spread and apply to the skin, making them patient-friendly.

Ii. They provide hydration and moisturization to the skin, improving its barrier function.

Iii. Creams can deliver both hydrophilic and lipophilic drugs, offering a broad range of therapeutic options.

Iv. Creams can be formulated with various active ingredients, including antibiotics, antifungals, corticosteroids, anti-inflammatory agents, and moisturizers.

V. Creams allow for controlled release of drugs, providing prolonged therapeutic effects.

Vi. Creams can be easily removed from the skin by washing.

**1. Dermatology:** creams are commonly used to treat skin conditions such as eczema, psoriasis, acne, and dermatitis.

**2. Wound healing:** creams can be applied to promote wound healing and prevent infection.

**3. Cosmetics:** creams are widely used in cosmetic formulations for moisturizing, anti-aging, and skin rejuvenation purposes.

**4. Sunscreens:** cream-based sunscreens provide protection against uv radiation and prevent sunburn.

**Clove as an antimicrobial agent:**

Clove (*syzygium aromaticum*) is a spice that has been used for centuries in traditional medicine due to its various health benefits. One of its notable properties is its antimicrobial activity. Clove contains several bioactive compounds, including eugenol, which is responsible for its antimicrobial effects. Eugenol acts by disrupting the cell membranes of these microorganisms, inhibiting their growth and ultimately leading to their destruction.[10]

**I. Antibacterial activity:** clove has been found to exhibit antibacterial activity against a wide range of bacteria, including both gram-positive and gram-negative strains. It can inhibit the growth of bacteria such as escherichia coli, salmonella typhi, staphylococcus aureus, and streptococcus mutans, among others.

**Ii. Antifungal activity:** clove also demonstrates antifungal properties. It has been shown to be effective against various fungal strains, including candida species, aspergillus species, and dermatophytes.

**Iii. Antiviral activity:** studies have indicated that clove possesses antiviral properties. It has shown activity against certain viruses, including herpes simplex virus (hsv) and human immunodeficiency virus (hiv).

**Cinnamon as an antimicrobial agent:**

Cinnamon is a spice derived from the inner bark of trees from the cinnamomum genus. It has been widely used for culinary and medicinal purposes, and it also possesses antimicrobial properties. It contains several active compounds, including cinnamaldehyde, which has been shown to possess potent antibacterial and antifungal effects. Cinnamon oil acts by interfering

With the microbial cell wall and membrane, impairing their integrity and resulting in the inhibition of bacterial and fungal growth.

**I. Antibacterial activity:** cinnamon has been shown to exhibit antibacterial effects against various bacterial strains. It can inhibit the growth of bacteria such as escherichia coli, salmonella, staphylococcus aureus, and bacillus cereus.

**Ii. Antifungal activity:** cinnamon demonstrates antifungal properties and has been found to be effective against different fungal species. It can inhibit the growth of candida albicans, aspergillus niger, and other fungi.

**Iii. Antiviral activity:** cinnamon has shown antiviral activity against certain viruses. It has been reported to have inhibitory effects against respiratory syncytial virus (rsv), herpes simplex virus (hsv), and other viruses.

**Aim and objectives:**

 to prepare and evaluate antimicrobial cream by using clove oil and cinnamon oil.

 to determine the antimicrobial activity of clove and antibacterial activity of cinnamon.

 to provide a natural treatment for drug resistant bacteria by avoiding any adverse effect.

 to provide health benefit.

**Active constituents and their pharmacological activities:**

**A) eugenol:** eugenol is the primary active compound in cloves, constituting about 70-90% of the essential oil extracted from the buds. It possesses several pharmacological activities, including analgesic (pain-relieving), anti-inflammatory, and antimicrobial properties. Eugenol is also known for its local anaesthetic effects and can be used topically for toothaches and oral pain.

**B) caryophyllene:** caryophyllene is a sesquiterpene compound found in cloves and other plants. It has anti-inflammatory properties and acts as a selective agonist of cannabinoid receptor type 2 (cb2), which is involved in modulating the immune response and reducing inflammation.

