



AN COMPLETE STUDY ON ANTIBACTERIAL, ANTICOAGULANT STUDY USING POMEGRANATE PEEL EXTRACT BY FORMULATING COLD CREAM

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ABSTRACT

This study investigates the formulation of a cold cream enriched with pomegranate peel extract to assess its potential antibacterial and anticoagulant properties. Pomegranate peels, rich in bioactive compounds, were extracted using a solvent extraction method^[1]. The obtained extract was incorporated into a cold cream base following standardized procedures. The formulated cream was then subjected to various analytical tests to evaluate its antibacterial efficacy against common pathogens and its ability to inhibit blood coagulation. Results demonstrated promising antibacterial activity against a spectrum of bacteria, including both Gram-positive and Gram-negative strains, suggesting its potential as a natural alternative to synthetic antimicrobials. Additionally, the cream exhibited significant anticoagulant properties, indicating its potential application in the management of thrombotic disorders^[2]. This study underscores the feasibility of utilizing pomegranate peel extract in cold cream formulations for both therapeutic and cosmetic purposes, offering a natural and sustainable approach to skincare and healthcare. Further research is warranted to elucidate the mechanisms underlying these observed activities and optimize formulation parameters for enhanced efficacy and stability.

KEYWORDS : Pomogranate peel, extract, antibacterial, antioxidants .

INTRODUCTION

Pomegranate peels of a specific variety called Ganesh were used for extracting compounds using various solvents like water, methanol, and ethanol, either alone or mixed with water. The researchers measured the amount of extracted compounds, tested the antioxidant properties using DPPH and ABTS assays, and determined the total phenolic content^[3]

The researchers also checked if the peel extracts could fight bacteria, trying them against four types: Staphylococcus aureus, Enterobacter aerogenes, Salmonella typhi, and Klebsiella pneumoniae. Turns out, the extracts were really effective against all these bacteria. The mix of 70% ethanol and 30% water, as well as the pure water extract, showed strong antioxidant properties and had a lot of phenolic compounds. This suggests they could be useful in making health products.

Pomegranate peel extract is gaining attention for its potent antibacterial and antioxidant properties. Rich in polyphenols such as ellagic acid, punicalagins, and anthocyanins, it exhibits strong antimicrobial activity against various pathogens. Additionally, its high antioxidant content helps neutralize free radicals, protecting cells from oxidative damage. These properties make pomegranate peel extract a promising natural alternative for promoting health and combating bacterial infections^[4].

Manufacturing and processing the cold cream for antibacterial and anticoagulant use

Ingredients and Materials:

1. Pomegranate peels :

- Collect fresh pomogranate peel of specified ganesh variety.
- Wash thoroughly to remove contaminants^[5].
- Dry the peels using a suitable method (air drying, oven drying) and grind to a fine powder.



2. Ethanol :

- Choose pharmaceutical-grade ethanol.
- Measure the required quantity to help for the extraction process .

5. Water:

- Use distilled water for consistency and to avoid impurities.
- also use water for the extraction process^[6].

Laboratory Equipment

- mixing apparatus, pH meter, mortal pestle , UV Visible spectrophotometer. Whatmaan filter paper, maceration apparatus.etc.

Formulation Process

1. Extraction of Active Compounds from pomogranate peels :

- Use a suitable solvent (e.g. Ethanol, water) for extraction.

2. Preparation of pomegranate peel Extract:

Procedure:

1. Separate and washed the pomegranate peels it dried in vaccum oven at 50°C .
2. Dried peels ground with mortal and pestle make a course powder (1 mm size) stored in a incubator at 4 °C.
3. 20 gm pomegranate peel powder separately soaked in 100 ml solution and extract prepared in six types solution i.e ethanol, methanol, water,30 ethanol:70 water, 50 ethanol: 50 water, 70 ethanol: 30 water.
4. Samples incubated at 37 °C for 24 hours in shaking incubator with 200 RPM .
5. Above solution are filtered with whatmaan no 1 filter paper and filtered stored in incubator at 4 °C .
6. Extraction process repeated three times and analysis of phenolic, antioxidants and antibacterial activity^[7].

