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Formulation and evaluation of vitiligo cream

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1. Introduction :

Vitiligo is a chronic skin condition characterized by the loss of pigment, resulting in white patches of skin. This occurs when melanocytes, the cells responsible for producing melanin (the pigment that gives skin its color), are destroyed or malfunction. Vitiligo can affect people of all ages, races, and genders, though it is more noticeable in individuals with darker skin tones. The exact cause of vitiligo remains unclear, though it is believed to be an autoimmune disorder.(1)

In autoimmune conditions, the body's immune system mistakenly attacks its own healthy cells. In the case of vitiligo, the immune system appears to target melanocytes. Genetic factors are also thought to play a role, as the condition tends to run in families, though environmental triggers such as stress, sunburn, or chemicals may also contribute to its development. Vitiligo can develop gradually or suddenly, with patches of depigmentation occurring in different areas of the body, such as the face, hands, arms, feet, and even mucous membranes.(2) The severity and extent of the condition can vary widely among individuals, with some experiencing only a few small patches, while others may have widespread depigmentation. While vitiligo is not painful and does not cause physical harm to the body, it can have a significant psychological impact. Many individuals with vitiligo experience emotional distress due to the visibility of the condition, which can lead to issues with selfesteem, anxiety, and social stigma.(3)

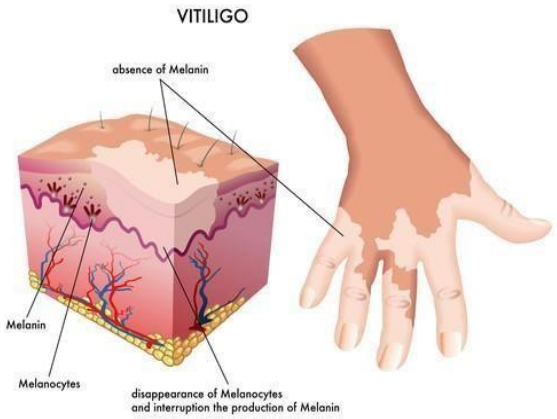
As a result, treatment options for vitiligo not only focus on managing the physical aspects of the condition but also on addressing the emotional and psychological effects. There is no cure for vitiligo, but various treatments can help manage and improve the appearance of the skin. These may include topical corticosteroids, phototherapy (light therapy), and in some cases, surgical options such as skin grafts or depigmentation therapy.

Traditional treatments for vitiligo often involve the use of topical corticosteroids, immunosuppressive agents, and phototherapy. However, these treatments come with limitations, including side effects, the need for prolonged use, and variability in patient response. In response to these challenges, researchers have increasingly turned to herbal remedies and novel chemical formulations as potential alternatives or adjuncts to conventional therapies.(4)

The formulation of a vitiligo cream that combines both herbal and chemical approaches holds promise for addressing the multifaceted nature of the condition. Herbal treatments have long been known for their anti-inflammatory, antioxidant, and skin-healing properties, making them valuable in managing vitiligo. For example, herbs such as *Psoralea corylifolia*, *Gingko biloba*, and *Curcuma longa* have shown potential in stimulating melanocyte activity and reducing the depigmented patches associated with vitiligo. Meanwhile, chemical agents like corticosteroids, vitamin D analogs, and immunomodulators are commonly used in clinical practice for their ability to manage symptoms and enhance skin pigmentation. The combination of these two approaches — herbal and chemical — in the development of a vitiligo cream could provide a more comprehensive solution. By incorporating the healing properties of herbal ingredients alongside the targeted action of chemical agents, such formulations aim to provide effective depigmentation restoration, while minimizing side effects and improving patient compliance.

The evaluation of such a cream involves a multi-step process to ensure its safety, efficacy, and stability. This includes assessing the physicochemical properties of the cream, such as texture, spreadability, pH, and viscosity. In addition, the effectiveness of the formulation is evaluated through clinical studies, which may include measurements of repigmentation, improvements in skin appearance, and reductions in the size of vitiligo patches. Toxicological testing, skin irritation studies, and long-term stability assessments are also critical to ensure the formulation is safe for regular use.(5)

Figure No. 1: This fig. illustrates Vitiligo, showing the loss of melanocytes and melanin in the skin, leading to depigmented white patches.



