Formulation and Evaluation of Emulsified Orange Peel Essential Oil Face Serum

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Abstract:

The largest organ in the human body, the skin is essential for sensation, temperature and regulation. Skin protects your body from the physical injury, chemicals and allergens. Our age, health, origin and lifestyle are all reflected in our skin. Our skin's health can be determined by its colour, tone and evenness, pigmentation, and surface features. There are many different skin care products available from the cosmetic and pharmaceutical industries. Skin care products are topical formulations designed to cleanse, moisturise and treat to maintain its health and appearance. Skin functions from removes of dirt to proving pleasant skin feel. One of the risk factors, skin damage brought on by solar ultraviolet radiation (UVR) from the sun, is becoming a bigger issue in dermatology due to a higher frequency of both acute and chronic cutaneous reactions. the increased awareness of skincare, especially the focus on younger-looking skin and fewer wrinkles. The focus on serums, known for their concentrated ingredients and deep skin penetration, aligns with the demand for effective skincare products. The emphasis on serums, which are well-known for their potent chemicals and deep penetration into the skin, is in line with consumer demand for skincare products that work. Topical vitamin c has wide range of clinical applications includes ant pigmentary to photoprotective and antiaging. *Citrus sinensis* from Rutaceae family, origin of oranges being rich in vitamin and minerals have many health, especially skin benefits. One significant dietary source of the antioxidant phenolic is orange peels. The orange fruit has 1.5% essential oil in it. Emulsion technology appears to be one of the most important methods for improving their protection, solubility and nano capsulation. Wrinkles and aging skin are unwanted effects of photodamage and UV radiation. The purpose of this study was to use polyherbal extract to make a serum. The aim of this study was to create a serum using polyherbal extract for antiaging, sun protection for skincare purpose.

Keywords: Skin, Skincare, *Citrus sinensis*, orange peel essential oil, Emulsification, Face serum, Anti-aging.

Introduction:

The skin contributes about 15 percent of the body weight. The skin acts as a mechanical barrier to prevent from the external environment.[1] The health of our skin can be defined by its colour, tone, and evenness, pigmentation, and surface features. Skincare is a term covering cleansing, perfuming, changing appearance, changing body odour, protecting and keeping the skin in good condition.[2] Skin functions as removal of dirt, sebum and un-wanted substances from skin, reduction of unpleasant skin symptoms, restoration of damaged skin, protection of damaged skin from various noxes and providing a pleasant skin feel. Skincare products are easily available in the market. They play major role of nourishing and providing health benefits. Skincare functionality ranges from monofunctional to polyfunctional. A recent WHO assessment states that UVR exposure to the human skin occurs continually and that the harmful consequences can be separated into more dangerous chronic damages and acute damages, which include sunburn, erythema, discomfort oedema, and photo dermatoses.

Overexposure to solar UVR can cause sunburn, a sort of radiation burns. Skin cancer is becoming a significant health risk that reduces patients' quality of life. The Brazilian National Cancer Institute states that the most common cancer in Brazil is skin cancer, which can affect people of all skin kinds and at any age. It is thought to be brought on by exposure to sunlight.

Ageing is a complex and time-dependent biological process that affects all organ systems and is characterised by a decline in function and a reduced ability of the body to respond to stress due to physical, biological and chemical agents.[3]

Skin serums are formulated to deliver targeted and potent ingredients to address specific skincare concerns. They are designed to penetrate the skin deeply and provide nourishment, hydration, or address issues like wrinkles or pigmentation. The serum is more successful at addressing particular skincare issues like pigmentation and aging symptoms because of its tiny molecules, which allow for deep skin penetration.

Face serums are strong skincare solutions that effectively target particular cosmetic concerns since they are made with higher concentrations of active ingredients. Face serum is of thinner consistency and absence of heavy oils enhance absorption and penetration, making them effective for nourishing and layering on the skin. Face serum is a lightweight water-based skincare essential that targets different skin concerns.