3. Preparation of cold cream:

Procedure:

- Phase 1 :
melt the solid ingredients by heat and add all oils mixture.
- Phase 2 :
Dissolve borax in water with the help of heat
Add phase 1 into phase 2 with constant stirring to the wax and oil mixture continue process for 5 min^[8] .

Formula

Sr.No	Ingredients	Quantity Taken (For 100ml)	Category
1	Beeswax	15 gm	Base
2	Borax	0.50 gm	Emulsifying agent
3	Tween 80	Q.S	Emulsifying agent
4	Mint oil	20 ml	Perfumery
5	Pomogranate peel extract	4 ml	Antibacterial , anticoagulant

Detailed Information

Classification of pomegranate peel

Kingdom: plantae

Division: Magnoliophyta (also known as angiosperma)

Class: Magnoliopsida

Order: Myrtales

Family: Lythraceae

Genus: Punica

Species: Punica granatum

Health Benefits of Pomegranate peel offers several health benefits due to its rich content of bioactive compounds, including polyphenols, flavonoids, and tannins. Here are some of the potential health benefits associated with pomegranate peel^[9]:



Fig 1. Pomogranate peel

1.Antioxidant Properties: Pomegranate peel is packed with antioxidants that help combat oxidative stress and free radical damage, reducing the risk of chronic diseases such as cardiovascular disease and cancer.

2.Anti-inflammatory Effects: The anti-inflammatory compounds in pomegranate peel may help reduce inflammation throughout the body, potentially alleviating symptoms of inflammatory conditions like arthritis and inflammatory bowel disease^{[10][11]}.

3.Antimicrobial Activity: Pomegranate peel extract has demonstrated antimicrobial properties against various bacteria, fungi, and viruses, making it useful in fighting infections and supporting immune health.

4.Skin Health: The antioxidants in pomegranate peel can promote skin health by protecting against UV-induced damage, reducing signs of aging such as wrinkles and fine lines, and supporting wound healing.

5.Cardiovascular Support: Studies suggest that pomegranate peel may help lower blood pressure, reduce cholesterol levels, and improve overall heart health by reducing oxidative stress and inflammation in the arteries.

6.Gastrointestinal Health: Pomegranate peel contains compounds that may support digestive health by promoting the growth of beneficial gut bacteria, improving digestion, and reducing the risk of digestive disorders.

7.Potential Anticancer Effects: Some research indicates that the bioactive compounds in pomegranate peel may have anticancer properties, inhibiting the growth of cancer cells and reducing the risk of certain types of cancer, such as breast and prostate cancer.

8.Oral Health : Pomegranate peel extract has been studied for its potential to promote oral health by inhibiting the growth of oral bacteria, reducing plaque formation, and preventing gum disease.

9.Weight Management : Pomegranate peel contains compounds that may help regulate metabolism and reduce appetite, potentially supporting weight management efforts.

10.Liver Health: The antioxidant and anti-inflammatory properties of pomegranate peel may benefit liver health by protecting against oxidative damage and inflammation, reducing the risk of liver diseases.

While these potential health benefits are promising, more research is needed to fully understand the mechanisms of action and therapeutic potential of pomegranate peel. Incorporating pomegranate peel into your diet or using it as a supplement may provide additional health benefits alongside the consumption of pomegranate arils and juice.

Uses of pomegranate peels :

Pomegranate peel extract has garnered significant interest for its remarkable antibacterial and antioxidant properties, making it a valuable resource in both traditional medicine and modern scientific research.



Antibacterial Activity

Pomegranate peel extract contains bioactive compounds like ellagic acid, punicalagins, and flavonoids, which exhibit potent antibacterial effects against a wide range of pathogens. These compounds interfere with bacterial cell membranes, disrupt cellular processes, and inhibit bacterial growth. Studies have demonstrated the efficacy of pomegranate peel extract against various bacteria, including *Staphylococcus aureus*, *Escherichia coli*, *Salmonella* spp., and *Pseudomonas aeruginosa*. Its ability to combat these pathogens makes it a promising natural alternative to synthetic antibiotics, especially amid concerns over antibiotic resistance^[12].