**C) acetyl eugenol:** acetyl eugenol is a derivative of eugenol found in cloves. It exhibits antioxidant and anti-inflammatory properties. It has been studied for its potential protective effects against oxidative stress and inflammation-related conditions.

**D) beta-caryophyllene:** beta-caryophyllene is a bicyclic sesquiterpene found in cloves. It is known for its anti-inflammatory and analgesic properties. Beta-caryophyllene selectively activates the cb2 receptor and exhibits potential therapeutic effects in various inflammatory conditions.

**E) acetyl eugenol:** acetyl eugenol is a derivative of eugenol found in cloves. It exhibits antioxidant and anti-inflammatory properties. It has been studied for its potential protective effects against oxidative stress and inflammation-related conditions.

**F) beta-caryophyllene:** beta-caryophyllene is a bicyclic sesquiterpene found in cloves. It is known for its anti-inflammatory and analgesic properties. Beta-caryophyllene selectively activates the cb2 receptor and exhibits potential therapeutic effects in various inflammatory conditions.

**Identification test**

**Appearance:** clear, yellow liquid, which becomes brown when exposed to air. **Solubility:** miscible with methylene chloride with toluene and with fatty oils.

**Chemical test:**

I) a drop of clove oil is dissolved in 5ml alcohol and a drop of ferric chloride solution is added; due to the phenolic oh group of eugenols, a blue colour is seen.

**Active constituents and their pharmacological activities:**

**A) cinnamaldehyde:** this is the main active compound responsible for the characteristic flavour and aroma of cinnamon. It possesses antioxidant, anti-inflammatory, and antimicrobial properties.

**B) eugenol:** found in varying amounts in different types of cinnamon, eugenol contributes to the spicy and sweet aroma of the spice. It also has antioxidant and antimicrobial properties.

**C) coumarin:** this compound is present in higher amounts in cassia cinnamon (cinnamomum cassia) compared to ceylon cinnamon (cinnamomum verum or cinnamomum zeylanicum). Coumarin is responsible for the sweet aroma of cinnamon but may have adverse effects in high doses.

**D) cinnamic acid:** cinnamon contains cinnamic acid and its derivatives, such as caffeic acid and ferulic acid. These compounds possess antioxidant properties and contribute to the overall health benefits associated with cinnamon consumption.

**E) procyanidins:** cinnamon contains oligomeric procyanidins, which are a type of flavonoid compound with antioxidant and anti-inflammatory properties. These compounds may contribute to the potential health benefits of cinnamon.

In addition to these major constituents, cinnamon also contains trace amounts of essential oils, vitamins, minerals, and other beneficial compounds.

**Paraffin oil:**

White mineral oil; liquid petrolatum

Liquid paraffin is a purified mixture of liquid hydrocarbons obtained from petroleum to which not more than 10ppm tocopherol or of butylated hydroxytoluene may be added.

**Category:** laxative; lubricant.

**Description:** a transparent, colourless, oily liquid, free from fluorescence by daylight; odourless or almost odourless. **5. Borax:**

Borax or sodium borate.

Molecular wt. 381.4 g/mol; chemical formula: na2b4o7-10h2o

**Definition:** borax contains not less than 99.0% and not more than the equivalent of 103.0% of disodium tetraborate decahydrate.

**Description:** a white, crystalline powder, colourless crystal or crystalline masses, efflorescent, soluble in water, very soluble in boiling water, freely soluble in glycerol.

**Formulation and preparation:**

**Collection of crude drug and essential oil:**

The dried clove buds were collected from local market of beed, maharashtra, india. And its extract used for the formulation.

The cinnamon bark powder was collected from local market of beed, maharashtra, india. And its extract used for the formulation.

All the necessary ingredients or chemicals was collected from pharmaceutics lab of kishori college of pharmacy beed.

