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FORMULATION AND EVALUATION OF A HERBAL ANTI-ACNE LOTION CONTAINING AVOCADO OIL AND CINNAMON BARK EXTRACT

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ABSTRACT

The current study focuses on the formulation and evaluation of a novel herbal skin lotion incorporating avocado oil and cinnamon bark extract, aimed at providing antibacterial activity against *Propionibacterium* species, a primary causative agent of acne. Avocado oil was extracted via wet milling and centrifugation, while cinnamon bark extract was obtained through the decoction method. The lotion was formulated using standard emulsification techniques, combining oil and aqueous phases with appropriate stabilizers and preservatives. Evaluation of the final formulation revealed desirable physicochemical properties including a pH of 8.1, good spreadability (7.7 cm), smooth consistency, easy washability, and no signs of skin irritation. FTIR spectroscopy confirmed the compatibility of all components, with no observed chemical interactions. The antimicrobial efficacy was assessed using the agar well diffusion method. The herbal lotion demonstrated a moderate zone of inhibition (12 mm) against *Propionibacterium* spp., as compared to ciprofloxacin (29 mm), indicating its potential as a supplementary topical antibacterial agent. The study concludes that the formulation is a promising, skin-friendly, plant-based alternative with mild antibacterial properties suitable for cosmetic and dermatological use.

KEYWORDS: Avocado oil, Cinnamon bark extract, Herbal lotion, *Propionibacterium* spp, Antibacterial activity, Anti-acne formulation.

1. INTRODUCTION

Herbal formulation involves the natural ingredients which are used in cosmetic products. The features of the herbs are well-known. For example avocado, cinnamon, aloe vera etc. The origin of ayurveda in India by Rishi's also denotes the best of ayurvedic herbs. The formulation which contains the herbs are proved by ayurveda. Herbal remedies in rich the bodies with nutrients with other useful minerals. An herbal lotion that can give effective protection to skin and free from any toxicity. As they are natural and are found to be safe to use as compared to chemical based formulation.

Lotions are semi-liquid form it directly applied on the body. The benefits of coconut milk, honey, and alovera, the richness of saffron help to nourish the skin and also prevent dryness of skin during summer and winter season and slightly brings glow on the skin. The lotion act as a cooling, soothing or for protective purpose. Herbal lotion is a natural skincare product formulated using plant-based ingredients such as essential oils,

herbal extracts, and natural butters. Unlike conventional lotions that may contain synthetic chemicals or artificial fragrances, herbal lotions aim to nourish and heal the skin using the therapeutic properties of herbs.

1.1 HERBAL LOTION

Herbal lotions are concoctions made with phytochemicals derived from various plant sources, which impact skin functions and supply essential nutrients for maintaining healthy skin. A natural and safe alternative to chemical-based formulations is a herbal lotion that effectively blocks odours without posing any harm. Lotions are applied directly on the body and come in a semi-solid state. Herbal lotions are described as products that are made using different cosmetic substances that are allowed to be used as a basis, and then one or more herbal ingredients are added to give a specific cosmetic benefit.

1.2 TYPES OF HERBAL LOTIONS

Face Lotion: These are also known as bleaching creams, and they do more to conceal skin tone than to lighten it. similar to whitening lotions.

Shaving Lotions: The content of after-shave lotions is often similar to that of astringent lotions, with a larger percentage acting as a moderate antiseptic to help prevent infection of any abrasion.

Hair Lotion: The hair follicles are stimulated with hair lotion. Typically, they are scented with stimulating oil.

By Skin Type Targeted

- ✓ **Dry Skin**: Lotions With Almond Oil, Aloe Vera, & Shea Butter
- ✓ **Oily/Acne-Prone Skin**: Witch Hazel, Tea Tree, Neem
- ✓ **Sensitive Skin**: Chamomile, Calendula, Lavender
- ✓ **Mature Skin**: Rosehip, Green Tea, Ginseng

By Formulation Type

- ✓ **Water-based lotions**: Light, suitable for oily/normal skin
- ✓ **Oil-based lotions**: Richer, good for dry skin
- ✓ **Emulsions or creams**: Thicker lotions with both oil and water
- ✓ **Gel-based lotions**: Often lighter and cooling (e.g., aloe vera gel)

By Regulatory or Marketing Category

- ✓ **Cosmetic lotions**: Marketed for beauty and general skincare
- ✓ **Ayurvedic or traditional medicine**: Based on traditional herbal systems (e.g., Ayurveda, TCM)
- ✓ **Pharmaceutical or medicated lotions**: Require regulatory approval for claims like treating eczema, psoriasis, etc.

1.3 BENEFITS OF HERBAL LOTION

Natural Hydration: Herbal lotions deeply moisturize the skin without clogging pores, thanks to natural ingredients like aloe vera, shea butter, and coconut oil.

Gentle on Sensitive Skin: Free from harsh chemicals, herbal lotions are less likely to cause allergic reactions or irritation.

Rich in Antioxidants: Herbs like green tea, chamomile, and calendula help fight free radicals, promoting healthy and youthful skin.