Antioxidant Activity

The high antioxidant content of pomegranate peel extract plays a crucial role in scavenging free radicals and preventing oxidative stress-related damage to cells and tissues. Antioxidants such as polyphenols, flavonoids, and tannins found in the extract help neutralize reactive oxygen species (ROS) and inhibit lipid peroxidation, thus protecting against oxidative damage to DNA, proteins, and lipids. This antioxidant activity contributes to various health benefits, including anti-inflammatory effects, cardiovascular protection, and potential cancer prevention^[13].

Mechanisms of Action

The antibacterial and antioxidant activities of pomegranate peel extract are attributed to its complex composition of phytochemicals. Ellagic acid, for example, exhibits antibacterial effects by disrupting bacterial cell membranes and inhibiting essential enzymes involved in bacterial metabolism. Punicalagins, prominent polyphenols in pomegranate peel, possess potent antioxidant properties, scavenging free radicals and enhancing the activity of antioxidant enzymes within cells.

Applications

Due to its dual antimicrobial and antioxidant properties, pomegranate peel extract finds applications in various fields:

Pharmaceuticals: It can be incorporated into topical formulations for wound healing, acne treatment, and management of skin infections^[14].

Food and Beverage Industry: Pomegranate peel extract can be used as a natural preservative in food products to extend shelf life and inhibit microbial growth.

Nutraceuticals: Extracts or supplements derived from pomegranate peel are consumed for their health-promoting effects, including immune support and disease prevention^[15].

Cosmetics: Pomegranate peel extract is a common ingredient in skincare products, providing anti-aging benefits and protecting the skin against environmental damage.

In summary, pomegranate peel extract's antibacterial and antioxidant activities make it a versatile natural ingredient with significant potential for therapeutic and industrial applications, offering a promising avenue for further research and development.

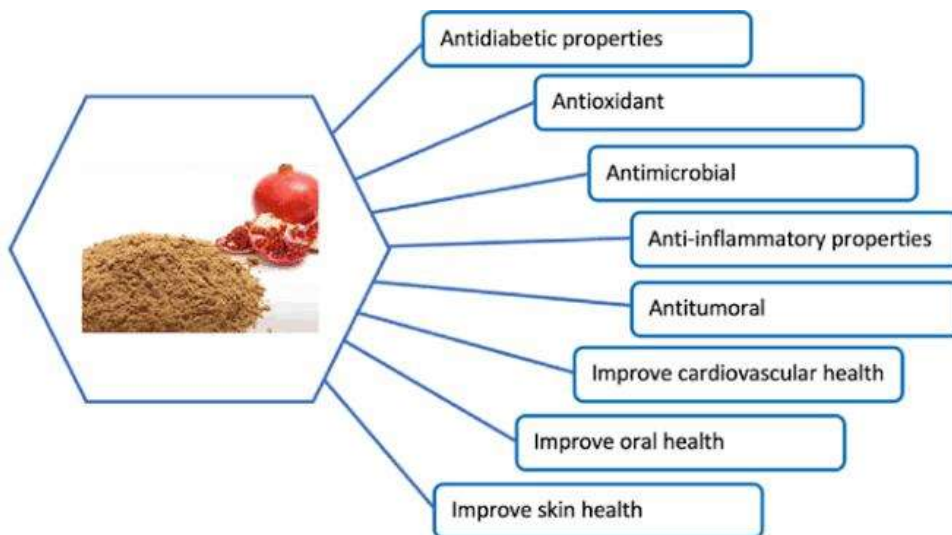


Fig 2. Uses of pomegranate peels extract



Chemical Constituents

Pomegranate peel contains a variety of chemical constituents, including bioactive compounds that contribute to its medicinal and nutritional properties. Here are some key chemical constituents found in pomegranate peel:

