International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 229-234 www.ijprajournal.com ISSN: 2456-4494

Lyophilized Saccharum Officinarum Gel Cleanser: Formulation and It's Evaluation

Dr. N. Tamilselvan[1*], Mrs. Reshma E S[2], Anjana Krishna T[3], Deepthi T[4], Farseena P[5], Mishal Kabeer[5], Shamil K[7]

[1]*Professor & Head of the Department of Pharmaceutics, Nehru College of Pharmacy, Pambady, Thiruvilwamala, Thrissur, Kerala*

[2]*Assistant Professor, Department of Pharmaceutics, Nehru College of Pharmacy, Pambady, Thiruvilwamala, Thrissur, Kerala*

[34567] *Department of Pharmaceutics, Nehru College of Pharmacy, Pambady, Thiruvilwamala, Thrissur, Kerala*

Corresponding author: Dr. N. Tamilselvan. Professor & Head of Pharmaceutics, Nehru college of Pharmacy,

Date of Submission: 10-03-2025 Date of Acceptance: 20-03-2025

ABSTRACT:

The demand for natural and sustainable skincare product has being increasing which has led to herbal-based cleanser. This study focuses on the formulation and evaluation of a Lyophilized Saccharum Officinarum (Sugarcane) Gel Cleanser, using the beneficial properties of sugarcane. Gel cleanser is water based formulation used to remove dirt, sebum, makeup and impurities. Sugarcane juice, rich in antioxidants, polyphenols, flavonoids, and glycolic acid, sugarcane offers exfoliating, anti-aging, hydrating, and antibacterial properties. However, due to its high water and sugar content, it is highly spoiled. Lyophilization (freeze-drying) is used mainly to increase its stability and preserving of bioactive compounds. The cleanser formulation uses lyophilized sugarcane juice, mild surfactants, gelling agent, humectants, pH adjuster and concentration were adjusted to achieve an effective and cleanser for all skin types. Formulation evaluation was performed through various tests, including pH determination, viscosity measurement, foamability and spreadability to assess the quality and suitability for application. In summary, the outcomes of this study demonstrate that a lyophilized sugarcane juice gel cleanser can be successfully formulated with desirable stability and physicochemical properties. Furthermore, its natural constituents suggest potential effectiveness as a skincare product for gentle exfoliation, hydration, and skin rejuvenation.

KEYWORDS: Sugarcane juice, Lyophilization, Gel cleanser, Antioxidants, Exfoliation, Anti-aging.

I. INTRODUCTION

Cosmetics encompass a vast array of products designed to enhance appearance and Cosmeceuticals represent a hybrid category, blending cosmetic and pharmaceutical properties, these product contain active ingredients that offer therapeutic benefits. Cosmetics are not only limited to makeup products it have various dimensions like skincare, hair-care, nail-care, fragrance. Skincare is simply about maintaining the health and integrity of skin. Skincare has become an essential part of self-care and people increasingly looking for skin friendly products containing natural ingredients. Skincare products include cleanser, moisturizer, toner, serum, mask, eye cream, sunscreen.

A gel cleanser is a water based cleanser with a gel like consistency, to remove dirt, oil, makeup and impurities while maintain hydration. In recent years, the demands for natural based skincare products were grown significantly with focus on effective and sustainable formulations. Saccharum Officinarum (commonly known as sugarcane) is a promising ingredient in skin care due to rich content of antioxidants, polyphenols, flavonoids[1,2]. Recent studies shows that it has potential anti-aging effect due to the presence of antioxidants which reduce the damage caused by free radicals[3]. Sugarcane juice is highly prone degradation and microbial attack due to the presence of high amount water and sugar content. To enhance stability and preserve the bioactivity of the components, lyophalization technology has been incorporated in the development of Saccharum officinarum gel cleanser along with gentle cleansing agents.

