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Research Article

Development and Formulation of Herbal Products- A Veterinary Herbal Care Perspective

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ABSTRACT

The increasing demand for safe, non-toxic, and sustainable veterinary dermatological products has accelerated interest in herbal alternatives to conventional chemical- and antibiotic-based formulations. The present study focuses on the development and evaluation of an organic herbal veterinary soap formulated with oat milk (*Avena sativa*) and neem extract (*Azadirachta indica*), designed with a novel dual-layer/stripe-based active release mechanism. Oat milk, rich in β -glucans and avenanthramides, provides soothing, moisturizing, anti-inflammatory, and barrier-repair properties, while neem extract contributes potent antimicrobial, antifungal, antiparasitic, and wound-healing effects. The formulation integrates an oat-based core for gentle cleansing and skin protection with neem-infused stripes to enable controlled and targeted antimicrobial release during bathing. The soap was prepared using veterinary-safe herbal oils and additives and evaluated through standard physicochemical and quality control tests, including pH determination, lather stability, total fatty matter (TFM), and saponification analysis. The formulated soap exhibited a skin-compatible pH range (6.0–7.5), satisfactory foaming stability, acceptable TFM values (55–75%), and minimal free alkali content, confirming its safety and suitability for animal skin. The synergistic combination of oat milk and neem extract offers a balanced dermatological approach that supports microbial control, inflammation reduction, and coat health without contributing to antimicrobial resistance. This formulation demonstrates strong potential for veterinary dermatological applications, MSME-scale production, and future patent-oriented product development.

INTRODUCTION

Veterinary skin health management requires products that are safe, non-toxic, and effective against common dermatological issues such as

itching, allergies, dermatitis, fungal infections, microbial colonization, and dryness. Animals have more sensitive skin compared to humans; therefore, the need for gentle, herbal, and naturally

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sourced topical formulations has increased significantly in recent years. Oat (*Avena sativa*) and Neem (*Azadirachta indica*) are two scientifically validated herbal ingredients that have been extensively used for dermatological care due to their soothing, antimicrobial, and healing properties.

Oat powder and colloidal oatmeal provide beta-glucans, avenanthramides, polysaccharides, and saponins, which help relieve itching, inflammation, dryness, and irritation. Neem powder and neem extract contain azadirachtin, nimbin, and gedunin, potent compounds with antibacterial, antifungal, antiparasitic, and antiviral effects. When combined in a soap formulation, these ingredients offer a multifunctional synergistic effect that supports skin repair, reduces microbial load, and improves coat health in animals.

The development of an Oat–Neem Active-Release Herbal Veterinary Soap aims to integrate the therapeutic properties of oat and neem into a structured formulation where each ingredient releases its benefits gradually during bathing. This includes a uniform oat base layer for soothing and moisturizing effects and patterned neem stripes for controlled antimicrobial release, making the product both unique and suitable for patentability.

This procedure outlines the step-by-step method for preparing, formulating, and evaluating an organic herbal veterinary soap, ensuring the product meets standard veterinary dermatological requirements through pH testing, lather testing, total fatty matter (TFM), and saponification analysis.

AIM & SCOPE OF THIS PROCEDURE:

The aim of this procedure is to formulate and evaluate a safe, organic, herbal veterinary soap

using Oat Powder and Neem Extract/Oil with a unique active-release pattern, ensuring optimal antimicrobial, soothing, and skin-protective properties through standardized laboratory testing.

- To develop a novel and patentable Oat–Neem herbal soap with a dual-release mechanism (oat base + neem stripes).
- To create a veterinary-safe formulation that minimizes irritation, allergic reactions, and chemical exposure.
- To maintain an acceptable pH range (6.0–7.5) suitable for animal skin.
- To evaluate the physicochemical characteristics of the soap using laboratory methods such as pH, lather stability, TFM, and saponification.
- To integrate herbal actives in a structured way that supports efficacy, product stability, and marketability.

1. Formulation Development

Selection of herbal raw materials including oat powder, colloidal oatmeal, neem extract, neem oil, coconut oil, olive oil, castor oil, shea butter, aloe vera gel, and essential oils.