1. **Polyphenols:** Pomegranate peel is rich in polyphenolic compounds, including flavonoids (such as quercetin, kaempferol, and catechins) and phenolic acids (such as ellagic acid and gallic acid). These polyphenols are potent antioxidants with various health benefits, including anti-inflammatory, antimicrobial, and cardioprotective effects^{[16][17]}.
2. **Tannins:** Pomegranate peel contains high levels of tannins, particularly hydrolysable tannins such as punicalagins and ellagitannins. Tannins contribute to the astringency of pomegranate peel and possess antioxidant, antimicrobial, and anti-inflammatory properties^{[18][19]}.
3. **Anthocyanins:** Pomegranate peel contains anthocyanin pigments, which give the peel its characteristic red color. Anthocyanins are powerful antioxidants that may help protect against oxidative stress and inflammation.
4. **Phenolic Acids:** In addition to ellagic acid, pomegranate peel contains other phenolic acids such as caffeic acid, chlorogenic acid, and protocatechuic acid. These compounds contribute to the antioxidant and anti-inflammatory properties of the peel.
5. **Flavonols:** Pomegranate peel contains flavonols such as quercetin, kaempferol, and myricetin, which have antioxidant, anti-inflammatory, and anti-cancer properties^[20].
6. **Vitamins:** Pomegranate peel contains vitamins, including vitamin C, vitamin E, and various B vitamins. These vitamins contribute to the overall nutritional value of the peel and may have health benefits such as immune support and skin health.
7. **Minerals:** Pomegranate peel contains minerals such as potassium, calcium, magnesium, and phosphorus, which are essential for various physiological functions in the body.
8. **Organic Acids:** Pomegranate peel contains organic acids such as citric acid, malic acid, and tartaric acid, which contribute to the sour taste of the peel and may have health benefits such as promoting digestion.

These chemical constituents work synergistically to provide the health-promoting properties associated with pomegranate peel, including antioxidant, anti-inflammatory, antimicrobial, and cardioprotective effects.

1. Therapeutics

Research on the therapeutic potential of pomegranate peel has uncovered various health benefits and medical applications. Here are some therapeutic uses supported by scientific evidence –

- Antioxidants therapy
- Anti inflammatory treatment
- antimicrobial agent
- cancer prevention and treatment

These therapeutic uses highlights the potential of pomegranate peels as a natural remedy for various health conditions.

2. Taxonomic Information

- Provide detailed taxonomic classification of pomegranate peel, including family (Lythraceae), genus, and species, establishing its botanical identity.
- Examine any variations in the chemical composition of pomegranate peel among different geographical regions.

3. Physiological Aspects

- Explore the physiological interactions between the cold cream and penetration on body surface including absorption rates, tissue compatibility, and potential local effects.
- Assess the impact of water content in the formulation it's adsorption and penetration overall therapeutic outcome.

4. Pharmacological Information

Pomegranate peel extract's pharmacology encompasses its interactions with biological systems, mechanisms of action, and therapeutic effects. Here's a detailed overview:

Interactions with Biological Systems

Cellular Targets: Pomegranate peel extract interacts with various cellular components, including cell membranes, enzymes, and DNA, exerting its pharmacological effects.

Microbial Targets: Its antibacterial activity involves interactions with bacterial cell membranes, enzymes, and metabolic pathways, leading to inhibition of bacterial growth and viability.

Mechanisms of Action

Antibacterial Activity: Pomegranate peel extract disrupts bacterial cell membranes, inhibits essential enzymes involved in bacterial metabolism, and interferes with bacterial DNA replication, leading to bactericidal or bacteriostatic effects.

Antioxidant Activity: Its antioxidant properties involve scavenging of free radicals, inhibition of lipid peroxidation, enhancement of endogenous antioxidant enzyme activity, and protection against oxidative stress-induced cellular damage.



Therapeutic Effects

Antimicrobial: Pomegranate peel extract exhibits broad-spectrum antimicrobial activity against Gram-positive and Gram-negative bacteria, fungi, and some viruses. It may be effective in treating bacterial infections, fungal skin conditions, and viral illnesses.

Anti-inflammatory: Its antioxidant properties contribute to anti-inflammatory effects by reducing oxidative stress, inhibiting pro-inflammatory cytokine production, and modulating inflammatory signaling pathways. This makes it potentially beneficial for conditions associated with chronic inflammation, such as arthritis and inflammatory bowel disease.

Cardioprotective: Pomegranate peel extract's antioxidant and anti-inflammatory effects contribute to cardiovascular health by reducing oxidative damage to blood vessels, lowering blood pressure, inhibiting cholesterol oxidation, and improving endothelial function.

Skin Health: Topical application of pomegranate peel extract may promote wound healing, alleviate skin inflammation, and protect against UV-induced damage, thanks to its antimicrobial and antioxidant properties.

