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Nutrient Enriched Face Mask Using Biopolymers

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ABSTRACT
Everyone around the world is constantly seeking for ways to retain their skin in a healthy and youthful way. People are looking for a material which can reverse the signs of age and shield them from the harmful effects of a hostile environment. Due to urbanization and industrialization, people are frequently exposed to allergies, pollutants, irritant chemicals and fine particles. The majority of individuals struggle with photoaging. Exposure to free radicals produced by UV radiation is one of the reasons of photoaging. Antioxidants are thus required to lessen it. The antioxidant flavonoids in soursop leaves (Annona muricata L.) help to delay the ageing process of the skin.Flavonoids, coumarins, alkaloids, tannins, and steroid or terpenoid chemicals are all found in soursop leaves. Soursop leaves contain flavonoid chemicals that function as antioxidants. The goal of this study was to learn how to manufacture Peel Off face masks from soursop leaves, to discover the advantages of these masks for facial skin, and to ascertain whether or not the general public would use goods made from soursop leaves to make peel-off face masks to treat acne.The soursop leaf extract was converted into a peel-off gel for simple topical application. The purpose of this work was to characterize the physical properties and antioxidant activity of a peel-off gel mask made from soursop leaf extract. The usage of natural products as key ingredients and biopolymers as binding agents to produce a peel-off gel face mask has been done. The soursop leaves were macerated in 96% ethanol before being tested for pH, antioxidant activity, and phytochemicals using the DPPH (1,1-diphenyl-2-picrylhydrazyl) assay. Extracts of soursop leaves at 1.0%, 2.0%, and 3.0% were used in the peel-off gel mask. The physicochemical properties of the masks as such organoleptic, pH, viscosity, dispersibility, and antioxidant activity were evaluated. The facemask helps in maintaining the texture of the skin and it paves the solution for curable substances which are used to treating skin damages.Gel peel-off masks are masks that, once applied to the skin, are simple to remove. Rice and soursop leaves moisturize the skin while acting as antioxidants. that each gel formulation made from peel-off soursop extract leaves, each with a different PVA content, was stable.

Keywords*: Antioxidant activity, soursop leaves extract, peel-off mask gel.*

I. INTRODUCTION

The main sources of damaging free radicals in the skin are ultraviolet (UV) rays, which accelerate the ageing process by making wrinkles, black or white spots (Panda et al., 2013), and skin cancer more likely to develop (Orazio et al.,2013). The cumulative effects of skin damage from exposure to sunshine are known as photoaging. The stratum corneum receives some of the sunlight's dispersed and reflected rays, which results in extracellular matrix alterations in the dermal skin that lead to wrinkles, changes in skin tone, and pigmentation changes (Panda et al.,2013). Chemicals known as antioxidants work to reduce or stop the effects of free radicals by balancing the negative effects of oxidants, electron donors, and reducing agents. By preventing physiological damage brought on by the oxidation process, antioxidants help the body (Birben et al.,2012). Natural or artificial chemicals can act as antioxidants. Nevertheless, employing synthetic antioxidants has negative side effects, such as BHA and BHT, which have already been linked to cancer development in the liver in tests on animals

(Lourenco et al.,2019). Thus, using natural antioxidants is a different option. The leaves of *Annona muricata L*, often known as soursop, which is a member of the *Annonaceae* family, are one natural source of antioxidants that help shield the skin from UV radiation (Sanusi & Abu Bakar 2018). Acne is a highly severe kind of skin irritation that develops when oil buildup causes a blockage in the pores. *Propionibacterium acnes, Staphylococcus aureus,* and *Staphylococcus epidermidis* bacteria are what cause this irritation (Achermann et al.,2014;

Otto, 2009). Natural compounds can be used to treat acne, they are thought to have less adverse effects when employed as active components, making them safe for long-term usage (Yang et al.,2017). Soursop, or *Annona muricata L*. leaves, is one of the natural remedies for acne that may be employed. *A. muricata* leaves's ethanol extract has the ability to stop the growth of the bacteria *P. acnes, S. aureus*, and *S. epidermidis*(Mulyanti et al.,2015). Since it may stop bacterial development at low concentrations, soursop leaf ethanol extract is the most effective anti-acne treatment (Pai et al.,2016). Alkaloids, acetogenins, phenols, Vitamins A, C, and C are among the bioactive substances found in soursop or leaf material. They are mostly flavonoids, which are phenolic chemicals and antioxidants (Oraket al.,2019).

