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Original Article

Development and evaluation of polyherbal face pack with antibacterial effect

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ABSTRACT

Cosmetics are the fastest-growing segment in the cosmetics industry, experiencing unparalleled growth. Cosmeceuticals, which combine medicinal and cosmetic qualities, have emerged as a key factor in the pursuit of healthier, more beautiful skin. Natural substances have been critical in the creation of cosmetics, providing efficacy without the negative side effects associated with synthetic compounds. The trend towards herbal-based goods is gaining attraction, motivated by a need for purity and safety. This study focuses on the ability of certain herbal compounds, such as Aloe vera, Neem, Papaya fruit, Almond, and Tulsi, to address a variety of skincare conditions, such as antioxidants, hyperpigmentation, blemishes, wrinkles, and deep cleansing. With their distinct chemical constituents, these herbs provide treatments for pimples, acne, blemishes, pigmentation, and skin suppleness. All powder ingredients created fine powder using sieve mesh no. 44. The formulation procedure, which entailed properly mixing all of the formulation using a geometrical method with variable powder weights, was subjected to thorough testing, which included organoleptic, rheological, physicochemical, irritancy, and washability studies. All formulations such as F1, F2, F3, and F4 were created. The findings corroborate the face pack's quality, safety, and usability. Formulation F1 was chosen as the best option across all studies, demonstrating its commercialization and market availability potential. Additional research and development routes may be pursued to investigate its prolonged performance and effectiveness.

Keywords: Herbal face pack; Cosmeceutical; Aloe vera; Papaya fruit; Neem; Almond; Tulsi.

Introduction

The "Cosmetic" word is derived from the Greek word "KOSM TIKOS" meaning the power, arrange, and skill in decoration [1]. According to FDA (Food and Drug Administration) Cosmetics are intended to be applied to the human body for cleansing, beautifying, promoting, attractiveness or altering the appearance without affecting the body structure or function. The origin of cosmetic was associated from hunting, fighting, religion and supervision and later associated with medicine [2]. Cosmetic producers coined the word "cosmeceuticals" in the early 1990s to

characterise skin care products that promise therapeutic results from the addition of plant active compounds such as alpha-hydroxy acid, retinoic acid, ascorbic acid, and co-enzyme Q10. Summer heat produces skin damage or rupture, resulting in freckles, blemishes, hyperpigmentation, wrinkles, and sunburns, whereas winter heat causes skin damage or cracks, maceration, and infections. Environmental factors such as germs, chemical agents, fungi, biological toxic agents, and, to a lesser extent, hunger cause the common disease, which affects all age groups. [3].

Despite India's rich heritage and understanding of herbal medicine, the country exports very few of these treatments. Given the large herbal medicine and nutraceutical industry in industrialised countries, India might reconsider exporting raw herbal medications. The market for herbal medicines in India includes over-the-counter medications, ethical and traditional formulations, and home treatments from the Ayurvedic, Unani, and Siddha medical systems, with a meagre export of around \$80 million. Castor oil, opium extract, and psyllium seeds and husk account for 60% of total exports [4]. In such situations, they are lost to believe on conventional medicine, when use home remedies by the patients for acute, often self-limiting conditions, such as cold, sore throat, or bee sting, there are often because professional care is not immediately available, too inconvenient, costly or time-consuming [5]. Dermatologists have tested and demonstrated that they are hypoallergenic and safe for use anytime, anywhere. People don't have to worry about developing skin rashes or itching because they are made of natural ingredients. Face packs are tiny powders or pastes with a smooth texture that are applied to the face in a thin layer and allowed to dry for a few minutes before wiping away with water. Routine application of a face pack exfoliates the skin, removes dry and dead skin, provides soothing, cooling, moisturising, and nourishing effects, and, depending on the formulation, also aids in the removal of dirt and grease from the skin without interfering with the skin's normal physiological functioning [6]. Herbal cosmetics are more popular since they are thought to be safer and have less adverse effects than synthetic cosmetics. Herbal cosmetics can help minimise allergy reactions and are harmless in nature. Herbal face packs are used to increase blood circulation, renew the skin, and eliminate debris from the pores. Herbal face packs are beneficial for the prevention, promotion, and treatment of skin issues. Herbal cosmetics are especially popular because they are environmentally friendly [7].