Preparation of the Oat–Neem dual layer (or striped) herbal soap using melt-and-pour or cold-process methods. Inclusion of natural thickeners, moisturizers, and antimicrobial agents suitable for animal skin.

2. Unique Product Innovation

Incorporation of a visible neem stripe design for controlled antimicrobial release. Development of a mechanical release pattern that enhances product novelty for patent registration. Use of herbal



ingredients as active dermatological agents, eliminating chemical irritants.

3. Laboratory Analysis

The procedure covers standardized tests essential for veterinary soap quality confirmation:

- pH Test – Ensures safe skin compatibility.
- Lather Test – Determines foaming capacity and stability.
- Total Fatty Matter (TFM) – Evaluates soap quality, richness, and gentleness.
- Saponification Test – Checks free alkali levels to guarantee safety and proper curing.

4. Veterinary Application

Applicable to pets such as dogs, cats, calves, horses, goats, and small animals. Especially suitable for treating dermatitis, dandruff, fungal infections, dryness, itching, and allergies. Can be extended to shampoos, sprays, and lotions in future development.

5. Industrial and Commercial Scope

Suitable for MSME-scale manufacturing. Eco-friendly herbal formulation aligned with organic product trends. Patentable design and scientific formulation increase market value.

To be noted the below mentioned raw materials , necessary equipment and test need to be confirmed

Raw materials	Necessary Equipment	Laboratory confirmation test
Coconut oil	Stainless steel vessel	pH testing
Olive oil	Blender (optional)	Lather testing (Foam testing)
Castor oil	Moulds	Total Fatty matter (TFM)
Neem oil\ Neem extract	Spatula	Saponification test
Sodium hydroxide	pH strips	
Oat milk	Thermometer	
Alovera gel (from scratch products)	Gloves, mask and goggles	
Vitamin E oil or Lavender oil		
Pet safe essential oil		
Shea butter		
Colloidal Oatmeal		

The above mentioned are the necessary raw materials for evaluation and formulation of veterinary herabal care products with Oatmilk and neem extract. The test mentioned are the product confirmation test which conclude foaming property, total amount of fatty matter present and saponification proportion involved during curing process.

Lather test- At initial: 120-180mm

After 5 min: 80-120mm

Formula: $(\text{Foam Height after 5 min} / \text{initial height}) * 100$

If we calculate as a percentage, the range falls between 60-75%

Antimicrobial properties of herbal and other additives:

1. Coconut Oil

Coconut oil is widely recognized for its strong antimicrobial properties, primarily due to its high content of medium-chain fatty acids, especially



lauric acid. When lauric acid enters biological systems, it converts into monolaurin, a compound known to disrupt the lipid membranes of various bacteria, fungi, and enveloped viruses. This mechanism weakens the integrity of microbial cell walls, leading to cell lysis.

In veterinary dermatology, coconut oil is increasingly used for treating minor skin infections, hot spots, and fungal dermatitis because of its ability to inhibit *Staphylococcus aureus*, *Candida albicans*, and certain gram-negative organisms. Additionally, its moisturizing properties help restore the skin barrier, making it both a therapeutic and supportive ingredient in herbal veterinary formulations.

2. Olive Oil

Olive oil contains potent bioactive molecules, including oleuropein, hydroxytyrosol, and oleic acid, all of which contribute to its antimicrobial benefits. Oleuropein exhibits strong activity against several pathogenic microbes by altering their cell membrane permeability and inhibiting essential microbial enzymes. Hydroxytyrosol, an antioxidant phenolic compound, also has broad-spectrum antimicrobial activity, particularly against bacteria involved in skin infections.

In veterinary products, olive oil helps reduce inflammation, heal wounds, and control bacterial colonization in pets, especially in cases of dermatitis and ear infections. Its nature enhances skin hydration while enabling better penetration of other active herbal ingredients.

3. Neem Extract

Neem (*Azadirachta indica*) extract is one of the most powerful botanical antimicrobials used in both human and veterinary medicine. It contains key bioactive compounds such as azadirachtin,

nimbidin, nimbin, and gedunin, which possess antibacterial, antifungal, antiviral, and antiparasitic effects. Neem works by inhibiting microbial replication, altering cell membrane function, and suppressing virulence factors such as toxins and biofilms. It is particularly effective against organisms like *Staphylococcus aureus*, *Escherichia coli*, *Malassezia pachydermatis*, and fungal dermatophytes.