1.1 Benefits of *Annona muricata*:

Many phytonutrients found in soursop can fight cancerous cells and other disease-causing tissues. These phytonutrients are rich in antioxidants, which improve general health. Several kinds of breast and liver cancer cells were discovered to be killed by soursop extracts. In one study, the soursop plant was found to be a successful cancer treatment for the majority of cancer types. While no human studies have been performed, the potential is promising. There are several antioxidants in soursop. It has been discovered that these antioxidants, particularly vitamins C and E, zinc. Soursop is frequently used to treat depression and other conditions including stress. Soursop's antibacterial properties have remedies that helps in healing acne and it regenerates the skin. Our skin and its glowing are extremely reliant on Vitamin – C and Ascorbic acid. Since soursop is highly filled with both vitamin – C and ascorbic acid, they help in treating hyperpigmentation also advances the glowing and radiant skin.

II. LITERATURE SURVEY

Nilforoushzadeh et al (2018) intended on the benefits of face masks and its good effects on skin and how it helps to rejuvenate the skin, hydrates the skin, moisturizes the skin and firming and lightening the skin. It proposed on the types of face masks which is for different types of skin and centered on the face masks sold in stores. PierfrancescoMorganti et al (2020) proposed on the beauty facial masks can protect our skin from the toxicity from the environment. It helps to maintain the skin cleaner and clearer. They proposed that facial masks would prevent the skin from chemicals and pollution and to hydrate them and to more fully comprehend the novel tissues developed by the biobased and biodegradable polymers. Channarong Siri and WassanaiWattanuchariya (2019) proposed that certain face masks can be made from local materials that can be available near us naturally through plants and their antioxidant properties and antibacterial activity that helps to activate the skin.Chitosan was used as the facial mask's substance to enhance the structure's good mechanical qualities.

Ridwanto et al (2018) put forward that biopolymers can be used as a binding agent to prepare facemask, biopolymers have some benefits to the skin in tightening and firming the skin. Certain biopolymers can be used to make peel off masks and to make biofilms in the face masks.AristhaNovyra Putri et al (2019) studied the reasons for acne formations on the skin surface and the bacteria causing the acne and the phytochemical compounds like flavonoids, alkaloids and polyphenol compounds which inhibit the bacteria that grows acne, which also explained the natural product that can be extracted through ethanol extraction methods and made into a gel to prepare a mask that can help in cleansing the face with the help of soursop (Annona muricata).UswatunChasanah et al (2022) proposed the recent problems faced in skincare regime is photoaging that is aging because of ultra violet rays in the atmosphere and the plant that can help in reducing them by making a peel off face mask gel from the soursop leaves extract and binding agent to expand the viscosity of the gel. Raya Wida Nur Vivid et al (2022) intended on utilizing the extract of the soursop leaves to be used as a therapy to treat acne by decocting a peel off face mask gel. In addition to using questionnaires, the researcher also employed observation, interviews, experiments, documentation, and research and development methods.

III. METHODOLOGY

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An overview of the experimental techniques used during the entire process is provided in this chapter. Every single procedure explains in full how the process was carried out, providing a clear understanding and outlining every step that was taken. Nothing can be skipped in between steps because this is a step-by-step process, and even the flow cannot be changed. Every operation takes a particular amount of time, and it should all be done in the right order.

