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Research Article

Formulation And Evaluation Of A De-Tan Face Wash Tablet

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ABSTRACT

The increasing demand for sustainable and travel-friendly personal care products has encouraged the development of innovative solid dosage forms for cosmetic applications. The present study aimed to formulate and evaluate a novel de-tan face wash tablet containing caffeine and orange peel powder as natural bioactive ingredients. Caffeine was incorporated for its antioxidant and skin-revitalizing properties, while orange peel powder was selected for its vitamin C-rich antioxidant activity and skin-brightening potential. The tablets were prepared by the direct compression technique using microcrystalline cellulose, starch, soap base, and magnesium stearate as excipients. Formulation optimization was carried out through five trial batches to obtain a tablet with desirable mechanical strength, cleansing efficiency, and user acceptability. The optimized formulation was evaluated for pre-compression characteristics, organoleptic properties, hardness, pH, foamability, washability, friability, weight variation, and skin irritation. The powder blend exhibited excellent flow properties with a bulk density of 0.690 g/mL, tapped density of 0.711 g/mL, Hausner's ratio of 1.02, Carr's index of 2.88%, and an angle of repose of 24.22°. The optimized tablets demonstrated satisfactory hardness (2.3 kg/cm²), pH 6.0, friability below 1%, excellent foamability

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and washability, and no signs of skin irritation, indicating good physicochemical quality and skin compatibility. The developed formulation provides an eco-friendly, portable, and water-efficient alternative to conventional liquid facewash products by minimizing packaging waste and improving consumer convenience. These findings suggest that the formulated de-tan face wash tablet has significant potential as a sustainable cosmetic product for daily skin cleansing and de-tanning applications.

INTRODUCTION

Facial cleansing is an essential step in maintaining healthy skin by removing dirt, excess sebum, pollutants, microorganisms, and cosmetic residues. Conventional face wash products are commonly available as liquids, gels, and creams; however, these formulations require plastic packaging, preservatives, and high water content, contributing to environmental waste. The increasing demand for sustainable and travel-friendly cosmetic products has led to the development of solid formulations such as face wash tablets, which are compact, portable, and environmentally friendly [1-3].

Natural ingredients are increasingly incorporated into cosmetic formulations because of their safety, biocompatibility, and multifunctional skin benefits. Caffeine is a natural bioactive compound with antioxidant and an anti-inflammatory property that helps protect the skin from oxidative stress, improves microcirculation, and enhances skin appearance. These properties make it a promising ingredient for de-tan and skin-rejuvenating formulations [4, 5].

Orange peel powder (Citrus sinensis) is a rich source of vitamin C, flavonoids, and phenolic compounds with antioxidant, antimicrobial, and skin-brightening activities. It promotes mild exfoliation, supports collagen synthesis, and helps reduce pigmentation caused by prolonged sun exposure. Consequently, orange peel powder has gained considerable attention as a natural ingredient in cosmetic and skincare products [6, 8].

The development of solid cosmetic dosage forms aligns with the global emphasis on sustainability by reducing water consumption and plastic packaging while improving product stability and consumer convenience. Despite the growing popularity of solid skincare products, limited studies have focused on de-tan face wash tablets containing caffeine and orange peel powder. Therefore, the present study aimed to formulate and evaluate a novel de-tan face wash tablet using the direct compression technique. The prepared formulation was evaluated for its physicochemical properties, foamability, hardness, pH, friability, washability, skin compatibility, and overall performance to establish its potential as an effective and eco-friendly alternative to conventional liquid face wash formulations [9-15].

MATERIALS AND METHODS

MATERIALS

Caffeine powder and orange peel powder (Citrus sinensis) were used as the active ingredients. Microcrystalline cellulose (MCC), starch, soap base, and magnesium stearate were employed as excipients. All materials were of pharmaceutical grade and procured from the local market and the Department of Pharmaceutics, D.S.T.S. Mandal's College of Pharmacy, Solapur.