Anti-inflammatory Properties: Ingredients like turmeric, neem, and lavender can reduce redness, swelling, and skin irritation.

Supports Healing: Many herbal lotions include wound-healing herbs such as comfrey, gotu kola, or calendula, which speed up the repair of minor cuts, burns, or rashes.

Aroma therapeutic Benefits: The natural scents from herbs and essential oils (like lavender or eucalyptus) can also offer calming or energizing effects.

Fig 1: Marketed Skin Lotion.

2. PLANT PROFILE

2.1 AVOCADO FRUIT

Fig 2: Avocado.

Common Names

- ✓ Avocado
- ✓ Alligator Pear
- ✓ Butter Fruit (in some regions)

Plant Description

- ✓ **Type:** Evergreen tree
- ✓ **Height:** 10–15 meters (33–50 feet), can grow taller under ideal conditions
- ✓ **Leaves:** Dark green, glossy, elliptical, 12–25 cm long
- ✓ **Flowers:** Small, greenish-yellow, not showy, pollinated by insects

Scientific Classification

- ✓ **Scientific Name:** *Persea americana*
- ✓ **Family:** Lauraceae (Laurel family)
- ✓ **Genus:** *Persea*
- ✓ **Species:** *P. americana*

Nutritional Benefits

- ✓ **Rich In:** Healthy fats (monounsaturated, especially oleic acid), Fiber, Potassium, Vitamins C, E, K, and B-complex (especially folate)
- ✓ **Health Benefits:** Supports heart health, Aids digestion, Promotes skin and hair health, Anti-inflammatory and antioxidant properties

Fruit Characteristics

- ✓ **Type:** Large berry with a single large seed (pit)
- ✓ **Shape:** Pear-shaped, round, or oval depending on variety
- ✓ **Skin:** Leathery, can be smooth or rough; green to dark purple/black when ripe
- ✓ **Flesh:** Creamy, pale green to yellow; rich and buttery texture
- ✓ **Flavor:** Mild, nutty, slightly sweet

Chemical Constituents of Avocado

Table 1: Chemical Constituents Of Avocado.

Component Type	Key Compounds	Functions
Fatty Acids	Oleic acid (omega-9), palmitic acid, linoleic acid	Moisturizing, anti-inflammatory, improves skin barrier
Vitamins	Vitamin A, Vitamin D, Vitamin E, Vitamin C, B-vitamins	Antioxidant, skin healing, promotes collagen
Phytosterols	Beta-sitosterol, stigmasterol	Anti-inflammatory, protects against UV damage
Carotenoids	Lutein, zeaxanthin, beta-carotene	Antioxidant, protects against skin aging
Proteins & Amino Acids	Various	Nourish and repair skin
Squalene	Natural skin emollient	Deep hydration, antioxidant, helps with scars

Uses of Avocado in Herbal Lotions

Table 2: Uses of Avocado in Herbal Lotions.

Use	Benefits in Herbal Lotion
Moisturizer	Deeply hydrates and nourishes dry, rough, or flaky skin
Anti-aging agent	Rich in antioxidants that reduce fine lines and wrinkles
Healing aid	Helps soothe and repair damaged or inflamed skin (e.g., sunburn, eczema)
Skin softener	Improves skin elasticity and smoothness
Antioxidant protection	Neutralizes free radicals, preventing oxidative stress
Collagen booster	Vitamin C and E support collagen synthesis and skin firmness
UV protection support	Offers mild natural sun protection and post-sun care relief
Scar and stretch mark treatment	Promotes regeneration of skin tissue and fades marks over time

2.2 CINNAMON BARK

Fig 3: Cinnamon Bark.

Common Names

- ✓ Cinnamon
- ✓ True Cinnamon
- ✓ Ceylon Cinnamon (from *Cinnamomum verum*)
- ✓ Cassia (from *Cinnamomum cassia*, also called Chinese cinnamon)

Scientific Classification

- ✓ **Kingdom:** Plantae
- ✓ **Family:** Lauraceae
- ✓ **Genus:** *Cinnamomum*
- ✓ **Species:** *Cinnamomum verum* (True/Ceylon cinnamon), *Cinnamomum cassia* (Cassia or Chinese cinnamon)

Botanical Description

- ✓ **Plant Type:** Evergreen tree
- ✓ **Height:** 10–15 meters (33–50 feet)
- ✓ **Leaves:** Oval, leathery, dark green, aromatic when crushed
- ✓ **Bark:** Smooth, brown, aromatic; harvested and dried as spice
- ✓ **Flowers:** Small, yellow-white with a distinct odor
- ✓ **Fruit:** Small, dark purple drupe (not commonly used)

Other Traditional & Medicinal Uses

- ✓ **Digestive aid** – relieves indigestion, nausea
- ✓ **Anti-diabetic** – may help regulate blood sugar levels
- ✓ **Cold remedy** – used in teas and syrups
- ✓ **Oral care** – breath fresheners, gum, mouthwash
- ✓ **Insect repellent** – due to strong scent and essential oils

Chemical Constituents of Cinnamon Bark

Table 3: Chemical Constituents Of Cinnamon Bark.