3.1 PREPARATION OF SOURSOP LEAVES EXTRACT:

Leaves of Soursop (*Annona muricata*) were collected from a well-maintained and developed herbal garden in a village near Tirupur. All the leaves were washed with water primarily and then with 50% ethanol to eliminate impurities or pesticides and any unwanted particles. They were washed again with distilled with remove exceeded surface ethanol. The washed leaves were left to air dried for one week without the exposure to the sunlight until it was completely dried. The dried leaves were collected and blended in a mixer grinder until it reaches a fine smooth powder consistency. The Fresh washed leaves were left to dry for one week and grinding the leaves to fine powder.The powder was left to dry in hot air oven at 40ºC for two days. The powder weighed 100g and then the oven dried powder was macerated through immersion method by submerging the powder in 1L of 96% ethanol for 3 × 24 hours. After the course of three days in maceration, marc is removed from the micelle using decantation or filtering. The micelle is then evaporated in the hot air oven to filter the residue away from the filtrate at 60°C. The filtrate and residue were obtained and separated after the maceration.A rotary evaporator operating at 50°Cwas then used to concentrate the resulting filtrate until a thick extract was produced.

3.2PREPARATION OF PEEL OFF FACE MASK GEL:

The preparation of peel-off masker gel was the primary step in creating a filming agent to bind with incorporating the soursop leaf extract. Three solutions were prepared. Solution A: Polyvinyl alcohol which was completely liquified in distilled water and heated at 800ºC for 15 minutes. After heating, Solution A is left to settle whole night. Solution B: Polyethylene Glycol (PEG) 1500 and Sodium metabisulfite were dissolved in distilled water.Solution C: Preservatives –Sodium Benzoate and Potassium Benzoate were dissolved in Propylene glycol. A homogenous gel was developed by incorporating the three solutions (A, B, C) with the soursop leaf extract. Different concentrations of extracts were obtained to analyze their effects. Thus, F1 would be 1.0%, F2 would be 2.0% and F3 would be 3.0% of soursop leaf extract respectively. Whereas F0 would be the peel off mask gel without the soursop leaf extract.

3.3PEEL OFF MASK GEL EVALUATION:

3.3.1 Organoleptic test:

The Organoleptic properties of a product were one of the primary advantages for customers to experience by perceiving the five senses of sight, smell, hearing, taste and touch of the product.

3.3.2 pH test:

Using a pH meter, the pH test was conducted. The pH meter was calibrated before use using a buffer with a pH of 4.01 or 6.46. The electrodes are dipped into a peel-off gel mask throughout the test, and the result is recorded once the number on the screen stops.

3.3.3 Drying time:

Drying test was conducted on the basis of analyzing the time the gel takes to dry after applying it. Thus, the drying test was performed by applying 0.7-gram samples were spread out on the slide to create a thin, flat layer that was about 1mm thick. The slides were then placed in an incubator set at 37° C, and the preparations were watched until they were totally dry.

3.3.4 Viscosity:

The viscosity test was performed by using a Viscometer. As gel begins to flow, the frictional force that is produced is measured. With a 60 rpm, the viscometer is turned on. Results for viscosity were seen. Three copies of the observation are made. The ideal viscosity ranges from 3,000 to 40,000 cPs.

3.3.5 Homogeneity test:

Homogeneity tests were performed on gel preparations that had been created both before and after being subjected to storage conditions. A piece of glass or another suitable clear material is used for the homogeneity test, and once the gel preparation has been applied, the homogeneity of the preparation is assessed.

3.3.6 Antimicrobial activity:

3.3.6.1 Media preparation:

Stock cultures were kept on nutrient agar slope at 4 °C. Culture was prepared for experiments. Cells from stock cultures were looped into test tubes filled with 50ml nutrient broth. A shaking incubator was used to incubate and stir the bacterial culture for 24 hours at 37°C. The streaking approach was used to embed each test solution in nutrient agar medium.