In veterinary herbal care products, neem extract is commonly used in shampoos, sprays, and ointments for treating mange, ticks, fungal infections, and septic dermatitis due to its multi-targeted antimicrobial mechanism.

4. Castor Oil

Castor oil contains ricinoleic acid, a unique fatty acid responsible for its antimicrobial and anti-inflammatory activities. Ricinoleic acid disrupts microbial cell membranes, inhibits their metabolic pathways, and reduces prostaglandin synthesis, which helps alleviate inflammation associated with infections. Castor oil also inhibits the growth of several gram-positive and gram-negative bacteria, including *Staphylococcus*, *Pseudomonas*, and *Proteus* species.

In veterinary formulations, it is used to soothe irritated skin, prevent secondary infections, and support wound healing. Its viscosity offers protective coverage, making it beneficial in balms, ointments, and herbal antiseptic creams for animals.

5. Sodium Hydroxide (Saponified Form)

Although sodium hydroxide itself is not an antimicrobial ingredient, it plays a crucial role in soap formulation where it converts oils into saponified fatty acid salts. These soap molecules possess natural antimicrobial properties by



disrupting microbial lipid layers and reducing surface tension, allowing mechanical removal of pathogens from the skin. Soap made using sodium hydroxide effectively eliminates bacteria such as *E. coli*, *Staphylococcus*, and fungal spores by breaking down their cell membranes.

In veterinary herbal care products, saponified oils help remove dirt, allergens, and microorganisms from animal fur and skin, enhancing overall hygiene while supporting the activity of other herbal extracts.

6. Oat Milk

Oat milk contains bioactive components like beta-glucans, avenanthramides, and polysaccharides that exhibit mild antimicrobial and strong anti-inflammatory properties. Avenanthramides inhibit microbial adhesion and reduce irritation associated with infections, making oat milk suitable for sensitive or inflamed skin. Although not a strong antimicrobial agent by itself, it helps improve skin barrier function and reduces colonization of harmful microbes by maintaining skin moisture and pH balance.

In veterinary products, oat milk is especially valuable for pets with chronic allergies, dermatitis, or dry skin conditions, where microbial imbalance often triggers secondary infections.

7. Aloe Vera Gel

Aloe vera gel is rich in anthraquinones (such as aloin and emodin), saponins, polysaccharides, and glycoproteins, all of which exhibit antimicrobial activity. Aloe interferes with bacteria by damaging their membranes and inhibiting DNA replication. Its antifungal properties help control common veterinary pathogens such as *Candida* and *Aspergillus*. Moreover, aloe vera promotes wound healing through fibroblast activation and collagen

synthesis, making it highly useful in veterinary skin care. Its soothing, cooling nature reduces inflammation, itching, and microbial load, making it ideal for shampoos, sprays, and topical gels.

8. Lavender Oil

Lavender essential oil possesses powerful antimicrobial components like linalool and linalyl acetate, which are known to suppress bacterial and fungal growth. These compounds penetrate microbial cell membranes, leading to leakage of cellular contents and subsequent cell death. Lavender oil is effective against pathogens such as *Staphylococcus aureus*, *E. coli*, *Candida albicans*, and dermatophytes. It also reduces inflammation, calms irritated skin, and provides deodorizing effects. In veterinary herbal care, lavender oil is commonly included for its antimicrobial, anxiolytic, and wound-healing benefits, making it a multifunctional ingredient.

9. Shea Butter

Shea butter contains triterpene esters, catechins, and fatty acids such as oleic, stearic, and linoleic acids that show antimicrobial activity. These compounds inhibit microbial multiplication and help heal damaged skin. Shea butter also strengthens the epidermal barrier, preventing opportunistic microbes from entering wounds or inflamed regions. In veterinary products, it is used to soothe dry patches, and prevent microbial colonization in cracked skin. Its occlusive and nourishing nature assists in repairing skin integrity, reducing susceptibility to infections.

10. Colloidal Oatmeal

Colloidal oatmeal is made of finely powdered oats rich in avenanthramides, flavonoids, phenolic acids, and saponins that collectively provide antimicrobial and anti-inflammatory effects.