• **Functions of Face Serum:**

1) Anti-aging benefits

2) Helps to remove skin blemishes

3) Keep skin moisturized

4) Improved skin texture: Serums can help smooth fine lines, wrinkles, and pores. 5) Enhanced skin brightness, reduce the appearance of dark spots and hyperpigmentation. 6) Hydration can provide long-lasting hydration and help lock in moisture. 7) Antioxidant protection from environmental stressors and damage caused by free radicals.[4]

▪ **Types of Face serum:**

Anti-aging Serum

Contain ingredients like retinol, peptides, and antioxidants to reduce fine lines and wrinkles. **Oil Serum**

It provides hydration and nourishment to the skin. They contain various oils, such as olive oil, coconut oil, which can help moisturize and improve the skin texture.

Gel serum

These are light weight skincare product. It provides hydration, target specification concerns and absorb quickly without heavy feel. It includes hyaluronic acid for moisture and antioxidants for skin nourishment.

Water based serum

It is lightweight and suitable for various skin types. It provides hydration without heavy feel. It contains hyaluronic acid and glycerine for moisturization.

Emulsion Serum:

It is combined with oil and water to provide hydration and nourishment.

Herbal Face serum:

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Plant-based components with skincare properties are commonly used in the formulation of herbal face serums. These serums frequently include oils, extracts, and other botanicals that have been selected for their anti-aging, anti-inflammatory, antioxidant, or moisturizing qualities. The purpose behind this serum is to provide natural nourishment to skin, promoting healthier complexation without harsh chemicals. These are popular for their natural ingredients and potential health and skin benefits.

Vitamin C is the most abundant antioxidant in human skin.1 unlike plants and some animals, humans are unable to synthesize vitamin C due to absence of the enzyme L-gulono-gamma lactone oxidase. despite high doses of oral supplementation, only a small fraction of vitamin C will be biologically available and active in the skin. Vitamin C is essential for collagen biosynthesis and is thought to have an antiaging effect. More importantly, it serves as a cofactor for prolyl and lysyl hydroxylase, key enzymes that cross-link and stabilize collagen Vitamin C also directly activates the transcription factors involved in collagen synthesis and stabilizes procollagen messenger Rna (mRNA) that regulates type i and iii collagen synthesis. In addition, vitamin C increases the gene expression of collagen and synthesis of the tissue inhibitor of mmP-1, which decreases collagen degradation.[5]

Citrus sinensis

It belongs to Rutaceae family. Oranges are originated from South East Asia, and were cultivated in China 2500 BC. biologically active, non-nutrient compound found in Citrus fruits such as phytochemical antioxidant, soluble and insoluble dietary fibers are known to be helpful in reducing the risk of cancers, many chronic diseases like arthritis, obesity and coronary heart diseases. Rutaceae are herbs, shrubs and trees with glandular punctate, commonly strongly smelling herbage comprising about 150 genera and 1,500 species.

Fruit is 6.5-9.5 cm wide and ripens to orange yellow. Anatomically, the fruit consist of two distinct regions: pericarp and endocarp. The pericarp is also known as the peel, skin or rind, and the endocarp is also called as pulp or juice sacs. It is scientifically proven that oranges being rich in vitamins and minerals have many health benefits. 1.5% essential oil is present in the orange fruit. D-limonene (90%), citral, sinesal, n-nonanal, n-decanal, n dodecanal, geranyl acetate, anthralin acid, citronellal, linalyl acetate, methyl ester is present.[6]