After that, bacterial cultures were cultured for 24 hours at 37°C. After being moved to the nutritional agar medium slants, a single colony was cultured for 24 hours at 37°C. At 4°C, these stock cultures were maintained. Next, for a subsequent experimental procedure, a loop of the Escherichia coli bacterial culture was placed into 50ml nutrient broth and incubated separately at 37°C for 18–20 hours.

3.3.6.2 Disc diffusion method:
The antibacterial activity of the soursop leaf extract was assessed by using the Disc Diffusion technique. 20 milliliters of the molten media were placed into sterile petri plates after the medium had been autoclaved, and nutrient agar plates had been made. When the medium had solidified, a 20–25 l suspension of bacterial inoculum was obtained and evenly swabbed across the plate, leaving no empty space. Clinical Whatman filter paper was used to create the discs. A sterile punch machine was used to create holes in the discs. Using sterile forceps, the discs were placed on the plate perpendicular and parallel to one another (4 discs in each plate) and submerged in the corresponding sample solution for testing for 2 minutes. To prevent contamination, the agar plates were then sealed and covered with paraffin. At 37 °C, the plates were incubated. Clear zones were visible around the wells after 24 hours. The zone of inhibition was measured in mm from well edge to zone.
3.3.6.3 Selection of effective extract ratio:
The minimum inhibitory concentration (g/ml) of an antibiotic is the lowest concentration at which it inhibits the growth of a particular strain of bacteria (MIC). The most fundamental laboratory test for assessing how effective an antimicrobial agent is against an organism is often considered to be a MIC. As a lower MIC number indicates that a less amount of the medication or sample is needed to halt an organism's development, drugs with lower MIC scores are more effective antibacterial agents. All of the inoculation plates were incubated for 24 hours in order to monitor the anti-bacterial action. The zone of inhibition was measured on a millimeter scale. The extract ratio with the greatest range of least inhibitory concentration and the best antibacterial activity was selected for more research.

3.3.7 Phytochemical analysis:

The phytochemical screening of the soursop leaf extract was calibrated to analyze the presence of phytochemicals such as alkaloids, terpenoids, flavonoids, steroids, saponins, phenols and tannins.
(a) Screening of Alkaloids:
One milliliter of plant extract and a few drops of Wagner's reagent sodium and potassium iodide were used. Alkaloids are indicated by a distinct brown formation.
(b) Screening of Terpenoids:
Concentrated sulfuric acid was carefully added to the mixture of extract (5 ml), chloroform (2 ml), and extract to create a layer. To demonstrate that terpenoids were present, a reddish-brown color of the interface was created.
(c) Screening of Flavonoids:
A few drops of sodium hydroxide solution were added to 1 ml of plant extract. The presence of flavonoids was revealed by the yellow precipitate.
(d) Screening of Steroids:
After adding concentrated H2SO4 from the tubes' sidewalls, 1 ml of chloroform was used to disperse the plant extracts, and 1 ml of acidic anhydride followed. The development of the red precipitate ring is a sign that steroids are present.
(e) Screening of Saponins:
A vigorous shaking of the suspension after adding 1ml of plant extract and 5ml of distilled water revealed the presence of saponins.
(f) Screening of Phenols:
1ml of plant extract and a few drops of a 10% ferric chloride solution were added. The creation of a brown tint denoted the presence of phenols.
(g) Screening of Tannins:
1 ml of curcumin extract and a few drops of 1% ferric chloride solution were also added. The formation of a brown color denoted the presence of tannin.

IV. RESULTS AND DISCUSSION

4.1SOURSOP LEAVES EXTRACT:

4.1.1 Organoleptic test:

The thick extract obtained after the rotary evaporator was underwent organoleptic test and the results were analyzed and had thick green-blackish color along with a distinguishing odor of a soursop leaves.