1.2 HOW COMMON IS VITILIGO

Vitiligo is relatively common, affecting about 1% of the global population. It can develop at any age, but it most often appears between the ages of 10 and 30. While the exact cause is not fully understood, it is believed to be an autoimmune condition in which the body's immune system attacks the pigment-producing cells (melanocytes) in the skin. (6)

The condition affects people of all races and ethnicities, but it may be more noticeable in people with darker skin due to the contrast between depigmented and normal skin. It can also sometimes be associated with other autoimmune disorders.(7)

Figure no. 2: This fig. highlights that vitiligo affects 1–2% of the global population and is more noticeable in people with darker skin tones.

1.3 SYMPTOMS OF VITILIGO ON YOUR SKIN INCLUDE:

- Depigmented (white or lighter) skin patches
- Irregular-shaped patches of skin
- Patches that may spread over time
- Premature graying or whitening of hair
- Loss of color in mucous membranes (mouth, nose)
- Changes in the color of the retina (rare) (8)

Figure no. 3: This fig. lists common symptoms of vitiligo, including white patches, quick sunburns, itching, gray hair, and changes in eye and skin color.

1.4 FACTOR RESPONSIBLE FOR VITILIGO

- Autoimmune response (immune system attacks pigment cells)
- Genetic factors (family history of vitiligo or other autoimmune diseases)
- Environmental triggers (sunburn, stress, trauma)
- Chemical exposure (certain chemicals, like in hair dyes)
- Neurogenic factors (nervous system involvement)
- Vitamin D deficiency (9)
- Hormonal changes (e.g., during pregnancy or puberty)

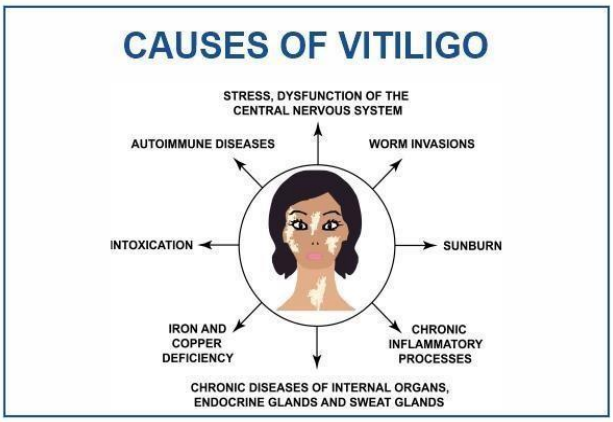


Figure no. 4: This fig. outlines various possible causes of vitiligo, including autoimmune diseases, stress, sunburn, nutritional deficiencies, and chronic internal disorders.

1.5 BENEFITS OF HERBAL OR CHEMICAL ANTI VITILIGO CREAM

Benefits of Herbal Anti-Vitiligo Creams:

- **Natural ingredients**: Often contain plant-based extracts, which may be gentler on the skin.
- **Reduced side effects**: Typically fewer side effects compared to chemical-based treatments.
- **Safe for sensitive skin**: May be better suited for individuals with sensitive skin.
- **Moisturizing properties**: Herbal creams often hydrate the skin, improving overall skin health.
- **Promotes skin healing**: Some herbs help in the healing and protection of the skin .(10)

1.5.1 Benefits of Chemical Anti-Vitiligo Creams:

- **Pigmentation restoration**: Helps stimulate the repigmentation of white patches.
- **Faster results**: Can show quicke effects, particularly with corticosteroid-based creams.
- **Reduces inflammation:** Helps reduce inflammation in the affected skin areas.
- **Improves skin texture:** Some creams help improve the overall texture and appearance of the skin.
- **Convenient:** Easy to apply and use on a daily basis.(11)