Present research work aimed to formulate and evaluate poly herbal face pack to promote nourishment and glow of skin by using natural materials like Aloe vera (*Aloe barbadensis*), Neem (*Azadirachta indica*), Papaya fruit (*Carica papaya*), Almond (*Prunus dulcis*), and Tulsi (*Ocimum tenuiflorum*). The face pack can also be used as scrub to remove dried, dead and flecky skin.

Materials and Methods

All the natural materials used in the present study i.e., Aloe vera (*Aloe barbadensis*), Neem (*Azadirachta indica*), Papaya fruit (*Carica papaya*), Almond (*Prunus dulcis*), and Tulsi (*Ocimum tenuiflorum*) were obtained from the botanical garden of Nibha Institute of Pharmaceutical Science in karimpur. The face pack

was created and followed by cleaning, drying, and pulverizing the necessary materials.

Aloe Vera (*Aloe barbadensis*)

The botanical name for aloe vera is *Aloe barbadensis* miller. It is a plant in the Asphodelaceae (Liliaceae) family that is perennial, xerophytic, succulent, shrubby, or arborescent. The plant has triangular, fleshy leaves with serrated edges, golden tubular blossoms, and a plethora of seeds. Aloe vera gel revitalises the skin by keeping it hydrated, and it maintains your skin looking young at all times. It is an excellent skin moisturiser for acne and pimples. Both ingested and topically, it has been demonstrated to relieve pain and inflammation. Aloe vera is particularly effective in treating pigmentation, skin eruptions, itching, blisters, skin ageing, sunburns, and acne. It includes over 20 amino acids, minerals, vitamins, polysaccharides, and other nutrients, making it a wonder beauty herb [8,9,10].

Neem (*Azadirachta indica*)

Neem trees are members of the mahogany family Meliaceae. It is one of two species in the genus *Azadirachta* and is native to India and Burma. All tree parts, including seeds, leaves, flowers, and bark, are used to create a wide range of medications. Neem contain the chemicals nimbin, azadirachtin, and nimbidin. It alleviates skin conditions such as psoriasis, eczema, and other skin infections. Boils, prickly heat, and other minor skin issues can be treated with neem powder. Face packs packed with neem also help to decrease acne scars and blemishes [11,3,5].

Papaya fruit (*Carica papaya*)

Papaya (*Carica papaya*), often known as papaw or pawpaw, is the succulent fruit of a huge plant in the Caricaceae family. The papaya fruit is mildly sweet with a pleasant musky flavour that is stronger in some types and climates than in others. This fruit contains antioxidants like as vitamin C and lycopene, which aid in the neutralization of free radicals. The end effect is slow-aging, youthful-looking skin that is elastic, firm, and smooth. Eating papayas on a regular basis will help you appear younger and stay active. Papaya contains natural therapeutic properties that soothe inflamed skin and alleviate sunburns and pigmentation caused by sun exposure [11,12].

Almond (*Prunus dulcis*)

Prunus dulcis (Almond) trees are deciduous trees in the Rosaceae rose family. They are Middle Eastern in origin and have been developed for their nutritious and adaptable almonds. Because of its emollient and nourishing characteristics, almonds are often used in skin care products such as almond. Almonds contain

Vitamin A, which can encourage the development of new skin cells. Almonds contain vitamin E, which has antioxidant effects that may help prevent cell damage and minimise sun-induced ultraviolet (UV) damage to the skin. Omega-3 fatty acids aid to prevent premature ageing and solar damage. Almonds also include dietary fibre, which aids with digestion and avoids skin problems. Proteins repair and replenish skin tissues, and minerals such as magnesium, zinc, and selenium promote skin health. Amino acids promote collagen production and protect the skin from oxidative damage caused by environmental factors [11,9,13].

Tulsi (*Ocimum tenuiflorum*)

Ocimum sanctum is a 75 cm tall, numerously branched, upright, strong, and aromatic herb in the Labiatae family. In English, this is known as India's Holy Basil, Tulsi in Sanskrit, and Kala Tulsi in Hindi. The roots, seeds, and leaves of this plant have all been used in ancient Ayurvedic medicine. It aids in the removal of pimples and acne, fades imperfections, and lowers pigmentation. Furthermore, *O. sanctum* L. is thought to have adaptogenic, analgesic, antispasmodic, anticancer, antidiabetic, antifungal, and antibacterial activities. The volatile oil from the leaves contains euginal (1-hydroxy-2-methoxy-4-allylbenzene) (also known as eugenic acid), and urosolic acid [11,2].