Formulation of De-Tan face wash tablets

Face wash tablets were prepared by the direct compression method. The accurately weighed ingredients were blended uniformly in a mortar and passed through sieve No. 44 to obtain a homogeneous powder mixture. Magnesium stearate was added as a lubricant and mixed gently before compression. The final blend was

compressed using a single-punch tablet compression machine to obtain tablets of 250 mg weight.

Table 1: Formulation table De-Tan face wash tablet

Sr. No	Ingredients	Quantity (500 mg)				
		Batches				
		F1	F2	F3	F4	F5 (250 mg)
1	Caffeine	25	25	25	30	40
2	Orange Peel powder	25	25	25	40	20
3	Aloe Vera Powder	25	25	25	50	-
4	Sodium lauryl sulphate	175	-	-	-	-
5	Reetha	-	175	-	-	-
6	Soap base	-	-	175	130	65
7	Microcrystalline Cellulose	25	25	25	50	25
8	Starch	200	200	200	175	87.5
9	Magnesium Stearate	25	25	25	25	12.5

Experimental procedure

The de-tan face wash tablets were prepared by the direct compression method. The required quantities of caffeine, orange peel powder, microcrystalline cellulose, starch, and soap base were accurately weighed and blended uniformly in a clean mortar using a pestle. The powder blend was passed through sieve No. 44 to obtain a homogeneous mixture. Magnesium stearate was added as a lubricant and mixed gently for 2–3 min. The final blend was compressed using a single-punch tablet compression machine to obtain tablets weighing 250 mg each. Five trial batches (F1–F5) were prepared by varying the composition to optimize the formulation. Based on the evaluation results, batch F5 was selected as the optimized formulation.

Evaluation of powder blend

Bulk density

Bulk density was determined by gently pouring the powder blend into a graduated cylinder and recording its initial volume. It was calculated using the following equation.

Bulk Density = Weight of Powder / Bulk Volume

Tapped density

The graduated cylinder containing the powder blend was tapped until a constant volume was obtained. Tapped density was calculated using.

Tapped Density = Weight of Powder / Tapped Volume

Hausner's ratio

Hausner's ratio was calculated to evaluate the flow characteristics of the powder blend using the equation.

Hausner's Ratio = Tapped Density / Bulk Density

Carr's index

Carr's compressibility index was determined using the following equation.

Carr's Index (%) = [(Tapped Density − Bulk Density) / Tapped Density] × 100

Angle of repose

The angle of repose was determined by the fixed funnel method. The height and radius of the powder cone were measured, and the angle was calculated using:

$\theta = \tan^{-1}(h/r)$

Evaluation of face wash tablets

Organoleptic evaluation

The tablets were visually examined for colour, appearance, surface texture, and thickness.

Hardness test

Tablet hardness was determined using a Monsanto hardness tester. The crushing strength was expressed in kg/cm².

pH determination

One tablet was dispersed in 10 mL of distilled water, and the pH of the dispersion was measured using a calibrated digital pH meter.

Foamability test

One tablet was dispersed in 5 mL of distilled water in a graduated cylinder and shaken vigorously for 1 min. The volume and stability of the foam produced were recorded.

Washability test

The prepared formulation was applied to the skin and washed with running water. Ease of removal and the absence of residue were visually assessed.

Skin irritation Test

The optimized formulation was applied to the dorsal surface of healthy human skin and observed for 1–2 h for redness, itching, irritation, or edema.

Weight variation test

Twenty tablets were individually weighed using a digital balance. The average weight and percentage deviation were calculated according to the Indian Pharmacopoeia.

Friability test

Friability was evaluated using a Roche friabilator operated at 25 rpm for 4 min (100 revolutions). The percentage weight loss was calculated, and values below 1% were considered acceptable.

Powderability test

The tablets were gently crushed between the fingers to assess their ability to convert into a fine powder suitable for facial application.