Role of herbs in cosmetics

Herbs are gaining attention in cosmetics due to its harmless and effective nature. Herbal cosmetics are formulations which contain

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 229-234 www.ijprajournal.com ISSN: 2456-4494

phytoconstituents derived from plant source used to maintain a healthy skin and cure various skin ailments. A number of herbal plant are naturally accessible and used in preparation of herbal cosmetics, these include turmeric, aloevera, neem and many more. Herbal skin cosmetics have multi-functionalities like antioxidants, anti-inflammatory, antiseptic and anti aging properties.

PLANT PROFILE

Saccharum Officinarum
Common name: Sugarcane, Ganna, Karimp

Taxonomical classification
Kingdom: Plantae
Order: Poales
Family: Poaceae
Subfamily: Panicoideae
Genus: Saccharum
Species: S. officinarum

Sugarcane Juice: Benefits for Skin

- Antioxidant properties: Sugarcane juice is rich in antioxidants, help to protect the skin from damage caused by free radicals. Free radicals can cause premature aging, so antioxidants act as anti-aging agent.
- Natural exfoliation: Sugarcane juice contains glycolic acid, an alpha-hydroxy acid (AHA) known for its gentle exfoliating properties. Glycolic acid helps to remove dead skin cells, providing smoother, brighter skin[4].
- Hydration: Sugarcane juice is also a natural humectant, helps to attract and retain moisture in the skin. This can help to keep the skin hydrated and prevent dryness.
- Antibacterial and anti-inflammatory properties.

Therapeutic uses:

Energy drink and digestive aid, Anti cancer agent, Improve immunity, heal wounds, maintain weight and has the ability to fight against LDL[5].

Cleansers

Cleansers are the agent which is used to remove dirt, sweat, sebum, dead skin cells, makeup and other unwanted materials from the skin[8,9].

Types:
1. Liquid cleanser
2. Oil based cleanser
3. Gel cleanser (foaming/ non foaming)
4. Exfoliating cleanser
5. Cleansing milk
6. Micellar water

Why we need cleanser?

Many impurities from the environment and cosmetic product are not soluble in water simply washing the skin with water is not enough to remove these fat based the impurities emulsification is needed. Skin cleanser work as a surface active agents (like emulsifier, detergent, surfactants) that reduce the surface tension and help to lift away dirt, oil, cosmetic residue, microorganism and dead skin cells by turning them into an emulsion. A good cleanser remove these impurities effectively without harming or irritating the skin[10].

Ideal properties of cleanser
1. It should have effective cleansing action.
2. Mild and nonirritant.
3. pH between 4.5 to 6.5.
4. Non-comedogenic.
5. Free from harsh surfactants.

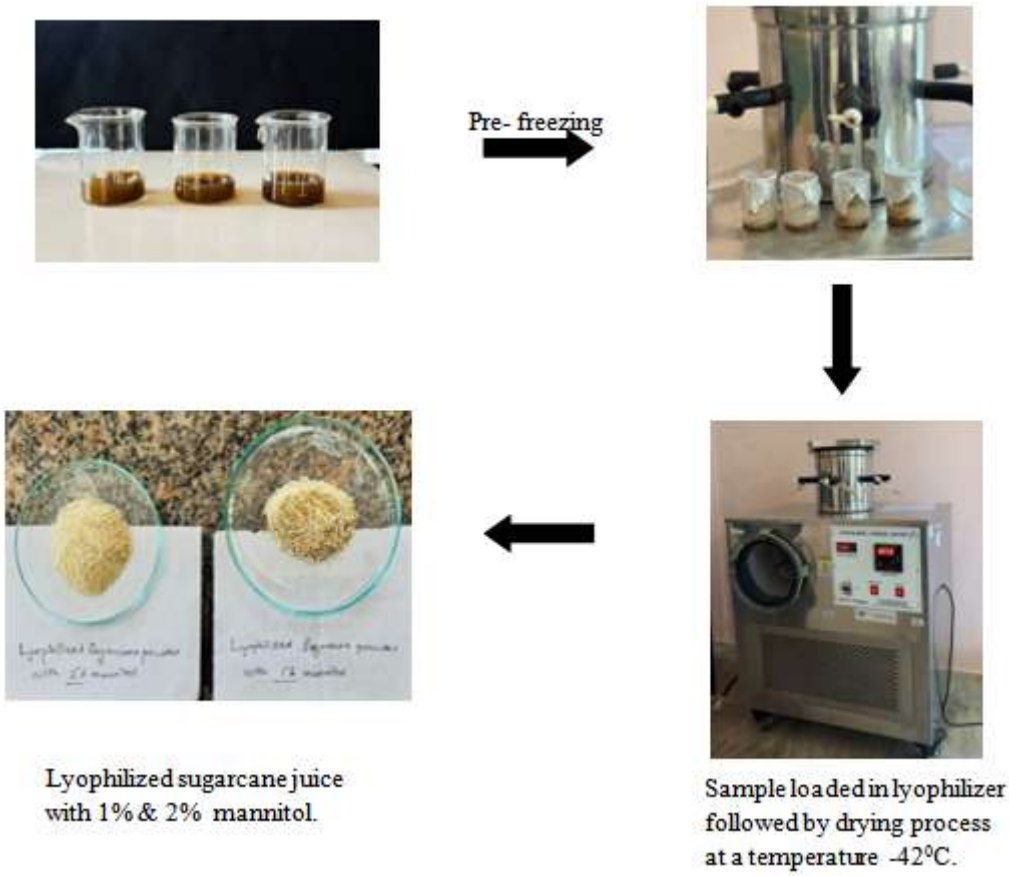
International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 229-234 www.ijprajournal.com ISSN: 2456-4494