Method of Preparation

Four different formulations were prepared with varying quantity/concentrations of all ingredients named F1, F2, F3 and F4. To obtain uniformly sized particles, all powdered materials were passed through a sieve with a mesh size of 44, followed by accurate weighing. Furthermore, all powder ingredients were geometrically combined to ensure consistent and even mixing. Table 1 shows the formula for preparing individual preparations with each ingredient. The individual preparation was stored in an airtight container, labelled as previously stated with the composition incorporated, and used for additional evaluation studies [9,14].



Figure 1: Prepared Formulation Powder.

Table 1: Formulation of Face Pack.

S. N.	Common Name of Ingredients	Scientific Name	Quantity of each formulation is 50 gm			
			F1	F2	F3	F4
1	Papaya fruit	<i>Carica papaya</i>	20	15	10	5
2	Tulsi	<i>Ocimum tenuiflorum</i>	3	3	3	3
3	Neem	<i>Azadirachta indica</i>	10	10	10	10
4	Aloe vera	<i>Aloe barbadensis</i>	12	12	12	12
5	Almond	<i>Prunus dulcis</i>	5	10	15	20

Method for Application

Take the prepared Herbal face pack powder in a bowl and add enough water or rose water to make a stiff

viscous mass. Allow this paste to dry for 10-15 minutes all over your face. Once the paste has dried, gently scrub and remove the pack from skin before washing it off with water [5,15].



Figure 2: Formulations F1 to F4.

Evaluation of Face Pack

Prepared face pack was evaluated using following parameters to ensure supremacy of prepared face pack [3]:

Organoleptic Evaluation

Organoleptic evaluations were done on things like colour, smell, appearance, texture, and smoothness. For the evaluation of colour and texture, touch sensation and visual perception were used, respectively [16].

Physicochemical Evaluation [3,9]

pH: A digital pH meter was used to determine the pH of the preparation. The pH metre was initially calibrated at various pH levels with an appropriate buffer solution. In distilled water, a 10% (w/v) dispersion of the product was made, and the pH was evaluated directly without any further dilutions [9].

Moisture content: Moisture content and loss on drying (LOD) are significant characteristics for plant-based goods. Inadequate drying of these agents may result in the enzymatic breakdown of active ingredients. The LOD technique was used to determine the moisture content of the preparation. 5 gm of sample was carefully weighed and placed in a previously weighed petri plate (W1). W2 is the weight of the petri dish containing the sample. The petri dish was heated in a hot air oven at 100-108°C until the sample's constant weight was reached. Measured the weight after 1 hours up to standard weight [17].

Ash value: The ash value of a herb is computed to identify its inorganic content. It is used to determine the identity or purity of a medication. An extremely high ash value, in general, indicates adulteration, contamination, or substitution during product manufacturing. About 2-4 gm of powder medication was placed in a crucible dish that had previously been fired and weighed. The temperature was progressively raised so that it did not reach the red colour. The ash is cooled and weighed once it has been completely burned.

Preparation of Ash: In a Silica crucible over the burner, 2-4 gm of drug was cremated. The charred material was heated for six hours in a muffle furnace at 600-650 °C. The resulting ash was white and carbon-free. It was then cooled and weighed on ash-free filter paper [14].

Total Ash Value: Total ash value is important for identifying excess of sandy, earthy matter with drug and is used to determine low grade, exhausted products. A 2-4 gm powdered sample was placed in a

crucible that had previously been ignited and tarred. The material was evenly spread on the crucible and ignited by gradually increasing the heat until a white powder was obtained, free of carbon. The sample was then cooled in a desiccator, and the weight of the sample was recorded. The percentage total ash was calculated using the air-dried sample.