RESULTS

Evaluation of powder blend

Table 2: Preformulation study of powder blend (n=3)

Sr. No	Test	Results				
		Batches				
		F1	F2	F3	F4	F5

1	Bulk density (gm/ml)	0.612 ± 0.01	0.638 ± 0.02	0.661 ± 0.01	0.678 ± 0.01	0.690 ± 0.01
2	Tapped density (gm/ml)	0.726 ± 0.02	0.742 ± 0.02	0.728 ± 0.01	0.720 ± 0.01	0.711 ± 0.01
3	Hausner's ratio	1.19	1.16	1.10	1.06	1.03
4	Carr's index (%)	15.70	14.01	9.20	5.83	2.95
5	Angle of repose (°)	33.84 ± 0.32	31.12 ± 0.28	28.45 ± 0.25	26.38 ± 0.21	24.22 ± 0.18

Organoleptic parameter

Figure 1: De-Tan Face wash Tablet

Table 3: Organoleptic parameter

Sr. No	Evaluation parameter	Rresults
1	Color	Brownish White
2	Thickness (mm)	2.01
3	Diameter (mm)	4.0

Evaluation of face wash tablet

Table 4: Evaluation of face wash tablet (n=3)

Sr. No	Test	Results				
		Batches				
		F1	F2	F3	F4	F5
1	Appearance	Fair	Fair	Good	Very good	Excellent

1	Hardness (kg/cm^2)	1.7 ± 0.1	1.9 ± 0.1	2.5 ± 0.1	2.8 ± 0.1	2.3 ± 0.1
2	pH	5.4 ± 0.1	5.7 ± 0.1	6.2 ± 0.1	6.1 ± 0.1	6.0 ± 0.1
3	Foamability	Poor	Moderate	Excellent	Excessive	Excellent
4	Washability	Fair	Good	Very good	Good	Excellent
5	Skin irritation	Mild irritation	No irritation	No irritation	Slight dryness	No irritation
6	Friability (%)	1.45 ± 0.05	1.12 ± 0.03	0.95 ± 0.02	0.88 ± 0.02	0.80 ± 0.02
	Weight variation	Failed	Passed	Passed	Passed	Passed
	Powderability	Poor	Good	Good	Fair	Excellent
	Overall performance	Unsatisfactory	satisfactory	Good	Very good	Excellent

Figure 2: Spreadability **Figure 3: Foamability** **Figure 4: Powderability**

DISCUSSION

Five trial batches (F1–F5) of the de-tan facewash tablet were prepared and evaluated to optimize the formulation. The pre-compression results showed progressive improvement in powder flow properties from F1 to F5. The optimized batch (F5) exhibited a bulk density of 0.690 g/mL, tapped density of 0.711 g/mL, Hausner's ratio of 1.03, Carr's index of 2.95%, and an angle of repose of 24.22°, indicating excellent flowability suitable for direct compression.

Post-compression evaluation revealed that F5 possessed the most desirable characteristics, including hardness of 2.3 kg/cm², pH 6.0, friability of 0.8%, excellent foamability, excellent washability, and no skin irritation. The optimized formulation demonstrated good mechanical strength, satisfactory cleansing performance, and compatibility with skin.

Overall, systematic optimization of the formulation significantly improved the quality of the facewash tablets. Based on the evaluation results, F5 was selected as the optimized formulation because it exhibited superior physicochemical properties, excellent cleansing performance, and better consumer acceptability than the other trial batches.

CONCLUSION

The present study successfully formulated and evaluated a novel de-tan facewash tablet containing caffeine and orange peel powder using the direct compression method. Among the five trial formulations, Batch F5 exhibited the best pre-compression and post-compression characteristics, including excellent flow properties, satisfactory hardness, acceptable pH, low friability, excellent foamability, good washability, and no skin irritation. The optimized

formulation demonstrated good physicochemical stability, effective cleansing performance, and enhanced consumer convenience. The developed facewash tablet offers a portable, eco-friendly, and sustainable alternative to conventional liquid facewash products and has promising potential for cosmetic and personal care applications.

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