Compound	Type	Function
Cinnamaldehyde	Aromatic aldehyde	Gives cinnamon its distinctive smell and flavor; antibacterial, anti-inflammatory
Eugenol	Phenolic compound	Analgesic and antiseptic properties (more in *C. verum*)
Coumarin	Natural compound	Blood-thinning properties (high in *C. cassia*, low in *C. verum*)
Tannins	Polyphenols	Astringent, antimicrobial
Terpenoids	Volatile oils	Antioxidant and fragrance properties
Mucilage	Polysaccharide	Soothing effect, used in skin care

Uses of Cinnamon Bark in Herbal Lotions and Skincare

Table 4: Uses of Avocado in Herbal Lotions.

Use	Benefit
Antiseptic	Helps cleanse skin and reduce bacterial growth
Anti-inflammatory	Soothes inflamed or irritated skin
Astringent	Tightens skin, reduces oiliness
Circulation booster	Promotes blood flow, may help reduce cellulite and puffiness
Antioxidant	Protects skin from free radical damage and aging
Aromatic	Used for warm, spicy fragrance in body lotions and oils

3. MATERIALS AND METHODS

3.1 EXTRACTION

3.1.1 Avocado Oil Extraction Procedure

The extraction of avocado oil begins with the careful selection of ripe, high-quality avocados that are soft but not overripe, avoiding any that show signs of rot, mold, or damage. The avocados are then thoroughly washed to eliminate dirt and pesticide residues. Each fruit is cut in half, the seed is removed, and the green flesh is scooped out, while the skin and pit are discarded. The extracted avocado flesh is then pulped or mashed using a blender or food processor until it forms a smooth paste with a texture similar to guacamole. Optionally, this paste can be slightly warmed to about 45–50°C (113–122°F) to facilitate oil release.

For oil extraction, the wet milling and centrifugation method is employed. Water is added to the avocado paste and mixed thoroughly. The mixture is then gently heated to around 45°C before being centrifuged to separate its components. This process yields a top oil layer, with water and solid residues settling at the bottom. The oil is carefully decanted from the top layer. Finally, the extracted avocado oil is stored in dark glass bottles to protect it from light and oxidation. These bottles should be kept in a cool, dry place or refrigerated to extend shelf life.

3.1.2 Cinnamon Bark Extract via Decoction Method

To extract cinnamon bark using the decoction method, coarsely broken or chopped dried cinnamon bark is first weighed and prepared, typically using a ratio of 1 part bark to 10 parts water by volume. The bark is placed in a pot, and the required amount of cold distilled water is added. The mixture is brought to a boil over medium heat and then reduced to a gentle simmer, continuing for 30 to 60 minutes depending on the desired concentration.

After simmering, the mixture is removed from the heat and allowed to cool to room temperature. The cooled decoction is filtered through cheesecloth or a fine mesh filter to remove bark particles, and an additional filtration using filter paper may be performed for greater clarity. To preserve the extract, ethanol (20–25%) can be added, or it can be refrigerated if preservatives are not used—though in such cases, the shelf life is approximately one week. The final extract is stored in a sterile amber glass bottle with a tightly sealed cap and labeled with the preparation date and concentration.

3.2 FORMULATION OF HERBAL SKIN LOTION

Table 5: Formulation Of Herbal Skin Lotion.

S.NO	PHASE	INGREDIENT	QUANTITY
1	Oil Phase	Bees Wax	4g
		Carbopol 934	0.3g
		Liquid Paraffin	15ml
		Stearic Acid	2g
		Vitamin E	0.5ml
		Avocado Oil	5ml
2	Water Phase	Cinnamon Bark Extract	5ml
		Citric Acid	0.5g
		Methyl Paraben	0.05g
		Propyl Paraben	0.02g
		Borax	0.5g
		Rose Water	Q.S

Procedure: To prepare the herbal lotion, the ingredients are divided into two main phases: the oil phase and the water phase. Begin by preparing the oil phase. In a clean beaker, combine 4 g of beeswax, 2 g of stearic acid, 15 ml of liquid paraffin, 5 ml of avocado oil, 0.5 ml of vitamin E, and 0.3 g of Carbopol 934. Place the beaker in a water bath and heat the mixture to approximately 70–75°C, stirring gently until all components are melted and a homogenous solution is formed. Separately, prepare the water phase in another beaker. To this, add a sufficient quantity of rose water to make up the final volume to 100 ml. Then incorporate 5 ml of cinnamon bark extract, 0.5 g of citric acid, 0.5 g of borax, 0.05 g of methyl paraben, and 0.02 g of propyl paraben. Heat this water phase to the same temperature (70–75°C), ensuring that all ingredients dissolve completely.

Once both phases have reached the same temperature, slowly add the hot water phase to the oil phase with continuous stirring. Use a mechanical stirrer or homogenizer to ensure proper emulsification. Continue stirring for about 10 to 15 minutes while maintaining the temperature. After emulsification, begin to cool the mixture gradually, maintaining continuous stirring throughout the cooling process. As the emulsion cools to around 40°C, measure the pH using a pH meter or indicator strips. The desired pH for skin application is between 5.5 and 6.5. If necessary, adjust the pH using a small amount of citric acid or triethanolamine (TEA). Continue mixing until the lotion reaches room temperature and attains a stable, creamy consistency.