6. Should have good texture and can be easily rinse off.
7. Compatible with other skin care products.

II. METHODOLOGY

1. Lyophilization of sugarcane juice:

Sugarcane juice is rich in antioxidants, polyphenols, flavonoids, but it is unstable and spoils within hours of extraction due to high amount of water and sugar. In order to maintain the stability and preserving the bioactivity of compounds lyophilization is carried out[11]. Lyophilization is a process is a process used to remove water content from a product. To obtain free flowing powder sugarcane juice is mixed with mannitol prior to freeze-drying.



Lyophilized sugarcane juice with 1% & 2% mannitol.

Sample loaded in lyophilizer followed by drying process at a temperature -42°C.

2. Preparation of gel base:

Weighed required quantity of gelling agent. Soak gelling agent in sufficient amount of water. Kept aside until it is fully hydrated. Once the gelling agent is swollen proper stirring is done to form uniform gel.

3. Preparation of formulation of lyophilized sugarcane juice gel cleanser:

Dissolve required quantity of sugarcane juice powder in small amount of water. Add sorbitol (humectant) and sodium benzoate Composition of gel cleanser (preservative) to the above mixture. Mix thoroughly and slowly add to the gel base while stirring. Required amount of surfactants is taken and prepare a mixture of surfactants by diluting in small amount of water (sodium cocoyl glutamate, coco glucoside, cocamidopropyl betaine). Add the mixture to the gel with gentle and continuous stirring. Add triethanolamine to adjust the pH.

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 229-234 www.ijprajournal.com ISSN: 2456-4494

Ingredients	F1	F2	F3	F4	F5	F6
Lyophilized sugarcane juice(gm)	0.5	1	1.5	0.5	1	1.5
Carbopol 940(gm)	0.25	0.5	0.75	-	-	-
Xanthan gum(gm)	-	-	-	0.25	0.5	0.75
Sodium cocoyl glutamate(ml)	3	3	3	3	3	3
Coco glucoside(ml)	2.5	2.5	2.5	2.5	2.5	2.5
Cocamidopropyl betaine(ml)	2	2.5	3	2	2.5	3
Sorbitol(ml)	2	2	2	2	2	2
Sodium benzoate(gm)	0.25	0.25	0.25	0.25	0.25	0.25
Triethanolamine(ml)	q.s	q.s	q.s	q.s	q.s	q.s
Distilled water(ml)	q.s	q.s	q.s	q.s	q.s	q.s

III. EVALUATION TESTS

a. Determination of physical parameters: Organoleptic properties like color, odor, appearance and texture of lyophilized sugarcane infused gel cleanser were visually investigated.