1.5.2 Benefits of Combining Chemical and Herbal Anti-Vitiligo Creams:

- **Enhanced Effectiveness**: The combination can provide the quick results of chemical creams with the gentle healing properties of herbal ingredients.
- **Balanced Approach**: Chemical creams may stimulate repigmentation, while herbal creams soothe and nourish the skin, reducing the risk of irritation.
- **Reduced Side Effects**: Herbal ingredients can help mitigate some of the side effects (like skin thinning or irritation) that may come with chemical treatments.
- **Comprehensive Skin Care**: Combines the strengths of both—chemical creams target the pigmentation process, while herbal creams improve skin health, hydration, and overall appearance.

- **Improved Skin Healing**: The soothing and antioxidant properties of herbal ingredients can support skin healing, while chemicals work on pigmentation.
- **Long-term Benefits**: A dual approach may provide both short-term pigmentation improvement and long-term skin protection and nourishment.(12)

2.1 CHEMICAL INGREDIENTS

2.1.1 Vitamin C

- **Antioxidant Properties**: Vitamin C helps combat oxidative stress, which can damage melanocytes (the cells responsible for pigment production). By neutralizing free radicals, Vitamin C may promote the overall health of skin cells and reduce further damage.
- **Collagen Synthesis**: Vitamin C is essential for collagen production, which can help in skin repair and regeneration. Healthy skin is better equipped to respond to treatments and can potentially support the repigmentation process.(13)
- **Melanin Production**: There is some evidence suggesting that Vitamin C, when applied topically, might stimulate melanin production in the skin, especially when combined with other treatments like phototherapy or corticosteroids.

Figure no. 5: Vitamin C capsules for Formulation of Vitiligo cream

2.1.2 Vitamin E (Tocopherol)

- **Skin Healing and Regeneration**: Vitamin E is known for its skin-healing properties. It helps in repairing damaged skin, promoting faster healing of lesions, and reducing scars that may appear due to vitiligo patches. It also supports collagen production, which is crucial for skin integrity.
- **Moisturization**: Vitamin E has emollient properties, which help in keeping the skin hydrated and soft. Since vitiligo patches can often lead to dry, sensitive skin, vitamin E can aid in reducing dryness and improving skin texture.
- **Protection from UV Radiation**: Although Vitamin E is not a substitute for sunscreen, it provides some protection against the harmful effects of UV rays, which can exacerbate skin damage. Since people with vitiligo are at risk of sunburn on depigmented patches, Vitamin E can help mitigate the effects of sun exposure.(14)

Figure no. 6: Vitamin E capsules for Formulation of Vitiligo cream

2.2 HERBAL INGREDIENTS:

2.2.1. Licorice Extract (1-5%)

- **Skin Brightening**: Licorice extract contains glabridin, which helps to lighten skin and reduce hyperpigmentation, improving the appearance of vitiligo patches.
- **Anti-inflammatory**: It has anti-inflammatory properties that can soothe irritated skin and reduce redness around depigmented areas.

- **Antioxidant Protection**: The extract provides antioxidant benefits, protecting skin cells from oxidative stress and free radical damage.
- **Inhibits Tyrosinase Activity**: Licorice may help regulate melanin production by inhibiting tyrosinase, potentially aiding in the restoration of pigment in vitiligo patches.
- **Soothing and Calming**: Licorice extract helps to calm sensitive or inflamed skin, providing relief to individuals with vitiligo.(15)

Figure no. 7: Licorice

2.2.2. Turmeric Powder (0.5-1%)

Reduction of Post-inflammatory Hyperpigmentation

Sometimes, after inflammation, **post-inflammatory hyperpigmentation (PIH)** can occur, which results in dark spots or uneven pigmentation. Turmeric's ability to reduce inflammation and improve skin healing might help **minimize PIH**, leading to smoother, more even skin over time.

