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***Artocarpus heterophyllus* leaves extract improve facial skin in clay mask formulation**

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Abstract. *Artocarpus heterophyllus* (*A.heterophyllus*) is one of plants that commonly used for skin care. This study aimed to formulate a clay mask preparation with the active ingredient *A.heterophyllus* 3% leaf extract and evaluating its activities in repairing facial moisture, smoothness, large pores, blemishes and wrinkles. The process of providing clay masks begins with the preparation of *Artocarpus heterophyllus* leaf ethanol extracts with standardized quality, preparation of clay mask bases with guaranteed quality, mixing clay mask bases with extracts, testing the quality and stability and effectiveness of skin care tested. The extract of clay mask formulations were stable in storage, homogeneous, pH 5.6-6.3; drying time is 10-18 minutes, and does not irritate. Effectiveness testing was performed using a skin analyzer for 4 weeks of treatment in adult female volunteers. Test results after 4 weeks of treatment showed that the ethanol extract of *A. heterophyllus* leaves 3% was able to improve moisture (15.5%), smoothness (33.1%), pore size (60.1%), blemishes (50.2%) and facial wrinkles (61.5%). Statistically, significant effects were found in moisture and smoothness of the facial skin ($p<0.05$). This study concluded that ethanol extract of *A. heterophyllus* in concentration of 3% have benefit in refining facial skin.

1. Introduction

Free radicals can cause premature aging of the skin [1]. The mainspring of any skin anti-aging therapy is to achieve a healthy, smooth, blemish-free, translucent and resilient skin [2]. Among all possibilities, clays are necessary for the cosmetic industry since they present interesting characteristics such as easiness of application and removal, reduced time for drying and hardening, and dermatological innocuousness [3,4]. The interest in developing clay facial masks is assigned to cleansing and lifting effects [5].

Natural ingredients have been used traditionally for dermatologic disorder which over the last 20 years, clinical and laboratory studies have identified the benefit of natural ingredient for skin care [6]. *Artocarpus heterophyllus* (*A. heterophyllus*), commonly known as the jackfruit tree or nangka in local name, is a plant that is easily found in Indonesia. This plant originating from Southeast and South Asia [7]. Previous study has shown that 3% ethanol extract of *A.heterophyllus* leaf improved skin moisture and pores size after one week interval of application [8]. Therefore, this study aim to formulate a clay mask preparation with the active ingredient *Artocarpus heterophyllus* 3% leaf ethanol extract and evaluating its activities in repairing facial moisture, smoothness, large pores, blemishes and wrinkles for 4 weeks of application.



2. Materials and Method

The study was conducted during April to September 2019 and has been approved by Health Research Ethical Committee, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia: No.652/TGL/KEPK FK USU-RSUP HAM/2019.

2.1. Extraction

The leaves were collected from Galang, Deli Serdang, Indonesia during. The plant was authenticated by *Herbarium Medanense*, FMIPA, Universitas Sumatera Utara. The raw material was prepared by washing the leaves and dried under temperature room. The dried leaves then were grinded followed with maceration using ethanol 96% to obtain ethanol extract of *A. heterophyllus*.

2.2. Mask preparation

Bentonite moistened with aquadest then added xanthan gum, mixed until homogeneous, added kaolin, TiO_2 and glycerin for perfect mixing, then added nipagin and sodium metabisulfite that has been dissolved in hot aquadest, and sodium lauryl sulfate that has been dissolved in aquadest, the preparation is mixed until homogeneous. The clay mask preparations of *Artocarpus heterophyllus* extracts and clay mask bases (Table 1). Extract of *A. heterophyllus* leaves is added to the bottom of the clay mask until it is completely mixed. The quality of clay mask preparations for *A. heterophyllus* extracts was carried out by testing the stability and quality of the preparations by physical and organoleptic characterization for 3 months of storage at room temperature.

Table 1. Clay mask formulation

Ingredient	Base	Extract
Extract	0	3%
Bentonite	1%	1%
Xanthan Gum	0.8%	0.8%
Kaolin	34%	34%
Gliserin	5%	5%
Sodium Lauril Sulfate	2%	2%
TiO ₂	0.5%	0.5%
Nipagin	0.1%	0.1%
Na. Metabisulfite	0.2%	0.2%
Rose Scent	q.s	q.s
Aquadest	ad 100%	ad 100%

2.3. Skin analysis

Volunteers were divided into two groups. Group I: Base (clay mask base without extract), Group II: *Artocarpus heterophyllus* leaf extract 3% : extract of *A. heterophyllus* clay mask. Skin test was conducted before mask application. The volunteers that have no irritation signs were included to the study. The effectiveness of the clay mask *A.heterophyllus* extract as a skin care preparation was proven by testing skin conditions using a skin analyzer to analyze skin moisture, smoothness, pores, stains and wrinkles before and after the application of the mask for 4 weeks. The results of the two group then compared.