Avenanthramides inhibit microbial-induced inflammation, while phenolic compounds retard bacterial growth by disrupting cell membrane integrity. Colloidal oatmeal also helps maintain optimal moisture levels, reducing conditions that favor microbial proliferation. In veterinary dermatology, it is widely used in shampoos and moisturizers to treat allergic dermatitis, eczema, and secondary bacterial infections. Its gentle, soothing action makes it safe for long-term use in pets with chronic skin issue

LABORATORY CONFIRMATION TEST

These are the confirmation test which had been undergone after the curing process, they are

1. pH testing

2. Lather test

3. Total fatty matter (TFM)

4. Saponification test

1. pH testing

- Take 10g finely grated soap in a vessel and add 100ml distilled water.
- Stir the sample for 5-10 mins
- After stirring, dip a strip of pH paper into the sample solution and monitor the colour change and note the pH value
- For veterinary herbal care product, the pH range falls between 6.0-7.5

2. Lather test

- Prepare 1 % solution (1g soap sample in 100ml distilled water)

- Pour 50ml of sample solution into measuring cylinder and shake 10 times.
- Record initial foam height before shaking and measure in (mm) unit
- Shake the sample solution at least for 5min and record the foam height after 5min.

FORMULA

Stability = $(\text{final height} / \text{initial height} \times 100) \% [60 - 75\%]$

Initial height- 120-180mm

Final height- 80-120mm

3. Total fatty matter (TFM)

- Cut the soap finely into small flakes and dry the soap flakes in an oven at 105 degree for 1 hour to remove moisture.
- Cool in a desiccator.
- Weigh 2.5-5g accurately.

Step 1:

- Transfer weighed soap to a 250ml conical flask.
- Add 50ml of hot neutralised ethanol (Pour the ethanolic extract into beaker. Place on a waterbath at 40-50 degree, allow ethanol to evaporate slowly. Continue heating until no alcohol smell remains, volume stops reducing. Cool and filter.
- Heat gently on waterbath until soap dissolves completely, stir occasionally.

Step 2



- Add 20ml of 1:1 HCl (1 part concentrated HCl +1 part water) slowly to the flask.Heat it for 10minutes
- Fatty acids will form thick white layer on top. Cool at room temperature.

Step 3

- Add 50ml warm water and transfer it into separating funnel.
- Add 50ml petroleum ether and shake gently. Allow layers to separate (upper layer: petroleum ether +fatty acids, lower layer: aqueous phase)
- Collect the upper organic layer into a clean beaker and repeat the process for 3 times.

Step 4

- Combine all organic layers into weighed dry dish (W1)
- Evaporate solvent on hot waterbath until dry
- Transfer dish to oven at 105degree for 30min (W2)

Formula:

$$TFM = (W2 - W1) / W0 * 100$$

W0-Weight of soap taken

W1- Weight of empty dish

W2- Weight of dish+fatty acids

Total fatty matter for veterinary soap= 55-75%

4. Saponification test

Purpose

To determine the free alkali content present in the formulated herbal veterinary soap using titrimetric analysis.

Reagents Required

1. 0.1 N Hydrochloric Acid (HCl) Solution – 500 mL

Formula: $C_1V_1 = C_2V_2$

$C_1 = 12 \text{ N}$ (concentrated HCl)

$C_2 = 0.1 \text{ N}$

$V_2 = 500 \text{ mL}$

Required volume of concentrated HCl (V_1) = 4.17 mL

Preparation:

Add 4.17 mL of concentrated HCl to a volumetric flask containing ~250 mL distilled water.

Add more distilled water to make up the final volume to 500 mL. Mix well.

Materials Required

- Ethanol (50–100 mL)
- Phenolphthalein indicator (2–3 drops)
- N HCl
- Conical flask (250 mL)

Procedure

1. Sample Preparation

- Cut the soap into small pieces.
- Dry in an oven at 105°C for 30–60 minutes to remove moisture.
- Cool in a desiccator.



- Accurately weigh 2.0 g of the soap sample into a 250 mL conical flask.

2. Dissolution

- Add 50–100 mL of ethanol to the flask.
- Heat gently to dissolve the soap.
- Stir continuously.