Acid insoluble Ash value: It is used to identify earthy matter. Cover the crucible containing total ash with a watch glass and add 25 mL of hydrochloric acid. For 5 minutes, the mixture was gently boiled. After that, the watch glass was rinsed with 5 ml of hot water and placed in the crucible. The ash-free filter paper was used to collect the insoluble matter, which was then washed with hot water until it became neutral. The insoluble matter was transferred to the original crucible, dried on a hot plate, ignited to constant weight, and subjected to cooling in a desiccator for 30 minutes before weighing the sample. The percentage of acid insoluble ash was calculated using an air-dried sample.

Water soluble ash value: It is the weight difference between total ash and residue after total ash treatment with water. It is used to determine whether or not the material has been exhausted by water. 25 mL of water was added to the crucible containing total ash and boiled for 5 minutes. The insoluble matter was collected using ash-free filter paper. After washing with hot water, the item was ignited for 15 minutes at a temperature not exceeding 450°C. The sample was cooled, weighed, and the percentage of water-soluble ash was calculated in comparison to the air-dried sample.

Swelling index: Done for swelling index of face pack mucilage. The swelling index is the volume in millilitres taken up by swelling of 1 gram of plant material under particular conditions. Swelling agent water in the amount specified for each plant material. 50ml volumetric flask + 20ml water in an upward direction + shake after 10 min. after 1 hr. + stand for 24 hr. + measured the volume in ml occupied by the extract. Then weight the swelling sample and the calculate [18].

Swelling Percentage =

$$\frac{W(\text{weight of Swallen Sample}) - \text{Weight of dry Sample}}{\text{Taken weight of Sample}} \times 100$$

Rheological Evaluation [3,9,15]

It included evaluating powder properties. The sample was evaluated using several physical requirements

such as angle of repose, bulk density, tapped density, and Hausner's ratio.

Angle of Repose: The height and radius of the heap are noticed and recorded after the requisite amount of dried powder is dropped from a height of 6 cm. The angle of repose (θ) for the above approach can be calculated the using the formula:

$$\text{Angle of repose } (\theta) = \tan \frac{H}{R}$$

Where, θ - Angle of repose
H - Height of the heap
R - Radius of the base

Bulk Density: It is the amount of a substance in a certain volume. It is determined by dividing the given mass of powder by its bulk volume. It is calculated by using a funnel to transfer an accurately weighed amount of powder sample to the graduated cylinder. The initial volume was recorded. The weight-to-volume ratio was computed using a formula:

$$\text{Bulk density} = \frac{\text{Mass of powder}}{\text{Volume of powder}}$$

Tapped Density: It is calculated by placing a known amount of powder (10 gm) into a graduated cylinder and tapping it a certain number of times. The starting volume was reported. For 10-15 minutes, the graded cylinder was tapped continually. The density can be calculated by dividing the mass of the powder by the tapped volume.

$$\text{Tapped density} = \frac{\text{Mass of powder}}{\text{Tapped volume}}$$

Housner's ratio: The Housner's ratio can be used to determine the flowability of powders. It is the ratio of the powder's tapped density to its bulk density.

$$\text{Housner's ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

Carr's index: The powder flow property, often known as percent compressibility, is also measured. It is proportional to the relative flow rate of cohesiveness and particle size. To get the % compressibility index, use the following equation:

$$\text{Carr's index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$$

Particle size: Particle size was performed by microscopic method as per standard procedure. Particle size analysis is an important parameter, which directly affect various properties of powder namely, spread ability, grittiness, etc.

Test for Irritancy

The prepared face pack was applied to a previously marked region of 1 square cm on the left-hand dorsal surface, and time was recorded. The skin was then examined at regular intervals for irritancy, erythema, and oedema (if any) for up to 24 hours [8].

Washability

Formulation was applied on the skin and then ease and extent of washing with normal tap water were checked manually [8].

Result

The following are the results of all evaluation parameters used to ensure the superior quality of the developed face pack.

Organoleptic evaluation

The current study's herbal face pack was tested for several organoleptic factors, and its observations such as colour, odour, texture, and smoothness are shown in Table 2.

Table 2: Result of organoleptic properties.

S.N.	Parameters	Observations			
		F1	F2	F3	F4
1.	Appearance	Powder	Powder	Powder	Powder
2.	Colour	Brownish Green	Dark Green	Brownish Green	Brownish Green
3.	Odour	Pleasant	Pleasant	Pleasant	Pleasant
4.	Texture	Fine	Fine	Fine	Fine
5.	Smoothness	Smooth	Smooth	Smooth	Smooth

Rheological evaluation

The observations of rheological evaluation such as bulk density, tapped density, angle of repose, Housner's

ratio, Carr's index, are given in table 3. This supports the face pack's flow qualities, as it was discovered to be a free flowing and non-sticky powder in nature.