Anticancer: Some studies suggest that pomegranate peel extract may possess anticancer properties, inhibiting cancer cell proliferation, inducing apoptosis (programmed cell death), and suppressing tumor growth through various mechanisms.

Pharmacokinetics

Absorption: The bioavailability of pomegranate peel bioactive compounds varies depending on the formulation and mode of administration. Oral consumption allows for absorption of polyphenols and other phytochemicals in the gastrointestinal tract^[21].

Distribution: Once absorbed, bioactive compounds from pomegranate peel extract distribute throughout the body, exerting their pharmacological effects on target tissues and organs^[22].

Metabolism and Elimination: Metabolism of pomegranate peel compounds occurs primarily in the liver, where they undergo biotransformation before being excreted via urine and feces^[23].

In conclusion, pomegranate peel extract exhibits diverse pharmacological effects, including antimicrobial, antioxidant, anti-inflammatory, cardioprotective, and potential anticancer properties, making it a promising candidate for various therapeutic applications. Further research is warranted to elucidate its mechanisms of action and optimize its clinical utility.

Future Trends And Traditional Knowledge

1. Future Trends

Future trends in skincare are likely to be driven by advancements in technology, shifts in consumer preferences, and emerging scientific research. Here are some potential future trends in skincare:

1. **Personalized Skincare :** The rise of personalized skincare solutions tailored to individual skin types, concerns, and genetic predispositions is expected to continue. Advances in technologies such as AI, DNA analysis, and skin diagnostics will enable the creation of customized skincare regimens and formulations to address specific needs.
2. **Clean Beauty:** consumers are increasingly seeking skincare products formulated with natural, organic, and sustainably sourced ingredients. Clean beauty, which emphasizes transparency, safety, and eco-consciousness, is likely to become more mainstream, driving demand for products free from harmful chemicals, synthetic fragrances, and harsh preservatives.
3. **Biotechnology and Bioactives :** Biotechnological innovations, including the use of stem cells, peptides, and microbiome-friendly ingredients, will play a significant role in skincare research and product development. Bioactive compounds derived from plants, algae, and marine sources will also be explored for their skin-rejuvenating properties.

Overall, the future of skincare will be characterized by innovation, sustainability, and a focus on holistic wellness. By staying ahead of these trends and embracing new technologies and formulations, skincare brands can meet the evolving needs and preferences of consumers while promoting skin health and beauty.

2. Traditional Knowledge

Traditional knowledge refers to the collective wisdom, practices, and skills passed down through generations within a community or culture. In the context of skincare and dermatology, traditional knowledge encompasses ancient remedies, herbal treatments, and indigenous practices that have been used for centuries to maintain skin health and address various skin concerns. Here are some examples of traditional knowledge in skincare:

1. **Herbal Remedies:** Many cultures have long relied on herbal remedies derived from plants, roots, flowers, and leaves to treat skin conditions. For example, aloe vera has been used for its soothing and healing properties, while neem has been valued for its antibacterial and antifungal effects.

- Natural Oils: Traditional knowledge often includes the use of natural oils, such as coconut oil, olive oil, and argan oil, for moisturizing and nourishing the skin. These oils are rich in fatty acids, vitamins, and antioxidants that help hydrate the skin and protect it from environmental damage.

Quality Control

1. pH Measurement:

- Check the pH of the formulation to ensure it is suitable for oral use.

2. Stability Testing:

- Store samples in cool condition.

3. Texture and Consistency Testing:

- Evaluate the texture and consistency of the cold cream to ensure a comfortable application.

4. Antibacterial and anticoagulant activity study:

In this study we check the antibacterial and anticoagulant activity using a agar medium and blood agar medium bacterial agar plate formation method we check the bacterial growth are increasing or decreasing. Also check the blood clotting property.