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4.1.2 Phytochemical analysis:

Table 1: Phytochemical analysis test

S.No	Test Name	Process	Formation	Result
1.	Alkaloids (Wager's test)	4to5 drops of wager's reagent and some ml of leaf extract	Brown precipitate	+
2.	Terpenoids (Sulfuric acid)	5ml of conc. Sulfuric acid, 2ml of chloroform to the extract	Reddish-brown color	+
3.	Flavonoids (Ferric chloride)	2ml of leaf extract and 10% ferric chloride solution	Green or Blue color	+
4.	Steroids	0.2ml of conc. Sulfuric acid, 2ml of chloroform to the extract	Red color	+
5.	Saponins (Foam test)	2ml of leaf extract and 6ml of water-shake vigorously	Foam Formation	+
6.	Phenols (Ferric chloride)	2ml of leaf extract and 10% ferric chloride solution	Deep blue/Black color	+
7.	Tannins	1ml of leaf extract and some drops of dil. Ferric chloride solution	Deep green or blue color	+

4.1.3 pH test:

The extract of the soursop leaves was analyzed and the pH meter results had shown the pH of 5.8 – 6 that is precisely implying the acidic property.

4.1.4 Antimicrobial activity:

The MIC of plant extracts or antibiotic activity against gram-negative bacteria, including E. coli, have been determined using the agar disc diffusion technique. Against the examined microorganisms, the extracts displayed antibacterial properties. The soxhlet extraction of samples demonstrated more antibacterial activity than the samples extracted using maceration, as determined by the zone of inhibition.

4.2 PEEL OFF MASK GEL EVALUATION:

Polyethylene Glycol and Polyvinyl alcohol served as the foundation for the recipe of the peel-off gel mask created from the soursop leaf extracts where Polyvinyl alcohol served as a film-forming agent and Polyethylene Glycol 1500 served as a plasticizer. Propylene glycol was employed as a humectant and cosolvent preservative, Sodium Benzoate and Potassium Benzoate as preservatives, and Sodium metabisulfite as an antioxidant.

4.2.1 Physicochemical characteristics of the gel:

4.2.1.1 Organoleptic test:

According to the results of the organoleptic observation, the peel-off gel mask had a thick texture, a dark green hue, and a noticeable scent of soursop leaves extract.

4.2.1.2 pH test:

Figure 5.10 depicts the pH of the peel-off gel mask. At the increasing extract concentration level at 6.20, 5.87, 5.80, and 5.71, respectively, the pH of F0, F1, F2, and F3 considerably lowered. This result was obtained since all pH values varied from 4.5 to 6.5 and the pH of the soursop leaves extract was 5.85. Because the gel mask has a higher pH than the skin (4-6) and doesn't get harmed in neutral pH substances, it is safe to use on the skin.

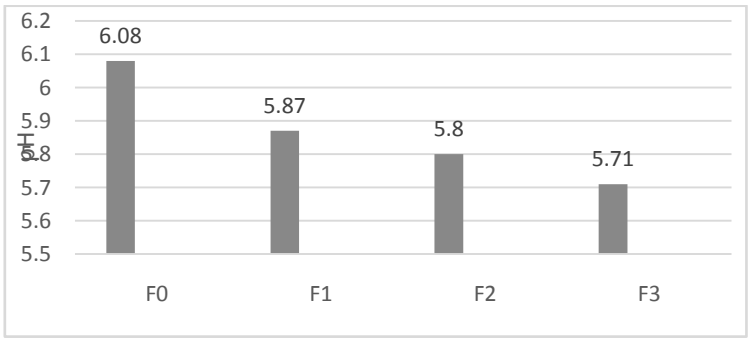

Figure: According to the increasing extract concentration, the pH of the soursop leaf peel-off extracts dropped.

