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DEVELOPMENT BODY SCRUB WITH NIACINAMIDE AND JOJOBA BEADS AS EXFOLIATOR

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I. INTRODUCTION

Skin is the largest organ in the body that protects and covers the entire outer surfaceof the body from UV rays, chemical exposure, mechanical injury, and pathogens. This daily exposure can accumulate dead skin layer on the stratum corneum so that it leads to alayer of skin that looks older and thicker. Naturally, this dead skin will peel off within two weeks or more. However, the removal of old dead skin layer can be accelerated by the application of cosmetic products and can produce new layers of skin that are more resilient, smooth, and look young (Azila, A.K, 2015). Body scrub is a popular body treatment which has the function of an exfoliant that is able to remove dead skin cells, cleanse and removedirt, hydrates the skin, and make the skin smooth and soft (Ganceviciene A *et al*, 2012).

Growing awareness from consumers about skin care, increases the demand and purchasing power of consumers for personal care products that drive the global market. According to *Grandview Research*, Asia Pacific dominates the global market, contributingnearly 35.0% of total revenue in 2018, where the global market size of body scrubs in 2018is estimated to reach USD13.4 billion. The popularity of scrubs as personal care product has become a recent trend and this is anticipated to drive the market over the next few years. This attracts manufacturers to invest more in meeting the needs of customers who continue to grow and develop.

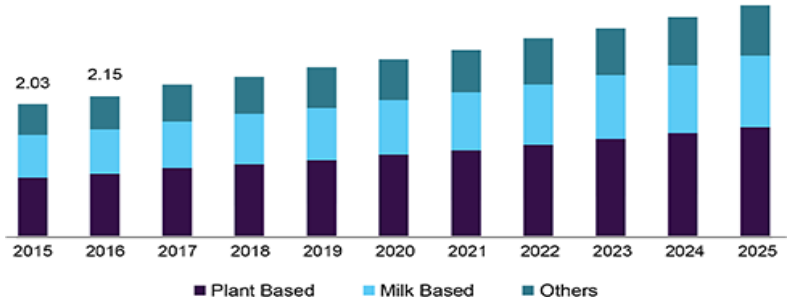

Figure 1: U.S. Body scrub market size, by type, 2015-2025 (USD Billion) Source: www.grandviewresearch.com

The use of scrubs is believed to nourish the skin and provide skin vitamins such as antioxidants. Antioxidants are needed in protecting the skin against UV A and UV B exposure, regenerating healthy skin cells and maintaining healthy skin (Abdassah M *et al*, 2015). Niacinamide is a powerful antioxidant, can reduce melanin in the skin and can be well tolerated. niacinamide is commonly used in cosmetic products as a skin lightening (Choi and Berson 2006; Ramos-e-Silva et al. 2013). Bissett et al. (2004) reported that topical and cosmetic niacinamide treatments containing niacinamide have anti-wrinkle effects. Niacinamide is an essential nutrient for body and skin. Niacinamide can be applied topically for a spectrum of skin type oily, congested, dry, sensitive or combination.

The body scrub contains mild cream in which there is niacinamide with therapeutically effective concentration and abrasive exfoliating agent. Cream is a half- filled dosage form containing one or more dissolved or dispersed medicinal ingredients in the appropriate base material (BPOM, 1995). Cream has a greater aesthetic appeal because it is not oily and the ability to absorb the skin at the time of application (Ansel, 1989).

Niacinamide used in body scrub formulations is around 1-20% by weight. Body scrubs are used topically on the skin. Body scrub cream is massaged on the skin and then cleaned (Fitzjarrell, 2002). Common abrasive materials included in the Scrub include jojoba beads. Extracted from the waxes of the Jojoba plant, these jojoba grains are smooth and do not irritate the skin. these grains are ideal for body use and are very mild with natural emollient properties, making them ideal for sensitive skin.

II. NIACINAMIDE MECHANISM

Topical application of niacinamide can penetrate into percutaneous layer in human skin (Franz, 1975). NAD levels in skin cells increased after using niacinamide topical as evidence

of percutaneous penetration (Bissett, *et al*., 2003).

Table 1: Niacinamide Mechanism.