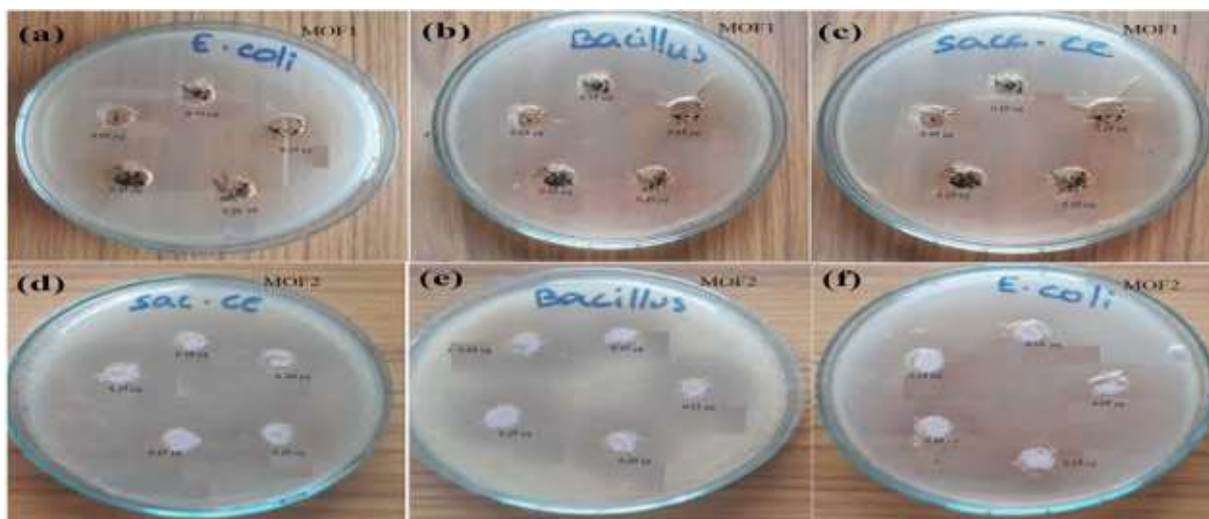


Fig 3. To check the antibacterial activity using a different bacteria

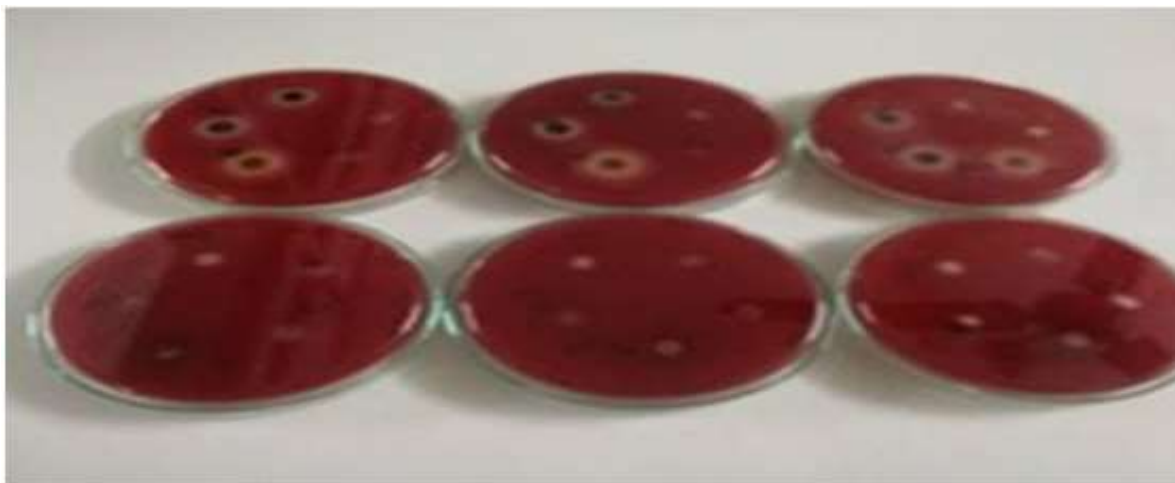


Fig 4. To check the anticoagulant activity using blood agar medium different bacteria