Protection from UV Damage

Turmeric has some degree of **UV protection**, which can be helpful for vitiligo patients who are at risk of sunburn or further skin damage in areas of depigmentation. Although turmeric is not a substitute for sunscreen, its antioxidant and anti-inflammatory properties may offer additional protection against the harmful effects of UV radiation, which can worsen vitiligo or cause further irritation to sensitive skin.(16)

Improvement of Skin Tone and Texture

Turmeric is often used for its ability to enhance **skin tone** and **texture**. Since vitiligo causes uneven pigmentation, turmeric extract may help improve the **appearance of the skin**, making it look more uniform and smooth. This effect can be particularly beneficial for people with vitiligo who want to enhance the appearance of their skin while undergoing repigmentation treatments.

Skin Healing and Repair

Turmeric has **wound-healing** and **skin-regenerating** properties. In the context of vitiligo, where the skin can sometimes become more sensitive or irritated due to treatments or the condition itself, turmeric extract may help **promote skin repair** and soothe affected areas. It helps with the healing of skin tissue, which can be beneficial if the vitiligo patches become damaged or inflamed.(17)

Figure no. 8: Turmeric powder

2.2.3. ALOE VERA Gel (10-20%)

- **Skin Healing and Regeneration**:
  Aloe vera is known for its skin healing properties. It promotes cell regeneration, which can be beneficial for vitiligo patients, as it may help in the regeneration of depigmented skin areas and support overall skin health.
- **Anti-inflammatory Effects**: Vitiligo can sometimes cause skin irritation or inflammation around the depigmented patches. Aloe vera has strong antiinflammatory properties that can help soothe and calm irritated skin, reducing redness and swelling.
- **Moisturizing**: Aloe vera is a natural moisturizer that helps in hydrating the skin. This is especially useful for vitiligo patients who might have dry skin. Proper hydration can improve the skin's appearance and texture.
- **Antioxidant Properties**: Aloe vera contains antioxidants like vitamins A, C, and E, which can protect the skin from free radicals and oxidative stress. This may help in preventing further damage to the skin and promote the overall health of skin cells.(18)
- **Lightening and Evening Out Skin Tone**: Aloe vera contains compounds that can help in lightening dark spots and even out skin tone, which may be beneficial for people with vitiligo, particularly in areas where the skin has developed patches of different pigmentation.
- **Supports Immune System**: Aloe vera has immunomodulatory effects, meaning it can help regulate immune responses. This is relevant in vitiligo because it is an autoimmune disorder where the immune system attacks melanocytes
  (pigmentproducing cells). Aloe vera may help modulate immune function to support skin health.
- **Gentle and Non-Irritating**: Aloe vera is often gentle on the skin and can be a safe option for sensitive skin types, which is important for vitiligo patients who may have more delicate skin.(19)

Figure no. 9: Aloe Vera gel

Additional Ingredients:

1. Emollient (e.g., Shea Butter or Coconut Oil, 5-10%)

- **Benefit:** Moisturizes and helps to lock in hydration for smooth, nourished skin.
- **Form:** Shea butter or coconut oil.(20)

2. **Preservative (e.g., Phenoxyethanol, 0.5-1%)**

Benefit: Prevents microbial growth and ensures the product stays safe over.(21)

3.1 REVIEW OF LITERATURE

Sr.No	Authors Name	Year	Key Findings
1	A, Sanjana; Ahmed, Mohammed Gulzar; Gowda, B.H. Jaswanth; Surya, Suprith	2024	The present study investigates and highlights the potency of tacrolimus (TAC) for effective Vitiligo management using the to cubosome formulation. TACloaded cubosome formulations were prepared by using the ultra sonication technique.