Once the lotion is fully formed and cooled, transfer it into clean, sterilized containers, preferably amber or opaque to protect the product from light. Label each container with relevant information such as the product name, batch number, and date of manufacture. The resulting lotion should have a smooth, non-greasy texture, a mild herbal fragrance, and good spreadability. When preserved properly and stored in a cool, dry place away from direct sunlight, the lotion can have a shelf life of approximately 6 to 12 months.

3.3 EVALUATION PARAMETERS

Appearance: The color, odor and homogeneity of the lotion were visually determined.

Consistency and Grassiness: Both this parameter was performed on the skin. They both were checked by applying on skin.

pH: Lotion pH was measured with a digital pH meter. The pH meter was calibrated using standard buffer solution. About 5 ±0.01 g of the lotion was weighed in a 100 ml beaker and dissolved in 45.0 ml of distilled water and dispersed the lotion in it. The pH of lotion was measured at 27ousing the pH meter.

Smoothness: The smoothness of the lotion formulation was tested by rubbing between the fingers and observes whether the lotion is smooth, clumped, and homogenous or rough.

Spreadability test: 0.1g Sample was applied between two glass slides and was compressed to uniform thickness by placing 100gm weight for 5minutes. Weight was added to the pan. The Spreadability was calculated by using radius of circle formed by compressed slide.
Spreadability =m*l/t

m = Weight tide to upper slide
l = length moved on the glass slide
t = time taken.

Washability: A portion of lotion was applied over the skin of hand and allowed to flow under the force of flowing tap water for 10 minutes. The time when the lotion completely removed was noted.

Homogeneity: The formulation was tested for homogeneity by visual appearance and by touch.

Absorbency: Rated at which product is perceived to be absorbed into skin. Evaluated by noting changes in skin surface. Rated slow-moderated-fast.

Viscosity: The measurement of viscosity of the prepared gel was done with a Brookfield viscometer spindle no.7 and speed 60rpm at 25^{o}C. The formulated lotion was directly immersed into the spindle and the viscosity was measured.

Irritancy test: The formulated lotion shows no redness, edema, irritation and inflammation during studies. The formulated cream is safe to use.

Fourier Transform Infrared Spectroscopy (FTIR): In order to check the integrity (Compatibility) of drug in the formulation, FT-IR spectra of the formulations along with the drug and other excipients were obtained and compared using FT-IR spectrophotometer. In the present study, Potassium bromide (KBr) pellet method was employed. The samples were thoroughly blended with dry powdered potassium bromide crystals. The mixture was compressed to form a disc. The disc was placed in the spectrophotometer and the spectrum was recorded. The FT-IR spectra of the formulations were compared with the FT-IR spectra of the pure drug and the polymers. An infrared spectrum of pure drug, mixture of drug with each retardant and physical mixture of optimized formulation was recorded using FTIR Spectrophotometer. The scanning range was 500–4000 cm^{-1} and the IR spectra of samples were obtained using KBr disc method. Any change in spectrum pattern of drug due to presence of polymers was investigated to identify any chemical interaction.

Anti-Bacterial Activity
Ager Well Diffusion
Preparation of Inoculum: Grow Propionibacterium spp. in nutrient broth for 24–48 hours under anaerobic conditions until it reaches 0.5 McFarland turbidity (~1.5 × 10^{8} CFU/mL).

Inoculation of Agar Plate: Pour sterilized and cooled Mueller-Hinton Agar into Petri dishes. Once solidified, spread 100 µL of bacterial inoculum evenly over the surface using a sterile swab to create a lawn culture.

Well Formation: Using a sterile cork borer or pipette tip, punch uniform wells (6–8 mm in diameter) into the agar. Remove the agar plugs carefully.

Addition of Samples: Fill each well with 50–100 µL of the test sample**.** One well should be filled with Ciprofloxacin solution (standard concentration: 5–10 µg) as the positive control**.** Include a blank or solvent-only well as the negative control (e.g., distilled water or ethanol if used as solvent).

Pre-diffusion (Optional): Allow the plate to stand at room temperature for 30–60 minutes to enable diffusion of the sample into the agar.

Incubation: Incubate plates at 37°C for 24–48 hours in an anaerobic chamber or GasPak jar**.**

Measurement of Zone of Inhibition: After incubation, measure the diameter of the inhibition zones (including the well) in millimeters using a ruler or caliper.

4. RESULTS AND DISCUSSION

4.1 EVALUATION OF HERBAL SKIN LOTION

Table 6: Evaluation Of Herbal Skin Lotion.

S.NO	CHARACTERISTICS	PARAMETERS
1	Colour	Greenish White
2	Odour	Rose Like
3	pH	8.1
4	Smoothness	Smooth
5	Consistency	Grease
6	Spreadibility	7.7cm
7	Washability	Easily washable in water
8	Viscosity	3.9 Poise
9	Homogeneity	Homogeneous
10	Irritation	Moderated
11	Absorbency	Nil

Fig 4: Herbal Skin Lotion.