Mechanism	Study
Antioxidant effects Niacinamide increases the reduced forms of NAD(P), which have potent antioxidant properties (Baumann, 2007).	Analysis by multiple angle reflectance spectrophotometer demonstrated that 2.5% niacinamide resulted in smoother skin surface compared to vehicle alone($p<0.05$) (Gehring W, 2004)
Improves epidermal barrier function Evidenced by reduced TEWL and an increase in the skin's resistance to potentialharmful topical agents. Proposed mechanisms include increased synthesis ofceramides via upregulation of serine palmitoyltransferase, the rate limiting enzyme in sphingolipid synthesis, and stimulating keratinocyte differentiation viaan influence on keratin K1, which results in an increase in epidermal turnover (Tanno, *etal*., 2000)	3.5% niacinamide cream was compared withplacebo for four weeks and demonstrated a 14.8% reduction in skin roughness ($p=0.05$) (Tanno *et al*, 2000; Hakozaki *et al*,2002;Shoechnick N,2002)
Decreases yellowing of skin Through its antioxidant capabilities, niacinamide inhibits oxidative processes, such as protein oxidation, glycation, and theMaillard reaction, which produces Amadori products. Amadori products are yellowish- brown in color and accumulate in skin matrixcomponents, like collagen, in response tooxidative stress as we age (Matts, 2002).	In a randomized, double-blind, split-face, placebo-controlled, clinical trial, 50 white females applied 5% niacinamide and vehicle twice daily for 12 weeks. Results showed significant improvement in fine lines and wrinkles, hyperpigmentation, redness,yellowing, and skin elasticity ($p<0.05$) (Bissett DL, Miyamoto K, Sun P, et al, 2004)
Decreases erythema and blotchiness Increasing barrier function may result in lessirritation when the skin encounters environmental insults and hence less redness. This theory has not been substantiated (Bissett, *et al*., 2003).	This study using niacinamide 5% and niacinamide 2% + UVB/UVA sunscreenmoisturizer reported reduced facialhyperpigmentation in Japanese women (Tanno O *et al*, 2000)
Decreases fine lines and wrinkles By reducing GAGs and increasing dermal collagen and protein production (i.e., keratin,fillagrin, and involucrin) (Bissett, *et al*., 2004).	In a randomized, split-faced trial, 5% niacinamide was used on 18 Japanese women vs.vehicle. Pigmentation change was evaluated qualitatively and quantitatively using high resolution digital images and subjective judgments. After 8 weeks, there was significant lightening of hyperpigmentation on the side treated with niacinamide compared to vehicle ($p<0.05$) (Tanno O *et al*, 2000)
Hyperpigmentation Reduces melanosome transfer from melanocytes to surrounding keratinocytes (Hakozaki, 2002).	One study showed that 5% niacinamide moisturizer provided 35–68 percent inhibition ofmelanosome transfer from melanocytes to keratinocytes (Hakozaki T, Minwalla L, ZhuangJ, *et al*, 2002)

III. DEVELOPMENT NIACINAMIDE BODY SCRUB

3.1 Ideal Body Scrub

The ideal and acceptable scrub has several properties, they are non-toxic, non- irritating to the skin, able to remove dead skin cells, mild abrasive, have small gritty particles, and not sticky to the skin (Chein, Y.W, 2005). scrub has important components and can play an important role in maintaining the strength of the protective skin barrier that is able to retain moisture, protect the skin from damage, remove impurities from the skin, provide a barrier against the movement of water and electrolytes and barrier from invadingmicroorganisms (Ghode Shweta P *et al*, 2019).

3.2 Niacinamide Body Scrub Formulation

Niacinamide is the heterocyclic aromatic amide that conform to the structure shown below:

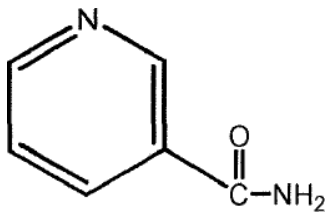

Figure 2: Niacinamide (Fitzjarrell, 2002).

Table 2: Formulation niacinamide bodyscrub (Fitzjarrell, 2002).

Ingredient Range (weight percent)	Concentration	Function
Water	50-60%	To dilute
Sucrose cocoate	3-6%	Surfactant
Disodium oleth-3 sulfosuccinate	7.5-12.5%	Emulsifier
Citric acid	1-3%	Preservative
Beta caroteine	0.01%	Antioxidant
Apricot kernel oil	2-4%	Skin conditioning agents - occlusive
Cetyl alcohol	4.5-8.5%	Emollient/ emulgator
Jojoba esters	5-7%	Exfoliating particulate (250-600)µm
Niacinamide	1-20%	Active Ingredient
Sodium PCA	0.25-1.25%	Moisturizer
Aloe Vera extract	0.25-1.25%	Shooting

The type of Niacinamide body scrub emulsion is oil in water. This type more acceptable because it is easily washed with water if applied to the skin. Cosmetics that contain niacinamide must maintain a final pH between 6 and 7.5 Niacinamide can turn into nicotinic acid. So, avoid using niacinamide with Sodium Lactate, because can increase the skin pH. On the other hand,

using Vitamin C, glycolic acid or even Gluconolactone (preservative) can cause the pH to drop lower than intended, pH should be confirmed to be accurate in order to ensure product stability (Finholt and Higuchi, 1962).

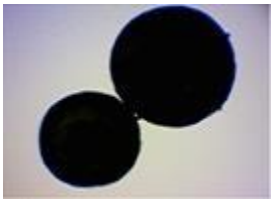

Figure 3: Jojoba beads.

Source: https://cosmetics.specialchem.com/selection-guide/exfoliating-agents-selection#content

Exfoliator particle size 200-700 microns is ideal for exfoliation on body skin. The beads are perfectly spherical for a gentle scrub with a low irritancy potential, which is ideal for incorporating into products for sensitive, aged, or problem skin. Jojoba Beads (250-600 microns) was applied widely to most body scrub, shower gel, body polishes and exfoliatingface mask.