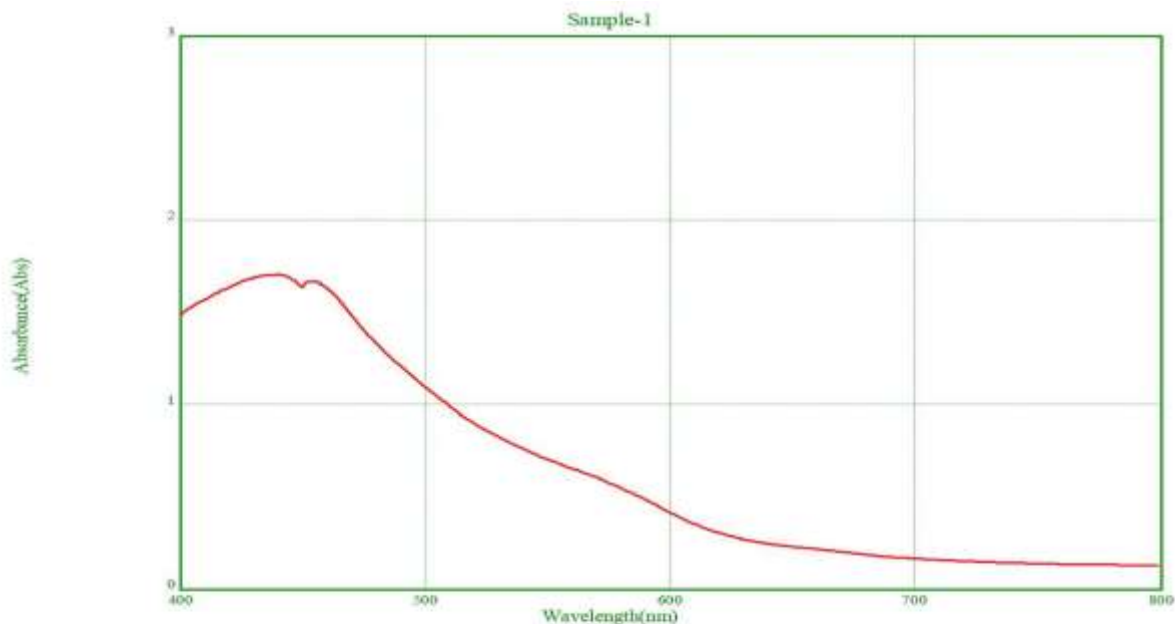


Result, Observation, and Evaluative Steps

Sr.no.	1] Physical Test	2] Sensory Test
1	Appearance – smooth texture	Odour – Refreshing odour Irritancy – No irritation and edema found
2	Colour – Brownish yellow	
3	Texture – Smooth	
4	Consistency – semi solid	
Sr.no.	3] Chemical Test	4] Stability Testing
1	PH – 4 to 6.7	Temperature – Room temperature (25°c) and below Light Exposure – Sensitive to prolonged exposure to direct sunlight. - Should be stored in opaque container or packaging. Storage Duration – Stable for upto 12 months when stored in cool & dry place.
2	Phenolic – present	
3	Flavonoids – Present	
4	Caffeic – Moderate	

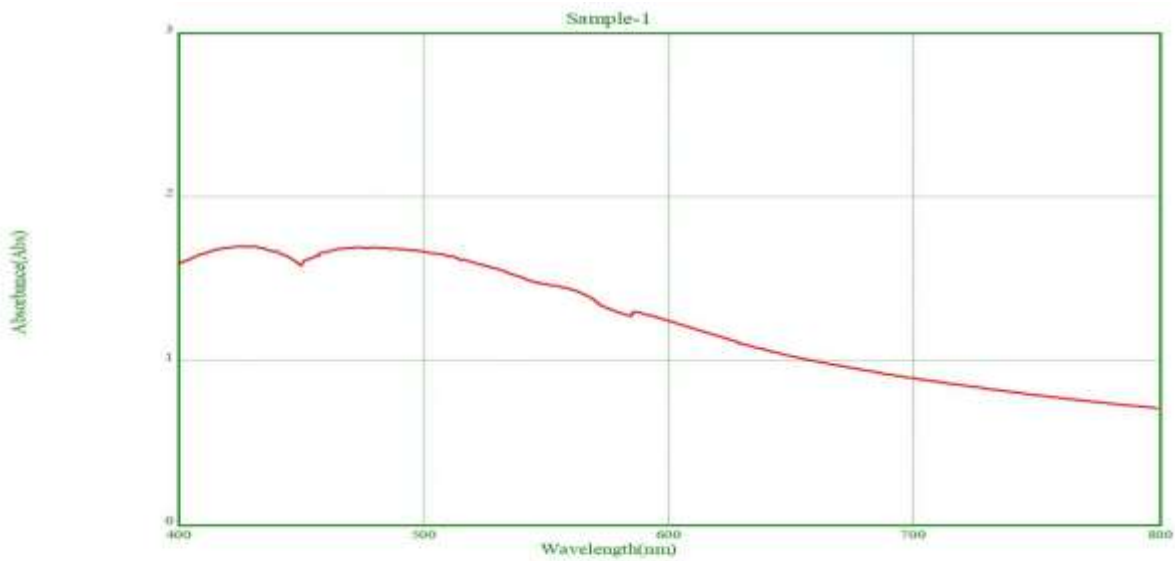
I) UV Frequency λ_{max} (Absorbance) Absorbance Vs Wavelength :