4.2 Anti-Bacterial Activity

Table 7: Anti-Bacterial Activity.

S.NO	Microorganisms	Control	AE	CE	HSL	Ciprofloxacin
		Zone of inhibition in mm				
1.	*Propionibacterium sps*	-	10	11	12	29

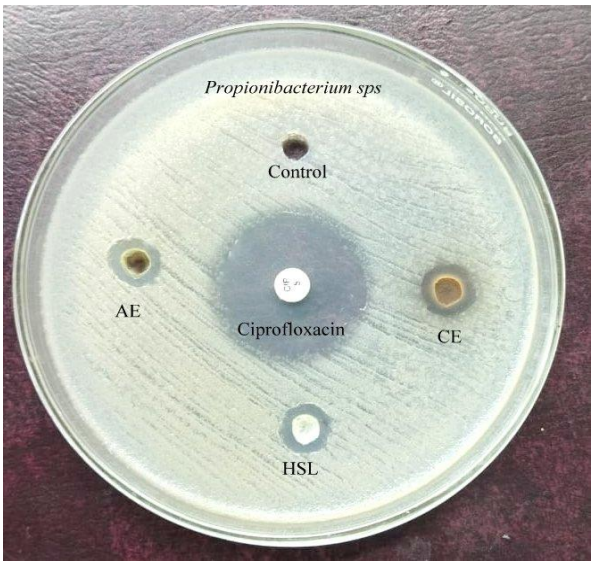
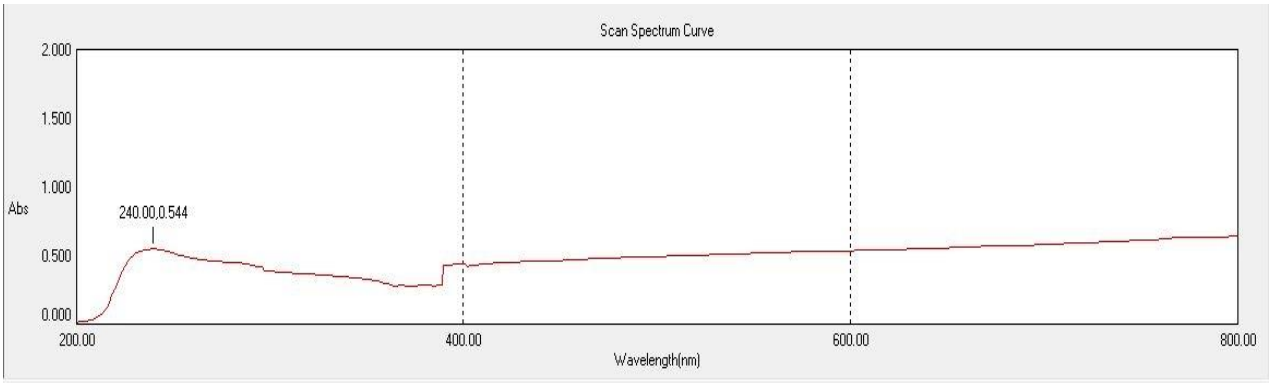


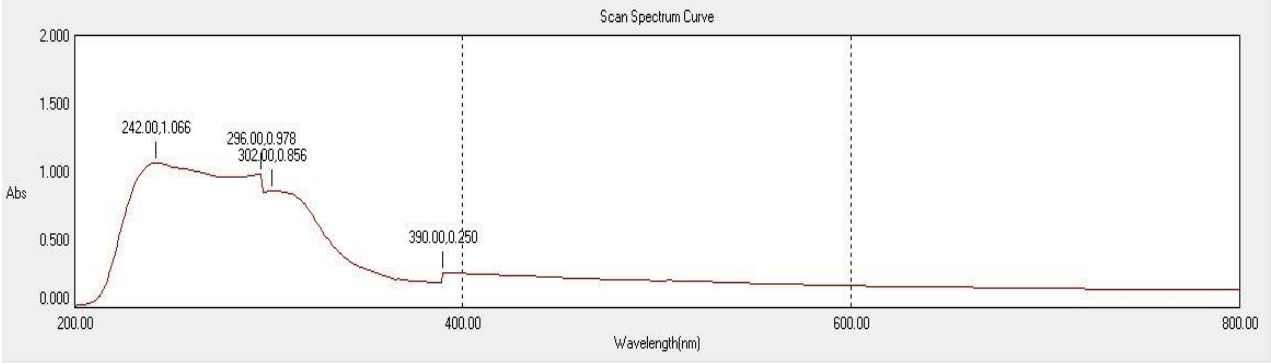
Fig 5: Anti-Bacterial Activity.