Fig No 1: *Citrus sinensis* fruit

Taxonomical classification of *Citrus sinensis*

Kingdom: Plantae

Subkingdom: Tracheobiontas

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Rosids

Order: Sapindales

Family: Rutaceae

Genus: *Citrus*

Species: *sinensis*

Genetic: Citrus Fruit

Scientific name: *Citrus sinensis* L Osbeck

Local name: Sweet orange

Table No. 1: Phytoconstituents in Various part of Citrus sinensis Plant

Table No. 1: Phytoconstituents in Various part of Citrus sinensis Plant

Sr no	Plant Part	Phytoconstituents
1	Fruit peel	Flavone glycosides: Neohesperidin, Naringin, Hesperidin, Narirutin Triterpene: Limonene, Citrol Pigment: Anthocyanin, Beta-cryptoxanthin, Cryptoxanthin, Zeaxanthin and Rutin, Eriocitrin, Homocysteine Polymethoxylted flavones: Tangeritin and Nobiletin Flavonoids; Citacridone, Citabrsine and Noradrenaline
2	Leaves	Terpanoids, Linalool, β elemene
3	Flowers	Triterpenes, Limonene
4	Fruits	Vitamins; B1, B2, B3, B5, B6, and Vitamin C Minerals; Calcium, Iron, Magnesium, Zinc, Phosphorus, Potassium

Uses:

Food uses: Due to its refreshing flavour oranges had become famous in warm places.

Fruit: Citrus sinensis are sliced, dried and pulverized, and the powder is added to baked goods as flavouring.

Skin: Peels are used for making perfume and soaps. Fragrance is oranges' biggest quality. To clear, detoxify, and tone the skin orange peels are used and have found wide use in skin care products.

Juice: Oranges are commonly utilized in fruit cups, salads, gelatines and numerous other desserts,

and as garnishes on cakes, meat and poultry dishes, at home. For preparing fresh juice pulp is used. Juice is rich in protein content

Medical uses: Citrus sinensis is effective in the management of arthritis, asthma, Alzheimer's disease, Parkinson's disease, macular degeneration, diabetes mellitus, gallstones, multiple sclerosis, cholera, gingivitis, optional lung function, cataracts, ulcerative colitis, Crohn's disease.
Traditional uses: Japanese believed that Citrus blossoms symbolize chastity. Blossoms and the pulp of oranges were used to create cosmetics in other places. In cases of anxiety disorder and stress, orange juice is very helpful. To maintain hydration orange juice is useful. It is used as general tonic. For the treatment of tuberculosis, it is used as a Mexican traditional medicine. For the treatment of angina, constipation, menstrual disorder, hypertension, it is used in France. It is used to prevent constipation. In Chinese medicine the humble orange has a long history as a cooling agent for coughs, colds and respiratory disorder. It is used as traditional symbol of good luck in China.[7]

Essential oils are used in a wide variety of consumer goods. The traditional technologies pertaining to essential oil processing are of great significance and are still being used in many parts of the globe. Water distillation, water and steam distillation, steam distillation, cohobation, maceration and enfleurage are the most traditional and commonly used methods. Maceration is adaptable when oil yield from distillation is poor. Distillation methods are good
for powdered almonds, Rose petals and rose blossoms, whereas solvent extraction is suitable for expensive, delicate and thermally unstable materials like jasmine, tuberose, and hyacinth. Water distillation is the most favoured method of production of citronella oil from plant material. Essential oils are generally derived from one or more plant parts, Essential oils are broadly used as pharmaceutical components, in nutrition supplements and for cosmetic industry and aromatherapy. Orange juice is one of the most widely-consumed beverages today in world. Approximately 50 60% of the processed fruits are transformed into citrus peel, which is composed of peels, seeds and membrane residues. Orange peel oil has been chosen for extraction because it provides a great potential for 24300 http:// ijesc.org/ IJESC, December 2019 further commercial form.[8]

Essential oils are widely used in food and pharmaceutical industries where they encounter major concerns more likely insolubility and instability. Therefore, using the response surface methodology, the influence of ultrasonication conditions as well as native gums which effect on stability, particle size, and rheology.[9]

Serums are a kind of hydrating skin care product that may penetrate the skin more deeply and release active ingredients. A high-quality face serum may increase moisture levels, minimize pore size, and

give your skin a smoother, firmer structure [1]. Antioxidants, chemicals that interact with cells, and skin like ingredients should be present in every one of these products—
moisturizer, anti-wrinkle, anti-aging, or face serum. For every skin type, these elements are essential for the healthiest possible complexion Serum is a non-oily skin care product that is perfect for skin. Its active content is highly concentrated, making it one of the best cosmetic items for delivering nourishment to the deepest layer of the skin.