**Extraction of essential oil:**

**I) extraction of clove oil: -**

100 gm of dried clove sample is taken into 500 ml volumetric flask with 400 ml water and subjected to hydro-distillation for 4–6 hours. Subsequently, the volatile distillate is collected and saturated with sodium chloride following the addition of petroleum ether. Later, hydro and ether layers are separated and dehydrated by using anhydrous sodium sulphate.

**Ii)** extraction of cinnamon oil: -

100 gm of cinnamon powder was taken into 500 ml volumetric flask with 300 ml and subjected to hydro-distillation for 4–6 hours. The recovered mixture was allowed to settle and the oil was withdrawn. After the hydro distillation process, the product was collected and separated using separatory funnel by adding diethyl ether. The essential oils in diethyl ethyl layer of the separatory funnel were separated several times until no oil was left in the separatory funnel. Dry and distil to obtain the oil.

**Procedure:**

1. All the ingredients of phase a and phase b were taken in separate porcelain dishes.

2. Bees wax of oil phase (phase a) are taken first for melting and then liquid paraffin will be added in order of increasing melting point and heat oil phase up to 75°c in a porcelain dish on water bath.

3. Ingredients of aqueous phase (phase b) are mixed in predetermined proportion and heated

4. To the same temperature as of oil phase (75°c.)

5. At 75°c, add aqueous phase in oil phase slowly.

6. All the ingredients are mixed with continuous stirring until a smooth and stable emulsion is formed.

7. Then the cream was allowed to cool down to the room temperature and transferred to suitable container. Since, formulation trial ii (c-1) gave a satisfactory product as a

cream base; it was selected as a suitable cream base for incorporation of clove oil and cinnamon oil.

8. Two different concentrations of both oils (i.e., 0.5% and 1%) were incorporated in cream base to formulate two formulations of antimicrobial cream (f1, f2) respectively.

**Test for antimicrobial activity:**

(1) preparation of nutrient agar plates: nutrient agar medium was prepared according to the manufacturer's instructions and autoclaved for 20 minutes at 20 psi. After autoclaving, the agar medium was cooled to 40–45°c in a water bath. 60 ml of the cooled agar medium was poured onto the petri dish.

(2) preparation of inoculum: soil is source of various types of microorganisms. A standard stock solution of 0.5mg/ml is prepared in distilled water. From this stock, five dilutions of standard are prepared. The median concentration is prepared as per the specification in the monograph.

(3) inoculation of the nutrient agar plate: to inoculate the nutrient agar plates, the suspension of bacterial inoculum is poured into surface of agar plates. The plate was rotated approximately 60 degrees to ensure even distribution of the inoculum.

**Result and discussion:**

The antimicrobial cream was observed by changes in parameters like colour, odour, ph, viscosity and particle size under normal conditions and antimicrobial cream was found to be substantially stable. The prepared creams (f1 and f2) were found to be homogeneous and in good appearance and consistency. The ph values of both the formulations were in the close range of (6-7). The formulation was slightly irritating to skin due to the spicy nature of clove and cinnamon. The spreadability of formulation (f1 and f2) indicates that the cream formulation is easy to apply. The formulation (f1 and f2) was found to be more consistent.

**Conclusion:**

In india there are many medicinal plants which are used from ancient times for skin care. Natural preparation is more acceptable in recent trends which are mostly recommended as having less or no side effect. The idea to be submerging this formulation was its antimicrobial property.

Clove oil and cinnamon oil are both known for their antimicrobial properties. They contain bioactive compounds such as eugenol in clove oil and cinnamaldehyde in cinnamon oil, which have been shown to exhibit antibacterial, antifungal, and antiviral activities. These compounds can inhibit the growth and proliferation of various microorganisms, including bacteria and fungi. The cream shows its effect against certain skin infections, wounds, or other dermatological conditions caused by microorganisms. The antimicrobial properties of the essential oils might help in reducing the microbial load and promoting healing.

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