4.3 UV – SPECTRUM



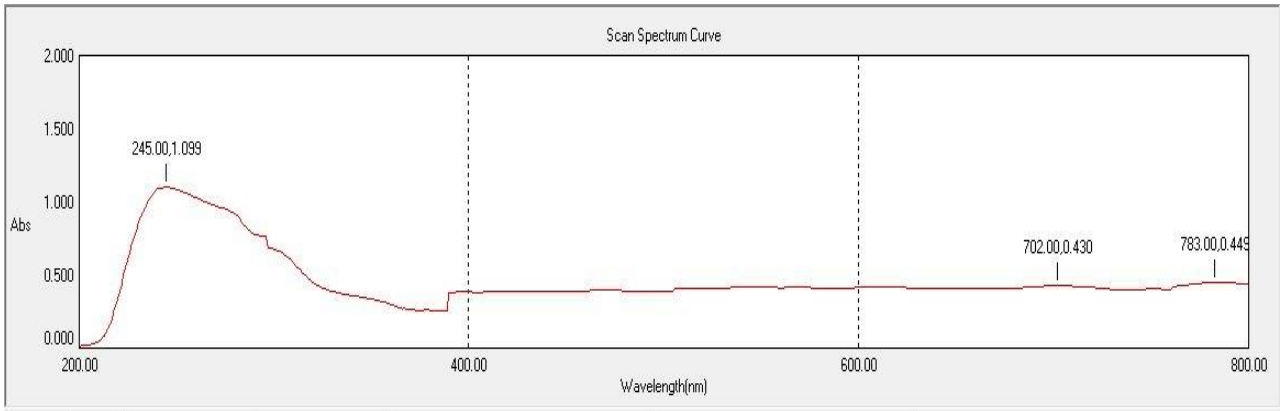
No.	P/V	Wavelength(nm)	Abs	Comment
1		240.00	0.544	

Fig 6: UV Spectrum Of Avocado Oil.



No.	P/V	Wavelength(nm)	Abs	Comment
1		390.00	0.250	
2		302.00	0.856	
3		296.00	0.978	
4		242.00	1.066	

Fig 7: UV Spectrum Of Cinnamon Bark Extract.



No.	P/V	Wavelength(nm)	Abs	Comment
1		783.00	0.449	
2		702.00	0.430	
3		245.00	1.099	

Fig 8: UV Spectrum Of Herbal Skin Lotion.

4.4 IR SPECTRUM

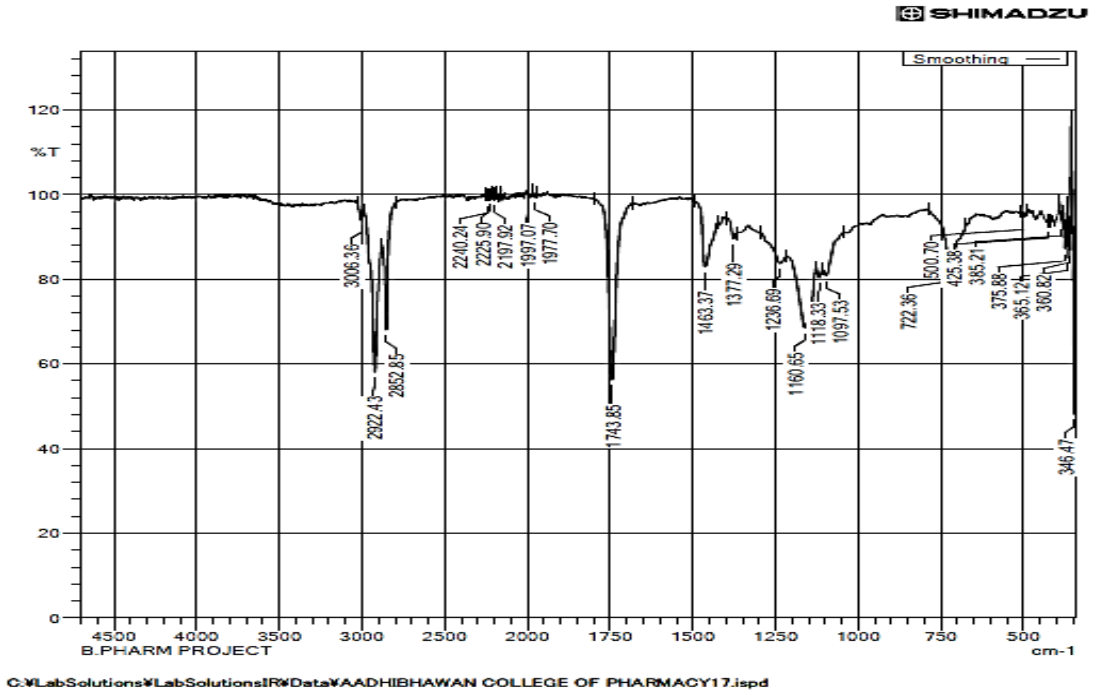


Fig 9: IR Spectrum Of Avocado Oil.