2.4. Data analysis

Data were analysed with Mann Whitney test using IBM SPSS Statistic 22.

3. Results

Characteristics of clay mask preparations of *A. heterophyllus* extract 3% can be seen in Table 2. The results as follows: stable in color and odor, homogenous, pH in acceptable range with drying time in 10-18 minutes, and does not cause irritation.

Table 2. *A. heterophyllus* Extract Clay Mask Characteristic

Characteristic	Result
Stability	Stable in color and odor
Homogeneity	Homogenous
pH	5.6 – 6.3
Drying time	10-18 minutes
Irritation	No Irritation

As shown in Table 3, *A. heterophyllus* extract 3% was able to improve moisture (15.5%), smoothness (33.1%), pores (60.1%), blemishes (50.2%) and wrinkles (61.5%). Statistically, both moisture and smoothness parameters showed significant difference compared to base treatment group ($p=0.04$ of each).

Table 3. *A. heterophyllus* Extract Clay Mask Effectiveness for Skin Care

Parameters	Group I (Base)	Recovery (%) Group II (<i>A. heterophyllus</i> extract 3%)	<i>p</i>
Moisture	5.5	15.5	0.04*
Smoothness	21.5	33.1	0.04*
Pores	37.3	60.1	0.05
Blemishes	22.8	50.2	0.05
Wrinkles	34.4	61.5	0.05

4. Discussion

Skin aging can reduce skin elasticity and damage melanin¹. Preventative aesthetic dermatology might supplement the request for healthy aging [9]. Facial masks are the most prevalent cosmetic products utilized for skin rejuvenation [10]. The antioxidant activity of active ingredient that believed to possess activity as skin caring agent. It is known that natural antioxidants obtained from plants have been developed to decrease the damaging effects in the body. Thus, pharmacological investigations have been conducted on *A. heterophyllus*, including as anti-inflammatory, antifungal, antibacterial, and antioxidant. These activities could be benefit for skin care [8].

Clays are mostly used in facial masks due to their high absorbency levels on the skin surface, such as greases, toxins and even bacteria and viruses [3]. Nevertheless, the tightening effect is also expected for clay facial masks, in function of the product hardening and contraction, after evaporation of water from the preparation, which causes a sensation of mechanical stress [3,11]. At the present study, the selection of base components based on stability and compatibility with ethanol extract of *A. heterophyllus* leaves. The basic components consist of bentonite, xanthan gum, kaolin, glycerin, sodium lauryl sulfate, TiO₂, nipagin, sodium metabisulfite and aquadest. The amount of each component was determined based on Harry, 2000 with modification [8,12].

As we know, that the skin needs fat and water for physiological functions, one of which is skin moisture [13]. Skin moisture is a condition that is affected by various endogenous and exogenous factors [14]. If the level of skin moisture is low or the water level is inadequate, it can cause dry skin [15]. This study showed that *A. heterophyllus* leaf extract able to improve the skin moisture almost three times (15.5%) compared to base control (5.5%).

Thus, dry and rough skin are two common signs when the skin experiences premature aging. When the skin is too often exposed to the sun, collagen and elastin in the layer will be damaged, so that dead cells accumulate in the stratum corneum causing the surface of the skin to appear more rough. In addition, the skin will also feel rough, dull and scaly due to the reduced ability of the skin to release dead skin cells to be replaced with new skin cells [16]. The present study showed that the volunteers skin smoothness were improved to 33.1% after *A. heterophyllum* leaf extract treatment. These both parameters showed effect that significantly improved skin facial ($p < 0.05$). This significant result suggests that the extract does not only has potency to improve skin hydration but also prevent skin aging. Furthermore, it will be beneficial for facial skin health.

Beside skin smoothness, other conditions that can predicted the skin health problems are by identifying the enlargement of pores size, the present of freckles and wrinkles. Skin pores become enlarged as a result of accumulation of dead skin cells. This study showed that *Artocarpus heterophyllum* extract 3% in clay mask preparations improved following skin parameters: skin pores to 60.1%, while base group only 37.3%; spot or blemishes to 50.2% and wrinkles to 61.5%. Eventhough, statistically insignificant different compared to base group, the values showed the efficacy of the extract as an ingredient after 4 weeks observation as facial skin care.

5. Conclusion

The process of providing clay masks established *Artocarpus heterophyllum* clay mask with standardized quality. *A. heterophyllum* ethanol extract with concentration of 3% is efficacious in refining facial skin which is beneficial for skin health.

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