- Sample 1 (Ethanol 25 %)



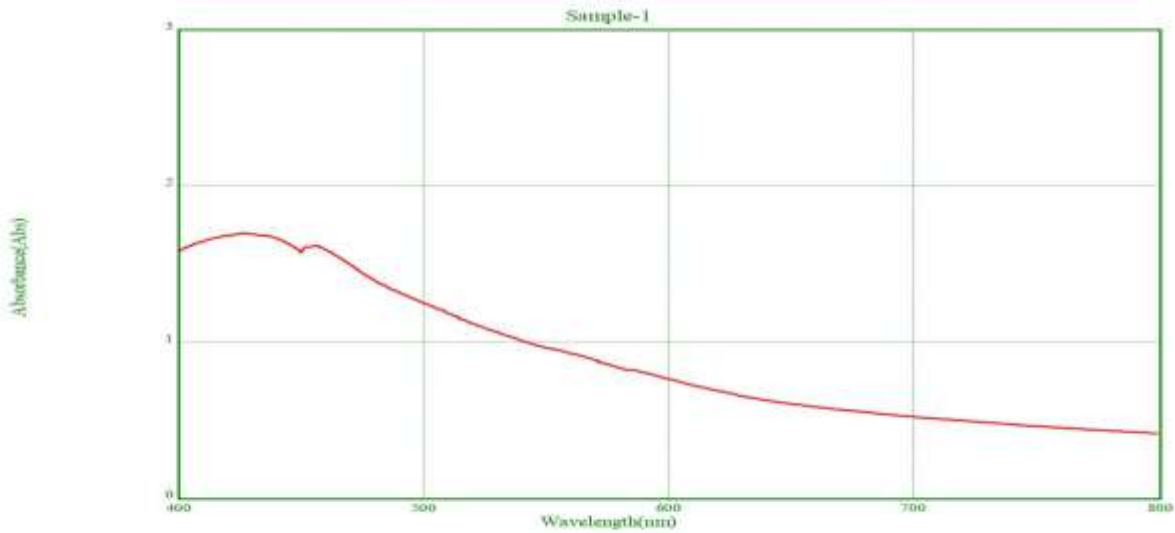
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- sample 2 (50 ethanol : 50 water)



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- sample 3 (70 ethanol : 30 water)



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- Sample 4 (30 ethanol : 70 water)



Conclusion on Cold Cream Formulation

In conclusion, our study provides compelling evidence supporting the efficacy of a cold cream formulation enriched with pomegranate peel extract for antibacterial and anticoagulant activity. The incorporation of pomegranate peel extract into the cold cream base resulted in a synergistic enhancement of its therapeutic effects, making it a promising candidate for skincare applications. The demonstrated antibacterial efficacy against a broad spectrum of bacteria, coupled with the anticoagulant activity observed in coagulation assays, highlights the multifaceted benefits of this formulation. These findings underscore the potential of pomegranate peel extract as a natural and effective ingredient in skincare products, offering both antimicrobial and circulatory benefits. Further research and clinical trials are recommended to validate these findings and assess the safety and efficacy of the formulated cold cream in real-world settings. Overall, our study contributes to the growing body of evidence supporting the integration of traditional botanical extracts into modern skincare formulations for enhanced therapeutic outcomes^[24].

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