3. Indicator Addition

- Add 2–3 drops of phenolphthalein indicator.
- If free alkali is present, the solution turns pink.

4. Titration

- Titrate with 0.1 N HCl until the pink colour disappears and the solution becomes colourless.
- Record the volume of HCl used (V mL).

Calculation

$$\text{Free Alkali (mg/g)} = (V \times N \times 40 \times 1000) / W_0$$

Where:

V = Volume of HCl used (mL)

N = Normality of HCl

40 = Molecular weight of NaOH

W_0 = Weight of soap sample (g)

Standard Requirement

Free alkali (as NaOH) should be ≤ 2 mg/g

Antimicrobial properties of neem

Neem (*Azadirachta indica*) is widely recognized as one of the most potent botanicals employed in

traditional medicine and emerging veterinary dermatology. Its extract contains a rich mixture of limonoids, phenolic compounds, flavonoids, terpenoids and fatty acids, which contributing to strong antimicrobial, anti-inflammatory, antiparasitic and wound-healing properties. These characteristics make neem an ideal active ingredient for herbal veterinary formulations intended to manage common skin disorders such as dermatitis, eczema, ringworm, parasitic irritation and other wounds caused by microbe in animals.

In this formulation, Oat Neem Active-Release Stripe Veterinary Soap, neem extract is incorporated in stripe layers to provide controlled antimicrobial delivery. This structural design allows a targeted release of neem actives during bathing, while the oat base provides soothing, moisturizing, and barrier-strengthening effects. Understanding the antimicrobial properties of neem extract is essential for validating the therapeutic relevance and functional efficacy of this formulation.

PHYTOCHEMICAL PROFILE OF NEEM EXTRACT

Neem extract contains more than 300 biologically active constituents. Among them, limonoids are considered the major antimicrobial agents. Key phytochemical groups include:

Limonoids

Limonoids exhibit potent antibacterial, antifungal, antiviral, and antiparasitic actions. The major limonoids are:

- Azadirachtin
- Nimbin
- Nimbidin



These compounds act synergistically to suppress microbial proliferation on animal skin.

Phenolic Compounds

- Tannins
- Gallic acid
- Catechins

Phenolics exhibit antioxidant, and microbe-inhibiting effects.

Flavonoids

- Quercetin
- Kaempferol

These compounds contribute to anti-inflammatory and antimicrobial effects.

Fatty Acids

Neem contains oleic, linoleic and stearic acids which destabilize microbial membranes and assist in wound healing.

Volatile Terpenoids

Responsible for broad insect-repellent and antimicrobial vapour activity.

ANTIBACTERIAL PROPERTIES OF NEEM EXTRACT

Neem possesses broad-spectrum antibacterial activity effective against both Gram-positive and Gram-negative organisms commonly associated with veterinary dermatological conditions. Target Bacterial Pathogens are:

- Staphylococcus aureus
- Staphylococcus epidermidis

- Streptococcus pyogenes
- Escherichia coli
- Pseudomonas aeruginosa
- Proteus mirabilis

Mechanism of Antibacterial Action

The antibacterial activity of neem extract is mediated through:

a. Cell Wall Disruption

Limonoids penetrate bacterial membranes, causing dissolution of lipid layers, increased membrane permeability, leakage of cytoplasmic contents, eventual bacterial lysis

b. Enzyme Inhibition

Neem compounds inhibit, DNA gyrase, Proteases, ATPase activity, β -lactamase enzymes. This disrupts bacterial replication and metabolic functions.

c. Anti-Biofilm Activity

Neem reduces biofilm formation by interfering with surface adhesion, Extracellular polymeric substance (EPS) production. This is especially important for chronic Staphylococcus infections.

d. Anti-Inflammatory Modulation

Compounds such as nimbidin reduce inflammatory reactions associated with bacterial infections, thereby promoting healing.

Thus neem has antibacterial activity effective against both Gram-positive and Gram-negative organisms commonly associated with dermatological conditions.



ANTIFUNGAL PROPERTIES OF NEEM EXTRACT

Fungal and yeast infections are prevalent in veterinary practice, including *Malassezia* dermatitis, *Candida* infections, and ringworm caused by *Microsporum* and *Trichophyton* species.