2	Krutika S. Bobde1 , Kanchan Upadhye , Vaibhav P. Uplanchiwar, Vinod M. Thakare , Anshu R Dudhe1 , Gayatri R. Katole1 , Namrata S. Mane1 , Prashant Bhokardankar	2023	The pharmaceutical industry's largest problem in the past year has been regulating the drug a delivery rate at specific human body place. Therefore, many scientists are contemplating the construction of novel controlled drug delivery methods to boost patient safety and effectiveness.
3	Samin Jalalmanesh Pharm D, Parvin Mansouri MD, Mehdi Rajabi Pharm D, PhD, Faezeh Monji Pharm D, PhD	2022	Vitiligo is an autoimmune and acquired disease characterized by the destruction of epidermal melanocytes leading to depigme ntation of the skin.
4	Dina B. Mahmoud , Aliaa N. ElMeshad , Maha Fadel , A beer Tawfik , Shahenda A. Ramez	2022	Vitiligo is a common autoimmu ne skin disorder in Caucasian and dark-skinned populations, that is characterized by patchy depigmentation of the skin as a result of the loss of melanocytes and melanin. Vitiligo often affects the hands and wrists;
			axillae; and perioral, periorbital, and anogenital skin of both men and women on the same level .
5	Hernandez Navarro, Sergi PhD, Segura Tejedor, Jordi PhD, Bajona Roig, Marta PhD, Luisetto, Roberto PhD, Fedrigo, Marny MD, PhD, Castellani, Chiara PhD, Angelini, Annalisa MD, PhD, Alaibac, Mauro MD, PhD, Bordignon, Matteo MD, PhD	2022	Vitiligo is an acquired chronic pigmentation disorder of skin. Even if the role of immune system seems to established, new pathogenetic hypothesis are rising in these years. It has been recently suggested by the development of an animal .
6	FEI QI, Fang Liu , Ling Gao	2021	Vitiligo is a multifactorial reversi ble skin disorder characterized by distinct white patches that result from melanocyte destructio n. Activated $CXCR3^+$ $CD8^+$ T cells promote melanocyte detach through interferon gamma (IFN γ secretion and chemokines secr eted by keratinocytes through the Janus kinase (JAK)/signal tr ansducer and activator of transc ription (STAT)-1 signaling pathway results in further recrui tment of $CXCR3^+$ $CD8^+$ T cells and the formation of a positivefeedback loop.

4.1 AIM AND OBJECTIVES

4.1 AIM:

Formulation and preparation of Vitiligo cream: A herbal and chemical approach.

4.2 OBJECTIVE:

To formulate a topical cream for the management of vitiligo by using a combination of herbal extracts and chemical agents that may help in the restoration of skin pigmentation and overall skin health.

1. Formulation of a Safe and Effective Cream
2. Patient Acceptability
3. Cost effective
4. Easy to apply

5.1 MATERIAL AND METHODOLOGY

Sr. No.	Ingredients	Percentage (%)	Function
1.	**Aloe Vera Gel**	(10-20%)	Soothes the skin, helps with to hydrate, and promotes skin healing.
2.	**Licorice Extract**	(1-5%)	Contains glabridin, which helps in skin lightening and 3evening out skin tone.
3.	**Turmeric Powder**	(0.5-1%)	Contains curcumin, which has antiinflammatory and skinrejuvenating properties. It help with pigmentation and skin repair.
4.	**Vitamin E**	(2%)	Helping to lighten hyperpigmentation and even out skin tone.
5.	**Vitamin C (Ascorbic Acid)**	(1-2%)	An antioxidant that helps to the brighten of skin and promote the collagen production
6.	**Emollient (e.g., Shea Butter or Coconut Oil)**	(5-10%)	Moisturizes and helps to lock in hydration for smooth, nourished skin.
7.	**Preservative (e.g., Phenoxyethanol)**	(5-10%)	Prevents microbial growth and ensures the product stays safe over time.

Figure 10: Liquorice extract

- Synonym: Liquorice Extract
- Family: **Fabaceae** (Leguminosae)
- **Chemical Constituents:** Glycyrrhizin, Glabridin, Coumarins, Triterpenoids.
- Uses: Skin Depigmentation Regulation**,** Anti-inflammatory Properties, Skin Protection and Repair.