4.2.1.3 Drying time:

The peel-off gel mask must dry for a certain amount of time in order to be acceptable. All peel-off mask gels satisfy the specified drying time of less than 30 minutes; F0 had a drying time of 28.1 minutes, while F1, F2, and F3 had drying times of 24, 23, and 22.05 minutes, respectively. No discernible difference existed between F1, F2, and F3 in terms of the peel-off gel masks' drying times relative to the control. Also, once the gel has dried, peeling is simple since the layer that has developed is elastic thanks to PEG 1500, a plasticizer that keeps the film layer in place. The consistency of soursop leaves extract causes the drying process to go more quickly.

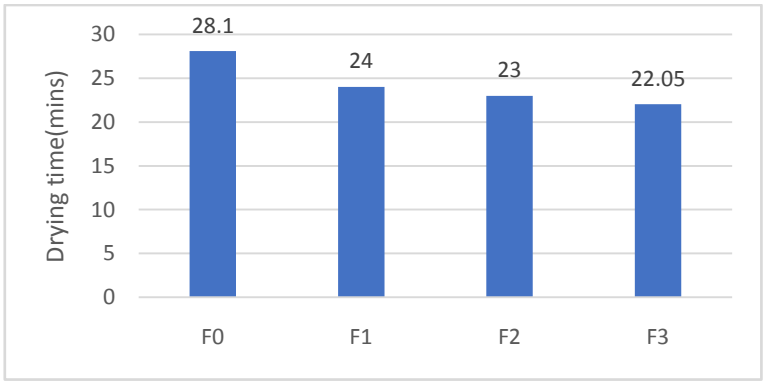

Figure: The Drying time of the gel with the soursop leaves extract is quicker than control

4.2.1.4 Homogeneity test:

To verify content consistency, a homogeneity test was run. Figure 1 depicts the homogeneity test results for F1, F2, and F3, which revealed no coarse particles and big granules. The outcomes complied with the dose requirements. The peel-off gel mask's homogeneity shows that all of the ingredients and the active component have been dissolved in the carrier. It was discovered that the peel-off gel mask's composition, which contains 15% PVA and 5% PEG 1500, is sound. The 15% PVA/PEG 1500 formulation produced a wet, clean, smooth, sticky, and readily removed mask gel, according to the prior study. Phase separation cannot be avoided without the proper PVA/PEG 1500 ratio.

4.2.1.5 Viscosity:

Figure 4 depicts the viscosity of a peel-off mask gel. The viscosities of peel-off mask gel in FI, FII, and FIII at 3 rpm were 15136 cps, 15237 cps, and 15500cps, respectively; at 6 rpm were 14467cPs, 14833 cps, and 14967 cps, respectively; at 12 rpm were 12400 cps, 12567 cps, and 12933 cps, respectively; and at 60 rpm were 10000 cps, 10100 cps, and 10233 cps, respectively. This viscosity value indicates that the peel-off mask gel's viscosity rises as extract concentration does. The peel-off gel mask's viscosity ranges from 3,000 to 40,000 cps, which is considered to be an acceptable range for use.