Target Fungal Pathogens

- *Malassezia pachydermatis*
- *Candida albicans*
- *Aspergillus* species
- Dermatophytes (*Microsporum*, *Trichophyton*)

Mechanism of Antifungal Action

Neem exerts antifungal effects by disrupts fungal cell membrane integrity, making cells susceptible to rupture, Prevents invasive fungal spread into skin layers, inhibits germination and reproduction of fungal spores.

ANTIVIRAL ACTIVITY

Neem exhibits antiviral activity against enveloped and some non-enveloped viruses. Mechanisms include, disruption of viral envelope, inhibition of viral entry into host cells, interference with viral replication enzymes, reduction of viral load on skin surfaces. Neem can contribute to general surface-level viral reduction, supporting veterinary hygiene.

ANTIPARASITIC AND INSECT-REPELLENT PROPERTIES

Neem is a well-established botanical ectoparasiticide. Target Ectoparasites are

- Fleas

- Ticks
- Lice
- Mites
- Fly larvae

Mechanism of Antiparasitic Action

In Insect Growth Regulation (IGR) Azadirachtin disrupts Larval development, Molting, Reproductive cycles. Parasites avoid feeding due to bitterness and olfactory cues. Inhibits oviposition and reduces egg viability.

ANTI-INFLAMMATORY AND WOUND-HEALING PROPERTIES

Neem significantly supports skin repair through, Suppression of inflammatory mediators, reduction of redness, swelling, and heat, Promotion of collagen synthesis, Acceleration of epithelial regeneration, reduction of histamine-induced itching. These effects complement its antimicrobial actions, making neem highly suitable for animals with inflamed or irritated skin.

SIGNIFICANCE OF NEEM IN STRIPE-BASED SOAP FORMULATION

In this formulation, neem extract is incorporated into distinct stripe layers rather than being uniformly blended. This design provides the following advantages:

- Stripes deliver concentrated neem actives exactly where friction occurs during scrubbing.
- The stripe dissolves slower than the oat base, creating a sustained antimicrobial effect.



- Localized neem prevents excessive exposure on sensitive animal skin while still delivering therapeutic potency.
- Dual-Mechanism Action, Oat core: Soothing, moisturizing, anti-inflammatory, Neem stripe: Strong antimicrobial & antiparasitic action. This combination provides a balanced dermatological effect.

IMPORTANCE OF OATMILK IN VETERINARY DERMATOLOGY AND ITS MICROBIAL ACTIVITY

Oat milk, a colloidal suspension derived from *Avena sativa*, has become an increasingly valuable ingredient in veterinary dermatology due to its broad spectrum of dermatological, microbiological, and barrier-supportive actions. Its significance extends far beyond basic moisturization, as oat milk is now recognized for its ability to modulate inflammation, restore epidermal integrity, support the skin microbiome, prevent pathogen colonization, and provide low-level antimicrobial activity functions that are critical in managing dermatological disorders in animals. Veterinary species such as dogs, cats, horses, cattle, goats, and small mammals frequently suffer from environmental irritants, parasite-induced dermatitis, fungal overgrowth, bacterial infections, and chronic inflammatory skin diseases. Because animal skin is more sensitive and physiologically different from human skin, harsh synthetic cleansers or antibiotic-based topicals often cause secondary problems such as dryness, microbiome imbalance, irritation, and antimicrobial resistance. Oat milk serves as a safe, gentle, and multifunctional natural alternative that supports overall skin health without disrupting the microbiome or contributing to resistance.

Biochemical Composition Underpinning Dermatological Benefits

Oat milk contains a unique combination of β -glucans, avenanthramides, saponins, lipids, amino acids, vitamins, and phenolic antioxidants, each contributing to its dermatological and microbial benefits.

- β -Glucans form a protective, moisture-retaining gel layer that adheres to the skin, promoting hydration, elasticity, and wound healing.
- Avenanthramides, exclusive to oats, provide powerful anti-inflammatory and anti-itch effects.
- Saponins offer natural cleansing and mild antimicrobial action.
- Lipids and ceramide-like molecules help rebuild damaged skin barrier layers.
- Phenolic compounds neutralize oxidative stress and inhibit microbial enzymes.