Figure 11: Turmeric powder

- Synonyms: Curcuma
- Family: **Zingiberaceae** (Ginger family)
- Chemical Constituents: **Curcumin**, Demethoxycurcumin
- Uses: Anti-inflammatory, Stimulates repigmentation

Figure 12: Aloe Vera gel

- Synonym: Ghritkumari, Lu Hui
- Family: Asphodelaceae
- Chemical Constituents:Polysaccharides, Anthraquinones
- Uses: Skin healing, Immune modulation

Figure 13: Vitamin C

- Synonym: Ascorbic acid
- Chemical Constituent: Main Compound**:** L-Ascorbic acid ($C_6H_8O_6$)
- Uses: Reduces oxidative stress, Improves absorption of other antioxidants, Enhances collagen

EXTRACTION PROCESS

I. OBJECTIVE

The Extraction's Goals in order to separate useful phytocnostituents for:

Herbal remedies

Skincare products (such as vitiligo or anti-pigmentation lotions)

Studies on pharmacology

II. Materials Required

- Licorice root powder (coarse or fine)
- Solvent (depending on target compounds):
  - o **Water** (for glycyrrhizin – water soluble) o
  - **Ethanol/Methanol** (for glabridin – alcohol soluble) o
  - **Hydroalcoholic mix** (for a broad spectrum of compounds)
- Glassware: Beaker, conical flask, funnel, filter paper
- Heating mantle or water bath
- Rotary evaporator (optional but ideal)
- Muslin cloth - No. 1 filter paper
-

III. Extraction Methods

1. Maceration (Cold or Room-Temperature Extraction) Steps:

1. Weigh ~100 g of licorice powder.
2. Add to a 1L glass container.
3. Pour in 500 mL of 70% ethanol or water (drug:solvent ratio = 1:5).
4. Seal and let stand at room temperature for **5–7 days**, shaking occasionally.
5. Filter the solution using muslin cloth or filter paper.
6. Collect the extract and evaporate the solvent (using a rotary evaporator or water bath at <50°C)and then store the extract,

Figure no.15: Licorice powder **Pros**: Simple, no heat — ideal for heat-sensitive compounds.

Cons: Time-consuming, less efficient extraction.

2. Soxhlet Extraction (Efficient and Thorough) Steps:

1. Place ~50–100 g of licorice powder in a thimble.
2. Load into the Soxhlet extractor.
3. Use 300–500 mL of ethanol or methanol in the boiling flask.

4. Heat the solvent to reflux for **6–8 hours** (until the solvent in siphon tube runs clear).
5. Collect the extract and evaporate excess solvent using a rotary evaporator.
6. Dry the final extract under vacuum or in a desiccator.

Pros: Highly efficient; continuous extraction.

Cons: Requires equipment, uses heat.

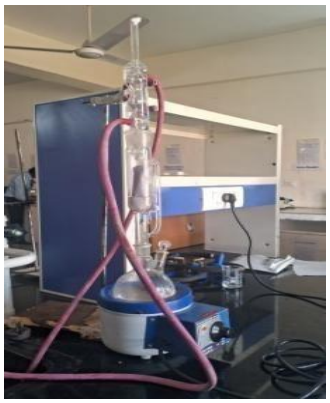


Figure no. 16: Soxhlet extractor

3. Aqueous Extraction (Decoction Method)

Ideal if targeting **glycyrrhizin**, which is water-soluble.

1. Add 100 g licorice powder to 1L distilled water.
2. Boil for 1–2 hours with occasional stirring.
3. Cool and filter through muslin cloth.
4. Concentrate the filtrate over a water bath.
5. Dry to obtain a soft or solid extract.

Pros: Safe, non-toxic.

Cons: Less effective for alcohol-soluble compounds.

Figure no. 17: Liquorice extract

IV. Post-Extraction Steps

Phytochemical Screening (Optional but Recommended)

- Confirm the presence of **flavonoids, saponins, tannins, glycosides** using qualitative tests.