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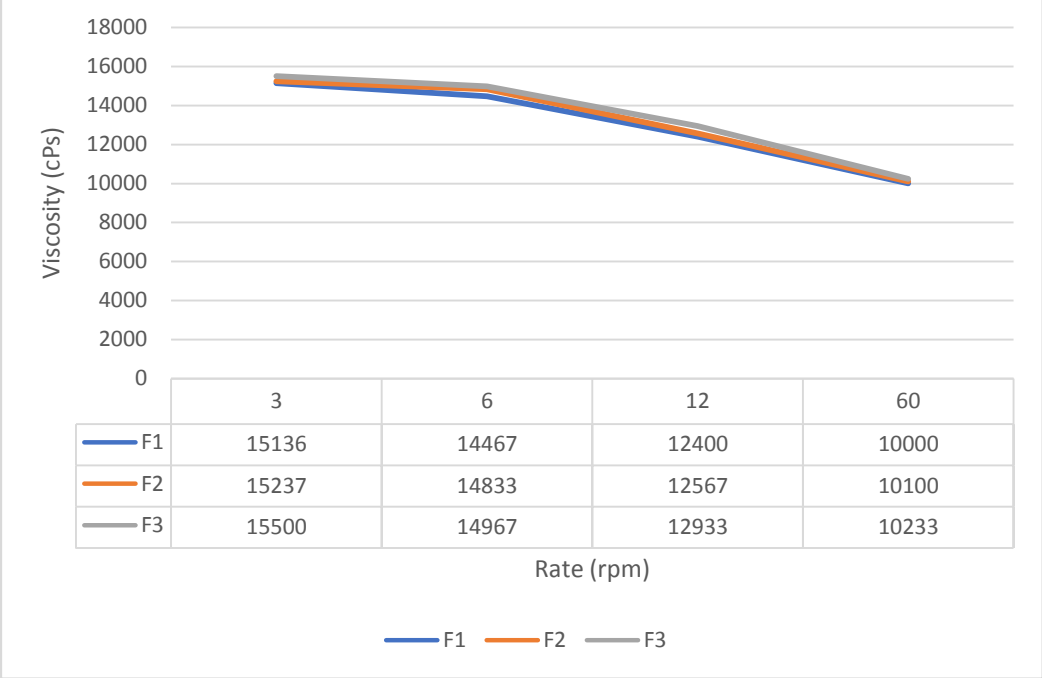

	3	6	12	60
F1	15136	14467	12400	10000
F2	15237	14833	12567	10100
F3	15500	14967	12933	10233

Figure: Stirring rate VS Viscosity of the gel mask

The results are similar to earlier research that found that thepH of the peel-off mask gel impacts its viscosity. Figure displays the peel-off mask gel's viscosity value for F0, F1, F2, and F3 at 3.0, 6.0, 12.0, and 60.0 rpm. Peel-off mask gel's viscosity often reduced as stirring speed rose; as a result, the flowing characteristic is pseudoplastic. As a result, the peel-off mask gel may be applied to the skin without difficulty. The thixotropic feature of gel causes it to flow when shaken and gradually recover after being stopped from moving. Normally, gel is thick or viscous under static conditions.

V. CONCLUSION

Throughout these past few years, the concerns regarding the skin care had been developed. People are involved in knowing the contents of the products they are using and they wanted to use, the ingredients that would suit their skin types and the chemicals which are harmful and how much amount of product we should apply on the skin. Figuratively, people nowadays learned a lot of things about skin care products and their ingredients. In the way of increased demand for vegan, nature based, organic ways to use the products for skin, we came up with a way of presenting a step in providing a product that possess naturally medicinal and skin rejuvenating properties. There have many papers and journals about preparing a skin care product from soursop leaves. They have mentioned that the higher extract content applied, the more fragrance and robust color have been obtained and the higher viscosity produced. High viscosity means the fluid exhibits high resistance between the adjacent layers of the fluid during their relative motion. As high viscous fluids have high internal friction between adjacent layers of fluids, they cannot shear easily. When they are poured from one container to another, they remain in contact with the air for longer duration due to which the ability of fluid to shear is too low. Our intention is to produce a product which is easily acceptable to skin without any complications. Thus, the fluids with low viscosity have a low resistance and shear easily and the molecules flow quickly. Making a peel-off gel face mask with low viscosity can help in the practical applications of it and be easily appliable.The ideal formulation for producing a peel off mask gel from soursop leaves extract was procured. The peel-off mask gel from the soursop leaves extracts is semisolid, homogeneous (apart from the 3.0% extract), fragrant, and dark brown in color. It has a pH range of 4.5 to 6.5, a viscosity range of 10,000 to 15,500 cps, pseudoplastic flow property, and the ability to spread swiftly. The higher extract level content was followed by an increase in antioxidant activity. A peel-off gel mask containing soursop leaf extract that satisfies the demands for real-time

stability must be developed.

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