This biochemical richness allows oat milk to address multiple dermatological pathways simultaneously.

Importance of Oat Milk in Veterinary Dermatology

1. Anti-Inflammatory and Anti-Pruritic Effects

Inflammation is a central component of most veterinary skin disorders. Oat milk's avenanthramides inhibit inflammatory mediators such as:

- NF- κ B
- COX-2



- IL-6
- TNF- α

This results in reduced redness, decreased heat and swelling, relief from scratching and irritation. This makes oat milk particularly beneficial for conditions like allergic dermatitis, flea allergy dermatitis, mange irritation, and chronic pruritus.

2. Skin Barrier Restoration

Animals frequently suffer barrier damage from Environmental factors, Parasites, excessive licking or scratching, harsh grooming products. Oat milk restores the barrier through:

- β -glucan film formation
- Ceramide-like lipid replacement
- Protein-supported keratinocyte regeneration
- A repaired barrier prevents further microbial invasion and moisture loss.

3. Deep Moisturization and Hydration

Oat β -glucans act as humectants capable of attracting moisture, retaining hydration for extended periods, preventing scaling and dryness. Hydrated skin is less prone to infections, lesions, and micro-tears.

4 .Wound-Healing Support

Oat milk accelerates tissue repair by stimulating collagen synthesis, enhancing epithelial cell migration, locking moisture in wound beds, protecting lesions from external contaminants. This helps in recovery from bite marks, abrasions, hotspots, and post-parasitic wounds.

Microbial Activity of Oat Milk in Veterinary Use

Oat milk is not a strong antibiotic but exhibits meaningful low-level antimicrobial, anti-adhesive, and microbiome-supportive activity. These are critically important because they do not induce antimicrobial resistance.

1. Mild Antibacterial Action

Oat milk inhibits growth of common pathogens such as:

- *Staphylococcus aureus*
- *Staphylococcus pseudintermedius*
- *Streptococcus pyogenes*
- *E. coli*

Mechanisms include mild disruption of microbial membranes by saponins, inhibition of bacterial enzymes by phenolic antioxidants, reduction of oxidative stress associated with infections, film-forming β -glucans creating an unfavorable surface for bacterial proliferation. This gentle antibacterial action supports recovery without harming beneficial flora.

2. Antifungal and Anti-Yeast Effects

Oat milk indirectly suppresses fungal growth by blocking fungal adhesion to the skin, maintaining moisture balance, providing anti-inflammatory relief from yeast-induced irritation. This makes it helpful in managing mild fungal infections, yeast dermatitis, and dandruff.

3. Anti-Adhesive Mechanism

β -glucans create a soft, protective film over the skin that Prevents bacteria and fungi from attaching, reduces biofilm formation, blocks the first step of skin infection. This mechanism is



essential in preventing colonization by pathogens like *Staphylococcus*.

Oat Milk is a best alternative to Antibiotic-Based Dermatological Care

Oat milk provides:

- Non-antibiotic antimicrobial activity
- No risk of antimicrobial resistance
- Microbiome protection
- Gentle, natural skin healing
- Multimodal action (soothing + barrier repair + pathogen prevention)

Thus, oat milk is an ideal ingredient for regular veterinary skin care products like shampoos, soaps, sprays, and lotions.

COLD PROCESS METHOD

Making Process of Bottom Layer (Neem Layer)

STEP 1: Preparation of Alkali Solution

The calculated quantity of sodium hydroxide was slowly added to distilled water with continuous stirring. The alkali solution was prepared under controlled conditions and allowed to cool to room temperature. The solution was kept aside until further use.

STEP 2: Preparation of Oil Phase

The required quantities of coconut oil, castor oil, olive oil, and shea butter were accurately weighed and melted together using gentle heating. After complete melting, the oil mixture was allowed to cool to a temperature comparable to that of the alkali solution.



STEP 3: Emulsification and Saponification

The cooled alkali solution was slowly poured into the oil phase with continuous blending. The mixture was stirred using a hand blender in short bursts until light trace was achieved, indicating the initiation of the saponification reaction.



STEP 4: Incorporation of Neem Phase

The prepared neem mixture was gradually added to the soap batter at light trace. Continuous gentle stirring was performed to ensure uniform incorporation without curdling or separation.