Solvent Removal

- Use a rotary evaporator at ~40–50°C under reduced pressure.
- Or, allow to air dry in a shaded, dust-free environment.

Storage of Extract

- Use amber-colored glass containers to avoid light degradation.
- Label with date, concentration, and solvent used.
- Store in a cool, dry place.

Procedure for Making Vitiligo Cream:

1. Prepare the Herbal Ingredients

The first step in making this cream is to prepare the natural, plant-based ingredients, also called *herbal extracts*. These are good for your skin and help soothe and support healing.

- **Aloe Vera Gel**:

  Start with aloe vera gel. If you have a fresh aloe vera leaf, you can cut it open and scoop out the gel. But if that's not possible, you can use store-bought aloe vera gel. Just make sure the label says it's at least **95% pure** so that it works effectively on your skin.

- **Licorice Extract**:

  Licorice is a natural ingredient known to help lighten dark spots. If you have licorice in *powder* form, take a small amount and mix it with a little warm water until it dissolves. If you don't want to use water, you can mix it directly into the aloe vera gel instead.

- **Turmeric Powder**:

  Turmeric is known for its anti-inflammatory and skin-brightening properties. Take about **half a teaspoon** of turmeric powder. Mix it with a few drops of water or aloe vera gel until it becomes a smooth, yellow paste. Make sure there are no lumps.(24) Once all three of these are ready, mix them together into one bowl to create your base herbal mixture.

2. Add the Main Active Ingredients (Chemicals that Help Treat Vitiligo)

Next, you'll add the special ingredients that are known to treat skin discoloration. These are called **active ingredients**. Handle them carefully and measure properly.

- **Vitamin E (2%)**:

  This is a strong ingredient that helps lighten the skin in areas where there's too much pigment or uneven skin tone. You only need a **small amount (2%)**. Add this to your herbal mixture (the one with aloe vera, licorice, and turmeric). Mix everything thoroughly until it looks well blended.

- **Vitamin C (1–2%)**:

  Vitamin C (also known as ascorbic acid) is another important ingredient. It helps brighten the skin and fights damage caused by the sun or pollution. Add about **1–2% of powdered Vitamin C** to your mixture. Stir well until the powder is completely dissolved and no grains are visible.(25)

3. Add Moisturizers (Emollients)

Moisturizers (called *emollients*) help to keep the skin soft and hydrated. They also make the cream smooth and easy to apply.

- **Shea Butter or Coconut Oil (5–10%)**:

  In a separate bowl, take a small amount of shea butter or coconut oil (5 to 10% of your total cream mixture). Gently melt it using a microwave or a double boiler (a bowl placed over a pot of hot water). Once it has melted, pour it into your main cream mixture (with the herbs and active ingredients). Stir very well so that everything blends smoothly and becomes creamy in texture.(26)

4. Add a Preservative (To Make It Last Longer)

Now it's time to add a preservative. This ingredient helps to keep your cream fresh and safe to use for a longer time by preventing bacteria or mold from growing.

- **Phenoxyethanol (0.5–1%)**:

  Add this in a small amount (between 0.5% and 1%). This preservative is widely used in cosmetics and is safe in low quantities. Stir it well into the cream.

5. Final Mixing

Now that all your ingredients are added, mix the entire mixture **very well**. Keep stirring until it becomes a smooth, creamy, and even mixture. There should be no lumps or grainy texture.

- If the cream feels too thick or hard to spread, you can add a bit more aloe vera gel or a few drops of water. Stir again until it reaches the consistency you like.

6. Cool and Store the Cream

- Once everything is mixed and your cream looks ready, **let it cool down** to room temperature if it's still warm from the melted oils.
- After cooling, transfer the cream into a clean, airtight container. It's best to use a **dark glass jar** (like amber or cobalt blue) because it protects

the cream from light, which can make some ingredients go bad over time.