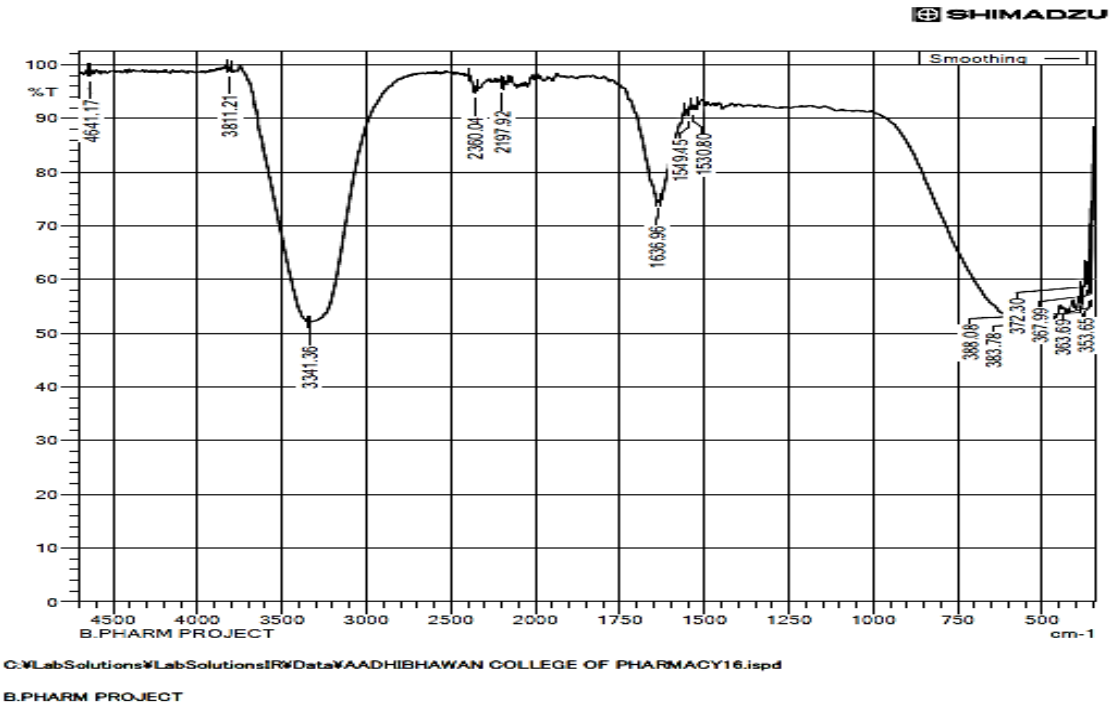


Fig 10: IR Spectrum Of Cinnamon Bark Extract.

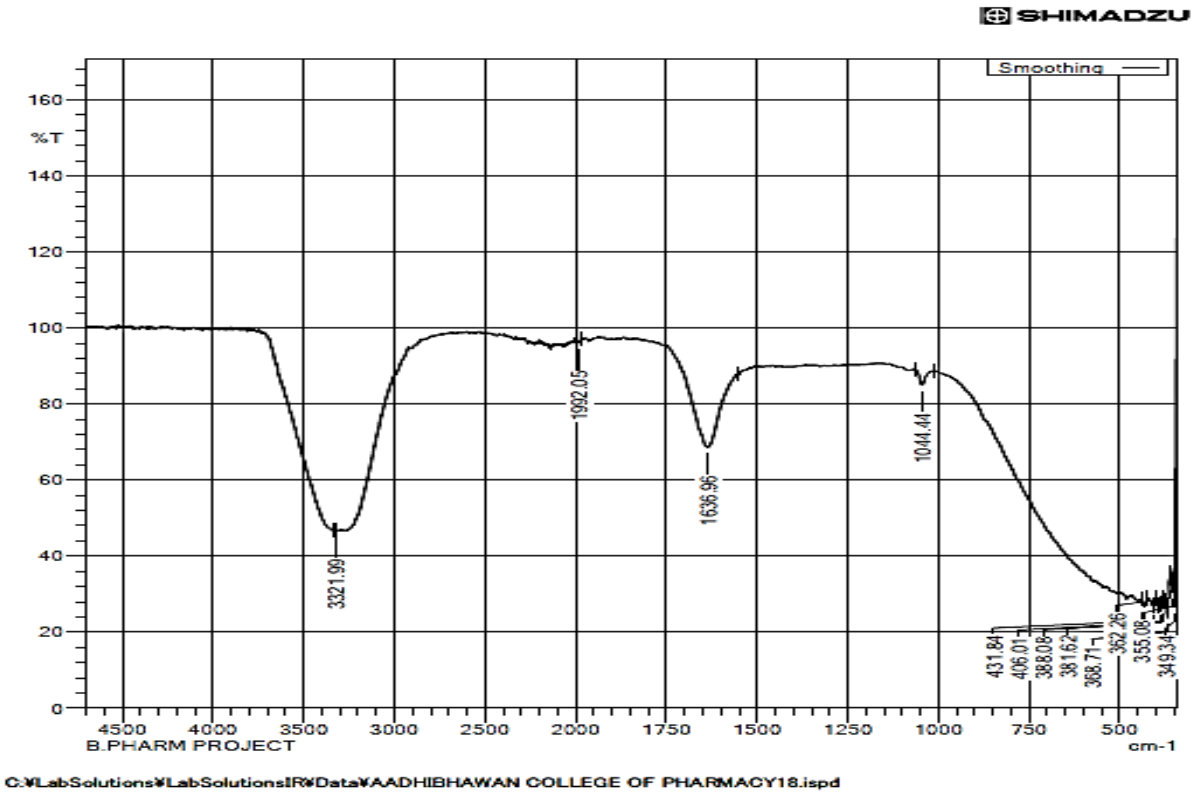


Fig 11: IR Spectrum Of Herbal Skin Lotion.