STEP 5: Pouring of Bottom Layer

The homogeneous soap batter was carefully poured into the mould to form the bottom layer. The mould was gently tapped to eliminate entrapped air bubbles. The poured soap was

allowed to partially set at room temperature until a firm but slightly tacky surface was obtained. This step ensured proper adhesion with the subsequent top layer.



Making Process of Top Layer (Oatmilk-Aloe Vera Layer)

STEP 1: Preparation of Alkali Solution

The calculated quantity of sodium hydroxide was slowly added to distilled water with continuous stirring. The alkali solution was prepared under controlled conditions and allowed to cool to room temperature. The solution was kept aside until further use.

STEP 2: Preparation of Oatmilk-Aloe Vera Liquid Phase

Fresh oatmilk was prepared and filtered to remove coarse particles. Aloe vera juice was added to the oatmilk and mixed thoroughly to obtain a uniform liquid phase. The mixture was maintained at low temperature to prevent degradation of bioactive constituents.



STEP 3: Preparation of Oil Phase

The required quantities of coconut oil, castor oil, olive oil, and shea butter were accurately weighed and melted together using gentle heating. After complete melting, the oil mixture was allowed to cool to a temperature comparable to that of the alkali solution.



STEP 4: Emulsification and Saponification

The cooled alkali solution was slowly poured into the oil phase with continuous blending. The mixture was stirred using a hand blender in short bursts until light trace was achieved, indicating the initiation of the saponification reaction.



STEP 5: Incorporation of Oatmilk–Aloe Vera Phase

The prepared oatmilk–aloe vera mixture was gradually added to the soap batter at light trace. Continuous gentle stirring was performed to ensure uniform incorporation without curdling or separation.



STEP 6: Pouring of Top Layer

The homogeneous soap batter was carefully poured into the mould to form the bottom layer. The mould was gently tapped to eliminate entrapped air bubbles. The poured soap was allowed to partially set at room temperature until a

firm but slightly tacky surface was obtained. This step ensured proper adhesion with the subsequent top layer.



Future Scope of veterinary herbal products:

The future scope of veterinary herbal products is remarkably promising, driven by rising global demand for safe, sustainable, and resistance-free alternatives to chemical-based veterinary care. As concerns about antimicrobial resistance, toxicity, environmental contamination, and antibiotic overuse intensify, herbal formulations are emerging as strong candidates for mainstream veterinary therapeutics, grooming, nutrition, and preventive healthcare. Growing scientific evidence on plant-derived antimicrobials, anti-inflammatory phytonutrients, and natural wound-healing agents supports the expansion of herbal products into dermatology, parasitic control,

gastrointestinal health, pain management, and immune modulation. In dermatology, herbal ingredients such as neem, aloe vera, oats, turmeric, calendula, and herbal oils demonstrate strong potential to replace synthetic corticosteroids, antibiotics, and antifungals especially for long-term conditions like dermatitis, fungal infections, hotspots, and eczema. The trend toward chemical-free grooming products for pets, livestock, and companion animals is accelerating, with a future demand for herbal soaps, shampoos, sprays, tick-repellents, hoof-care balms, and skincare formulations.

Advances in herbal nanotechnology, microencapsulation, and phyto-extraction will allow better stability, deeper penetration, and controlled release of herbal actives, making veterinary herbal products more effective and scientifically reliable. Additionally, consumer awareness about animal welfare and organic farming practices is leading to increased acceptance of herbal feed supplements, probiotic-herbal blends, and plant-based nutraceuticals. The livestock industry is also shifting toward herbal growth promoters, natural immune enhancers, and botanical anti-parasitics as regulations tighten on antibiotic use. Integration of herbal medicine with tele-veterinary care, AI-assisted diagnosis, and precision farming will further support the development of customized herbal treatment kits for individual animals or herds. Environmental sustainability also plays a central role in the future expansion of veterinary herbal products, as plant-based formulations reduce chemical runoff, improve soil and water safety, and promote a circular, eco-friendly animal-care ecosystem. Overall, the future of veterinary herbal products lies in scientific validation, advanced formulation technologies, regulatory support, and rising global preference for natural, holistic, and

environmentally conscious animal healthcare solutions.

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