Table 3: Result of rheological properties.

S.N.	Parameters	Observations				Inference
		F1	F2	F3	F4	
1.	Bulk Density	0.45	0.40	0.41	0.44	Good
2.	Tapped Density	0.63	0.56	0.59	0.63	Good
3.	Housner's ratio	1.34	1.40	1.43	1.42	Passable
4.	Carr's index	22.6%	23.5%	24.5%	24.6%	Passable
5.	Angle of repose	31.4	33	35	35.8	Between 31-35° is considered as Good

Physicochemical Parameters

Results of formulation are shown in table 4. Physicochemical parameters such as pH, Moisture Content, ash value and swelling index. The pH of the

face pack is determined to be close to that of the skin, and swelling index is examined in the second technique. As a result, the formulation can be regarded skin-safe.

Table 4: Result of physicochemical evaluation.

S.N.	Parameters		Observations			
			F1	F2	F3	F4
1.	pH		6.6	6.5	6.4	6.4
2.	Moisture Content		2%	6.2%	8%	8.8%
3.	Ash Value	Total Ash Value	2.051%	2.42%	2.01%	2.09%
		Acid insoluble ash value	0.921%	0.92%	0.96%	0.90%
		Water soluble ash value	1.49%	1.43%	1.44%	1.45%
4.	Swelling Index		130%	140%	170%	150%

Irritancy test

When the formulation was put to the irritancy test, it showed no symptoms of rashes, redness, irritation, or swelling throughout the test (Table 5).

Washability

The face pack can be simply removed from the skin with tap water (Table 6).

Table 5: Result of irritancy test.

S.N.	Parameters	Observations				No sign of erythema, oedema and irritation was observed
		F1	F2	F3	F4	
1.	Irritancy	Negative	Negative	Negative	Negative	
2.	Erythema	Negative	Negative	Negative	Negative	
3.	Oedema	Negative	Negative	Negative	Negative	

Table 6: Result of washability test.

S.N.	Parameters	Observations			
		F1	F2	F3	F4
1.	Washability	Easily washable			

Discussion

The findings of several property evaluations revealed that the prepared face pack was smooth and fine in texture, that formulations F1, F3, and F4 were brownish green in colour, and that formulation F2 was dark green in colour and had a nice odour. The particles' flow characteristics suggested good flowability. There were no symptoms of redness, rashes, swelling, or oedema found during the irritancy test. The ash content and moisture content were both within acceptable limits. The general powder characteristics were assessed for parameters such as Angle of repose, Bulk density, tapped density, and Hausner's ratio, with the findings indicating that all formulations have free flowing capabilities. While the formulation's pH was close to 6.5, indicating that the face pack could be put to the skin. The mixture washes off the skin easily and leaves no stains. The washability test results reveal that all four formulations are easily washable with ordinary tap water. Four distinct formulations with variable amounts of all components were prepared in the current formulation and evaluation process.

Conclusion

Natural medicines are more popular since they are thought to be safer and have fewer adverse effects than manufactured ones. Herbal formulations are becoming increasingly popular on the global market. Herbal face packs are used to increase blood circulation, revitalise muscles, preserve skin elasticity, and eliminate debris from skin pores. The herbal face pack contains natural herbal ingredients such as Aloe vera (*Aloe barbadensis*), Neem (*Azadirachta indica*), Papaya fruit (*Carica papaya*), Almond (*Prunus dulcis*), and Tulsi (*Ocimum tenuiflorum*). After testing, according to the findings of this study, the combination of these plants can be utilised as a herbal face pack for beautification. It also reveals that using this poly herbal face pack would improve people's appearance while also treating acne, ageing, dryness, and wrinkle concerns. The formulation was found to be homogeneous, free flowing, and easily washable off the skin without producing discomfort or irritation. It has been discovered that herbal face packs have the capacity to provide an effective radiant effect on skin. The entire study is useful for substantiating product claims due to its beneficial effects on humans.

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Conflict of Interest

None declared.

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