Materials And Methods:

Oranges was purchased from market. Peel of orange was peeled of and dried in sun for 4 days and powdered. Orange peel powder was prepared and used for oil extraction. Rose water used was of college laboratory. Vitamin E 400 and aloe vera gel capsule was purchased from medical store.

Method of extraction of orange peel essential oil (OPEO):

Sweet orange peel (*Citrus sinensis*) is part of orange plant that contains essential oil. The process of orange peel essential oil extraction using Solvent Free Microwave Extraction (SFME) affect optimum yield and quality of oil.

Orange peels are dried for over 4 days in sun. Afterwards peels were powdered off and passed through sieve NO 30 to get uniform powder of peel. Ratio of orange peel powder to distilled water was 25gm per 250 ml (100gm /L) was taken in flask. It was kept at 400watt microwave power for 60 min for extraction.

Nanoemulsification of OPEO:

The oil-in-water (O/W) nanoemulsion was prepared using OPEO (1% w/w), as the oil phase, and mixture of Tween 80 (2% w/ w) and Gum Tragacanth (GT) ((0.25% w/w) and distilled water (96.75% w/w), as the aqueous phase. So that, formulation of all samples was as follows:

Table No.2: formulation table for nanoemulsification of oil

Ingredients	For 100 ml	For 10 ml
Oil Phase	Oil	1 ml	0.1 ml
Aqueous phase	Tween 80	2 ml	0.2 ml
	Gum Tragacanth	250 mg	25 mg
	Sodium Benzoate	4mg	0.4 mg
	Water	q. s	q.s

At first, gum in water with sodium was added with stirring at room temperature and sodium bicarbonate was added, dissolved and stirred. Then tween 80 was added. This was aqueous phase in which oil (OPEO) was added with stirring at room temperature. Afterwards It was sonicated for 138s at 37°C.[10]

Table No. 3: Formulation of Polyherbal Face Serum:

Ingredients	F1(in ml)	F2(in ml)	F3(in ml)	No.
	OPEO	6	4	2
	Rose Water	4	4	4
	Aloe vera gel	2	2	2
	Glycerine	4	4	4
	Vitamin E capsule	2	2	2
	Water	q.s.	q. s	q.s.

Use of Ingredients:

1. OPEO:

It shows antioxidant property by protecting the skin from damage caused by free radicals

Reduce redness and irritation, promoting even toned skin

Shows skin brightening property by inhibiting the production of melanin, thereby reduce hyperpigmentation

Improved skin texture, improve collagen production.

It acts as natural astringent by reducing the appearance of pores and tighten the skin

2. Rose Water:

It acts as natural skin toner; it helps to balance skin pH and gives skin an even tone. It helps to retain moisture thus acts as humectant.

3. Aloe vera gel:

It is rich in hyaluronic acid, glycoproteins, and polysaccharides which help retain moisture in the skin thus reducing the appearance of fine lines and wrinkles.

It contains anti-inflammatory compounds like aloin and aloe-emodin, which help reduce redness and irritation, promoting a more even-toned complexion. It is also rich in antioxidants like vitamins A, C, and E, which help protect the skin from damage caused by free radicals, reducing the appearance of fine lines and wrinkles. It also helps improve skin elasticity by increasing collagen production, reducing the appearance of sagging skin.

4. Glycerine:

It helps retain moisture in the skin, leaving it feeling soft, supple, and hydrated. It helps to lock in moisture, reducing the appearance of fine lines and wrinkles. It helps to repair the skin's natural barrier function, reducing inflammation and irritation.

It helps protect the skin from damage caused by free radicals.

It helps to improve skin elasticity, reducing the appearance of sagging skin.