b. Determination of pH: The pH of the gel cleansers were evaluated by digital pH meter. One gram of gel was dissolved in 10ml of distilled water. Then the electrode was dipped in to the formulation until stable value is achieved and noted. The pH values of each formulation were recorded three times.

c. Washability: Formulations were spread on the surface of skin and then ease and extent of washing with water were manually observed.

d. Viscosity: Brookfield digital Viscometer is used to measure the viscosity of the formulation. The viscosity of formulation was measured with spindle no. 64 at 10 rpm and 25^0C.The required quantity of cleanser was filled in container with wide opening. The gel cleanser was filled in container in such a way that it should sufficiently allow to dip the spindle of the instrument. Samples of the gel cleansers were allowed to settle over 30 min at the constant temperature ($25\pm/1^0$C) before taking readings.

e. Spreadability: A diameter of 2 cm marked on a glass plate then 0.5g of the gel cleanser was applied on the circle. After that another glass plate was placed over it. Half kilogram of weight was kept on the upper glass plate for 5 minutes. After spreading of the gel cleanser the diameter of circle was measured.

f. Foamability: Foamability determined by dissolving 1 gram of the gel cleanser in 10 mL of distilled water in a graduated cylinder. The measuring cylinder was shaken until foam is produced and set aside for 15 minutes. After that height of the foam was measured and recorded.

IV. RESULT AND DISCUSSION

Result of Organoleptic evaluation:

Formulation	Color	Odor	Appearance	Consistency
F1	Pale yellow	Characteristic odor	Transparent	Slightly runny gel
F2	Dark yellow	Characteristic odor	Transparent	Smooth gel
F3	Whitish yellow	Characteristic odor	Translucent	Thicker gel
F4	Cream	Characteristic odor	Translucent	Slightly runny gel
F5	Cream	Characteristic odor	Translucent	Smooth gel
F6	Cream	Characteristic odor	Translucent	Thicker gel

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 229-234 www.ijprajournal.com ISSN: 2456-4494

Result of Physicochemical evaluation:

Formulation	pH	Washability	Viscosity (cPs)	Spreadability (cm/s)	Foamability (mm)
F1	5.7	Easily washable	1736	5.3cm/s	26mm
F2	5.4	Easily washable	2242	4.8cm/s	41mm
F3	4.6	Not easily washable	2968	3.9cm/s	45mm
F4	4.7	Easily washable	1894	5.2cm/s	24mm
F5	4.9	Easily washable	2136	4.4cm/s	35mm
F6	5.0	Not easily washable	2885	4.1cm/s	38mm

Discussion:

Three formulation was prepared with Carbopol 940 as gelling agent while other three formulation with Xanthan gum as gelling agent which is natural gelling agent. Comparatively, Carbopol 940 as gelling agent was found to be better for gel cleanser formulation as it provides a smooth texture and consistency. Formulation of gel, have different color due to the change in concentration of sugarcane powder and gelling agent. Formulation of gel cleansers has different pH value ranging from 4.6 to 5.7. F1,F2,F4 and F5 are easily washable while F3 and F6 are difficult to wash. The viscosity differ for each formulation (ranging from 1736-2968 cPs). The viscosity increases with increase in concentration of gelling agent. F2& F5 have an suitable viscosity for gel formulation. F2 and F5 have an ideal spreadability of gel formulation among these. All the formulation produces foam with height 24-45mm. Increase in foam was influenced by the addition of CAPB as a surfactant. F2 was found to be the ideal gel cleanser formulation while considering all the evaluation parameters.

V. CONCLUSION

The study explains about the formulation and evaluation of Lyophilized Saccharum Officinarum gel cleanser. Sugarcane, rich in antioxidants, polyphenols and flavonoids, has various skin care benefits which include anti-aging, exfoliation, hydration, and antibacterial properties. It's potent antioxidant activity reduce the damage caused by the free radicals, ultimately reduce the appearance of wrinkles and fine lines. Because of its high water and sugar content sugarcane juice is likely to spoil. Lyophilization is used to increase the stability and preserve the bioactive compounds in it. The formulation contain mild cleansing agent that cleanse without disrupting the skin's delicate balance. The gel cleanser formulation ensure good cleansing action, suitable for all skin type including sensitive skin and provide soothing effect. Six different formulations (F1 to F6) developed and subjected various evaluation parameters, it was concluded that F2 stood to out as the best formulation demonstrating an ideal balance of texture, viscosity, spreadability, washability, foamability and optimal pH. In conclusion, this gel cleanser formulation provide effective cleansing action and antioxidant property.