4.5 LABEL & INSTRUCTIONS

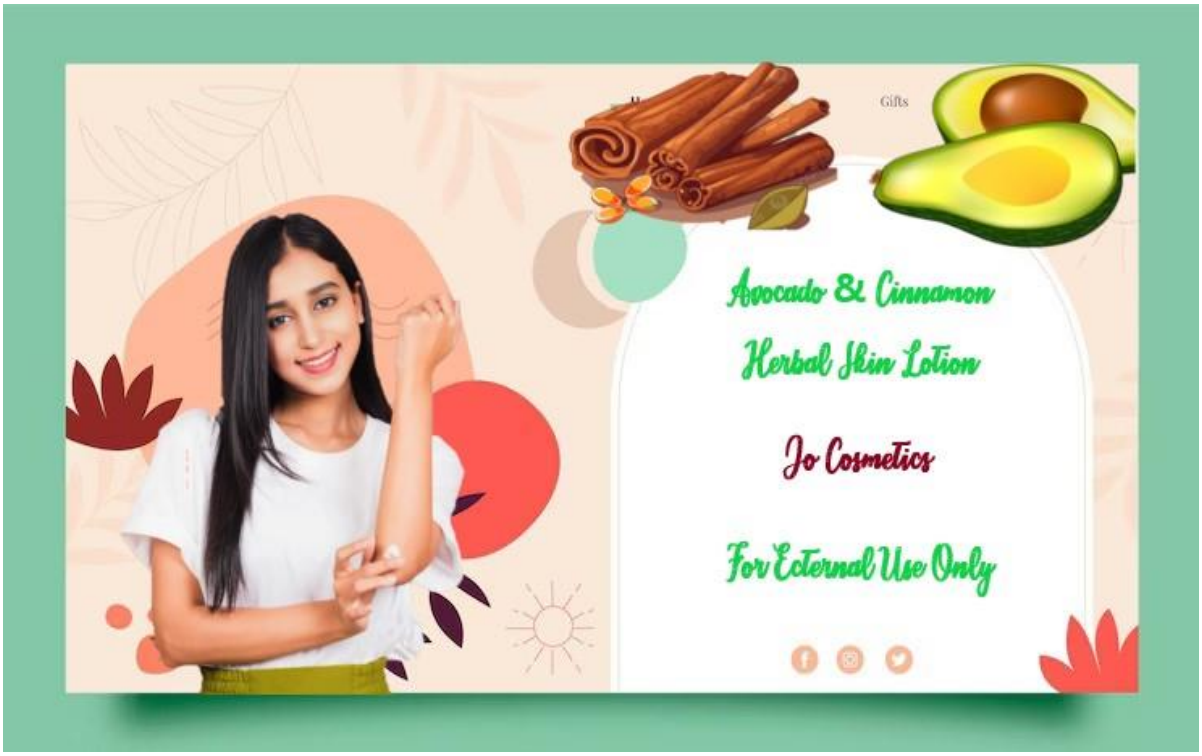


Fig 12: Label & Instructions.

DISCUSSION

The herbal skin lotion demonstrated effective antibacterial activity against *Propionibacterium* spp., albeit less potent than ciprofloxacin (12 mm vs. 29 mm inhibition zones), confirming moderate efficacy. Agar well diffusion, standardized under anaerobic conditions, reliably isolated the therapeutic effects of the lotion, as negative controls showed no activity. Such methodology is well-supported in the literature as appropriate for acne bacteria, particularly *P. acnes*. Ciprofloxacin's large inhibition zone aligns with prior susceptibility data showing strong fluoroquinolone activity against *P. acnes*. Cinnamon bark extracts likewise have demonstrated zones up to 18 mm and MICs around 256 µg/mL versus *P. acnes*. The combination of avocado oil and beeswax likely contributed to lotion consistency but may also support skin barrier function, indirectly improving antimicrobial efficacy. FTIR spectra comparisons between pure compounds and the formulation indicated no chemical interactions, supporting ingredient compatibility. Similar compatibility assessments are routinely performed in topical formulations. Physical evaluations, including pH (8.1), viscosity (3.9 poise), spreadability (7.7 cm), homogeneity, absence of clumping, moderate absorbency, and negligible irritation, confirm the product's suitability for topical application. These characteristics meet acceptable cosmetic standards and are consistent with other herbal-based lotions.

5. CONCLUSION

The formulated herbal skin lotion, incorporating avocado oil and cinnamon bark extract, exhibits moderate antibacterial efficacy against *Propionibacterium* spp. while maintaining desirable physicochemical and sensory properties. Although efficacy is lower than the ciprofloxacin control, the lotion's natural profile, good skin tolerance, and broad applications support its potential as a complementary topical agent. Future work should include quantitative MIC/MBC testing (e.g., broth microdilution), stability studies, and clinical evaluation to validate efficacy in acne management.

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