5. **Vitamin E capsule**:

It helps protect the skin from damage, reducing the appearance of fine lines and wrinkles.
It helps to lock in moisture, leaving the skin feeling soft, supple, and hydrated. Protect the skin from environmental stressors, such as pollution and UV radiation. Improve skin texture, reducing the appearance of pores and fine lines.
It helps to reduce redness and irritation.

Procedure:

In a beaker, glycerine, aloe vera and rose water was taken.

Above ingredients mixed homogenously.

In the above mixture Vitamin E capsule was added and mixed properly. In another beaker OPEO and water was taken and mixed properly.
Above mixture was added in mixture of aloe vera gel and mixed homogenously and thus face serum was prepared.

Serum was evaluated.

Result and Discussion:

1) Physical Evaluation:

The prepared face serum was observed for colour and appearance visually. Formulation was of uniform distribution of extract. The serum was evaluated for colour, odour and homogeneity and texture.

Table No.4: Physical evaluation parameter of Polyherbal face serum

Sr No	Test Parameter	F1	F2	F3
1	Colour	Vey light yellow	Very light yellow	Vey light yellow
2	Odour	Characteristic odour	Characteristic odour	Characteristic odour
3	Homogeneity and Texture	Good	Good	Good

2) pH:

A pH meter was calibrated using a standard buffer solution. Nearly 1 ml of the face serum was properly weighed and dissolve in 50 ml of distilled water and finally its pH was calculated. The skin has an acidic range and the pH of the skin serum should be in the range of 4.1-6.7.

Fig No 2: pH evaluation of formulated serum

Table No.5: pH evaluation

Formulation batch	F1	F2	F3
pH	4.6	5.3	6.4

3) Viscosity:

Viscosity of serum was checked by using Brookfield Viscometer. The viscosity of herbal face serum was normally in range.

Fig No 3: Viscosity evaluation of formulated serum

Table No.6: viscosity evaluation

Formulation F1 F2 F3 batch			
Viscosity	476	530	594

4) Determination of stability:

The prepared polyherbal face serum was evaluated for stability. It was done by keeping serum at room temperature for 1 month.

It was found that no cracking, settlement of content and microbial growth was observed. Thus, it was found that serum remains stable at room temperature.

Conclusion:

The purpose this formulation is to create serum that would nourish and manage acne due to high sun exposure and other factors. Orange peel essential oil is key component of formulation. The presence of vit c in orange oil shows antioxidant which help in management of acne and spot Aloe vera gel from inner middle area of leaf has excellent effect on acne, pimples, burns and radiation due to sun exposure. The serum eliminates fine lines, wrinkles , dark spots, blemishes with moisturizing effect pH and viscosity.

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Intelligent Biometric Attendance System Using IoT, ChatGPT, and AI for Automated Student Analysis and Reporting

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Abstract

Automating attendance tracking in educational institutions has become essential for efficiency, accuracy, and data-driven decision-making. This research proposes an AI-powered biometric attendance system integrated with IoT and ChatGPT to enhance attendance accuracy, generate automated student analytics, and send real-time notifications to parents. The system leverages facial recognition, fingerprint biometrics, AI analytics, and NLP-powered notifications to improve attendance monitoring. The study will also explore the use of machine learning techniques to predict student behavior based on attendance trends. This paper provides a comprehensive review of existing attendance management systems, highlights their limitations, and presents an IoT-AI hybrid framework for intelligent student attendance tracking.

1. Introduction

1.1 Background

Traditional attendance systems rely on manual roll calls, RFID cards, and fingerprint scanning, leading to inefficiencies, proxy attendance, and limited real-time analytics. Biometric solutions offer better authentication, but they lack automated AI-driven analysis and real-time reporting. Integrating IoT-based biometric devices with AI and ChatGPT-powered parental notifications can revolutionize attendance tracking.

1.2 Problem Statement

Despite advancements in biometric authentication, existing systems suffer from:

- Time-consuming manual data entry