- Label the container with the date you made it, and store it in a cool, dry place.

Figure no. 18: Vitiligo cream

6.1 RESULT

The formulated vitiligo cream, incorporating both herbal and chemical ingredients, was evaluated to determine its physicochemical properties, stability, and potential therapeutic effectiveness. The evaluation aimed to ensure that the cream meets standard quality parameters for topical formulations and to assess its suitability for the management of vitiligo. Various tests were performed, including pH determination, spreadability, viscosity, homogeneity, stability studies, and preliminary observations on efficacy. The results obtained from these evaluations are discussed in the following sections to highlight the performance and potential benefits of the combined herbal-chemical formulation.

Evaluation of Vitiligo Cream

To ensure the effectiveness, safety, and quality of the formulated vitiligo cream, the following evaluation parameters were assessed:

- Physical Evaluation
- pH Determination
- Viscosity
- Stability Studies
- Washability
- Irritancy Test
- Microbial Load Test

Evaluation Parameters Result

1. Physical Evaluation

- **Appearance**: Color, texture, homogeneity, and phase separation were visually inspected.

Appearance	Light yellowish

- **Odor**: The cream was evaluated for any characteristic or unpleasant smell.

Odor	Pleasant herbal

- **Consistency**: Checked manually to ensure smooth application.

Texture	Smooth, non-greasy

- **Spreadability**: Measured by the ease with which the cream spreads on the skin.

Formula:

Spreadability (g\cdotpcm/s)=TM×L where:

M = weight tied to upper slide

L = length moved by the slide

T = time in seconds

2. **pH Determination**

- The pH of the cream was measured using a digital pH meter.
- Ideal pH range: 5.5 – 6.5 (suitable for skin application).

Measured using pH meter by dispersing 1g of cream in 10 ml distilled water. **Result**: 6.2 ± 0.1 (skin-compatible, ideal range 5.5–7.0)

3. **Viscosity**

Determined using a Brookfield viscometer to assess the cream's flow and application behavior.

Measured using a Brookfield Viscometer at 25°C, 20 rpm **Result**: 36,000 ± 500 cps — Suitable for cream base

4. **Stability Studies**

- Conducted under different storage conditions (room temperature, refrigeration, and elevated temperature) over a period (e.g., 30, 60, 90 days).
- Parameters assessed: Phase separation, color change, consistency, and pH.

Performed at 25°C, 40°C, and 4°C for 4 weeks

5. **Washability**

Ease of washing off the cream from the skin was tested with water.

Applied on skin and washed under tap water **Observation**: Easily washable

6. **Irritancy Test**

- A patch test was performed on a small area of healthy skin (e.g., forearm) to observe any signs of irritation, redness, or allergic reaction.
- Conducted in accordance with ethical guidelines and with proper consent.

Figure no. 19: Skin Irritancy / Compatibility Patch Testing

7. **Microbial Load Test**

- Evaluates the presence of microbial contamination in the cream.
- Ensures the formulation is within acceptable microbiological limits.

Figure no.20: presence of microbial contamination

7.1 CONCLUSION

The present study successfully demonstrates the formulation of a vitiligo cream by integrating both herbal and chemical approaches to enhance therapeutic efficacy and patient compliance. The use of herbal extract provides a natural and holistic approach by stimulating melanogenesis and offering antioxidant and anti-inflammatory benefits. Concurrently, the inclusion of carefully selected chemical agents such as corticosteroids or immunomodulators enhances depigmentation control and accelerates the repigmentation process.

The final cream formulation exhibited desirable physicochemical properties, stability, and appropriate pH for topical application. Preliminary evaluations suggest that the combined use of herbal and chemical components may offer synergistic effects in the treatment of vitiligo, potentially reducing side effects associated with long-term chemical drug use alone.

Further in vivo and clinical evaluations are required to validate the efficacy, safety, and longterm tolerability of the formulation. However, this study lays a strong foundation for the development of an effective, affordable, and patient-friendly vitiligo treatment.

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