REFERENCES

[1]. Amandeep Singh, Uma Ranjan Lal, Phytochemical profile of sugarcane and its potential health aspects. Pharmacognosy Reviews, January-June 2015, Vol 9:45-50.

[2]. Joaquim Maur´icio Duarte-Almeida, Alexis Vidal Novoa. Antioxidant Activity of Phenolics Compounds From Sugar Cane (Saccharum officinarum L.)Juice. Plant Foods for Human Nutrition,Springer Science+Business Media, Inc.2006: 187–192.

[3]. Jin Ji, Yang X, Flavel M, Shields ZP, Neoh J, Bowen M-L, Kitchen B. Age-Deterring and Skin Care Function of A Polyphenol Rich Sugarcane Concentrate. Cosmetics. 2020; 7(2),30: 1-17.

[4]. Chinnaraja Chinnadurai. Potential Health Benefits of Sugarcane. C.Mohan (ed.), Sugarcane Biotechnology: Challenges and Prospects, Springer International Publishing AG 2017: 1-11.

[5]. Goutam Mahata. Sugarcane juice for human health and opportunities of employment generation, Indian Farming 69(07); July 2019: 09-12.

[6]. Agbaje Esther Oluwatoyin, Ayinla Adebola Christina, Ujomo Teju-made. Anti-inflammatory Activityof Saccharum Officinarum Linn (Poaceae) Juice in Animal Models Research Journal of Pharmacology and Pharmacy, 2019, 3:7:1-14.

[7]. Sara E. Ali, Qin Yuan, Shengpeng Wang, Mohamed A. Farag,More than sweet: A phytochemical and pharmacological review of sugarcane (Saccharum officinarum L.),Food Bioscience,Volume 44, Part B,2021,101431,ISSN 2212-4292.
[8]. KP Ananthapadmanabhan, James J. Leyden, Stacy S. Hawkins. Recent Advances in Mild and Moisturizing Cleansers.Journal of Drugs in Dermatology,2019;18(1 Suppl):80-88.
[9]. Mukherjee SS, Chandrashekar BS, Gaikwad RP.Cleansers: To use or not to. Indian J Paediatr Dermatol 2015;16:193-7.
[10]. Partha Mukhopadhyay, Cleansers and their role in various dermatological disorders. Indian J Dermatol 2011: 56(1): 2-6.
[11]. Camila Dal Magro, Raquel Bulegon, Gilmar de Almeida Gomes. Development of Freeze Dried Sugarcane juice powde. Revista CSBEA – v. 4, n. 1 (2018):23-32.
[12]. Muneer Saif Hasan Ahmed, Harish Nayaka MA. Evaluation of Phytochemical Screening and Biological Activity of Lyophilized Sugarcane juice, vacuum and open pan jaggery for aqueous extracts. Journal of Advanced Scientific Research, 2021; 12 (1): 81-91
[13]. Su, E.; Herman, S. Beyond,Sulfate-Free Personal CleansingTechnology, Cosmetics, 2025,12,14:1-26.
[14]. Ananthapadmanabhan KP, Moore DJ, Subramanyan K, Misra M, Meyer F. Cleansing without compromise: The impact of cleansers on the skin barrier and the technology of mild cleansing. Dermatol Ther 2004;17 Suppl 1:1625.
[15]. Vania Santika Putri, Verawati hati. Effect of Cocamidopropyl betaine (CAPB) concentration on physical characteristic of basil leaves, essential oil face wash, Medical sains: Jurnal Ilmiah Kefarmasian, vol. 9, April- June 2024: 447-48.