3.3 Niacinamide

Vitamin B3 is found in food sources such as nuts, meat, yeast, wholegrain and others). Vitamin B3 is also known as nicotinamide and nicotinic acid amide which is a water soluble vitamin (Saha, 2012). In topical skin care products, there are three main forms of vitamin b3 used, namely niacinamide (nicotinamide), nicotinic acid, and nicotinic esters (eg Benzyl nicotinate, myristoyl nicotinate).

There have been published studies on the benefits of topical niacin for skin care. Niacin (Vitamin B3) has two potential forms used in cosmetics, namely niacinamide (Nicotinamide) and nicotinic acid. Nicotinic acid may have more benefits than local niacinamide due to the fact that in addition to having a vitamin effect on the skin in increasing levels of niacinamide adenosine dinucleotide (NAD), nicotinic acid can also have a drug-mediated effect on the skin through interactions. with nicotinic acid receptors present in the skin (Oblong *et al*. 2005). However, nicotinic acid as a topical cosmeceutical has unpleasant side effects of vasodilation which can cause skin redness. Although the effect is harmless, it is very disliked by most consumers. While niacinamide does not cause skin reddening effects or cause changes in blood pressure, pulse or body temperature.

3.4 Jojoba Beads as Exfoliator

Exfoliation allows the replacement of skin cells and this is also a way to protect andassist the skin in the antiaging process. One way of exfoliating that can be done is by usingscrubbing particles. Jojoba beads were early onto the market and remain popular, with many manufacturers now offering exfoliant consists of natural hydrogenated jojoba oil. Jojoba beads is a small spherically shaped beads, insoluble in water and has a faint odor. Jojoba bead guarantees effective but gentle exfoliation without abrasiveness, provides comfort in use, and not occlusive.

Table 3: Niacinamide Body Scrub Brand in Market.

Brand	Ingredients	Claims
Erha21 Truwhite Activator Body Scrub	Aqua, Synthetic Wax, Glycerin, Cocamidopropyl Betaine, C12-15 Alkyl Benzoate, Dipropylene Glycol Dibenzoate, PPG-15 Stearyl Ether Benzoate, Cocamidopropyl Hydroxysultaine, Glyceryl Stearate, **Niacinamide**, Cetyl Alcohol, Sodium PEG-7 Olive Oil Carboxylate, Dimethyl Sulfone, Sodium PCA, Butyrospermum Parkii (Shea Butter), Olive Oil PEG-7 Esters, Panthenol,Fragrance, PEG-7 Glyceryl Cocoate,Ethylhexylglycerin, Xanthan Gum, BHT, Dsiodium EDTA, Menthyl Lactate, Menthol Crystal, Sodium Benzoate, Phenoxyethanol	Whitening Body Scrub with an ActiveWhitening System that serves to brighten the skin's color significantly.
Acure Brightening Body Scrub	Aloe Barbandesis Leaf Juice, Glycerin, Juglans Regia (Walnut) Shell Powder, Sodium Methyl Cocoyl Taurate, Sodium Lauroamphoacetate, Illite Citrus Lemon (Lemon) Peel, Sodium Lauroyl Lactylate, Glyceryl Laurate, Sodium PCA, Cellulosa Gum, Sodium Cocoyl Isethionate, CitrusAurantium Dulcis (Orange) Peel Oil, Gluconolactone, **Niacinamide**, Chamomilla Recutita (Matricaria) Flower Extract, Rubus	Brightening Blend of Clay, Sea Salt, andNiacinamide for an Exfoliating ExperienceThat Will Keep You Softand Refressed
	Fruticosus (Blackberry) Fruit Extract, Euterpe Oleracea Fruit Extract, Rosa Canina Fruit Extract, Calendula Officinalis Flower Extract, Aspalathus Linearis Leaf Extract, Punica Granatum Extract, Eugenia Caryophyllus (Clove) Leaf Oil, Citrus Nobilis (Mandarin Orange) Peel Oil, Xanthan Gum, Montmorillonite, Kaolin, Calcite, Sea Salt (Maris Sal) (Sel Marin), Ethylhexylglycerin, Potassium Sorbate, Sodium Benzoate	
Natural's By Watsons Macadamia Body Scrub	Aqua, Glycerin, Cetearyl Alcohol Caprylic/ Capric Triglyceride, Juglans Regia (Walnut) Shell Powder, Stearic Acid, Glyceryl Stearate PEG -100 Streate, Synthetic Beeswax, Phenoxyethanol Triethanoiamine, PEG-7 Glyeerl Cocate,	Natural by Watsons Macademia Bath Body range helps fight the signs of ageing using the power of Australian

	Acrylates/C10-30, Alkyl, Acrylate Crosspolymer, parfum, Chlorphenesin, Butyrospernum Parkii (Shea) Butter, Xanthan Gum Disodium EDTA, Toccopheryl Accetate, Macadamia Ternifolia (Macademia) Seed Oil*. Cocos nuifera (Coconut	Macadamia nuts An ancestral beauty ingredient This body scrub contains 100 natural exfoliators for
	Oil) * Crambe Anyssinica (Abyssinian)Seed Oil, **Niacinamide**, Propylene Glycol Macadamia Ternifolia (Macadamia) Seed Extract, Potassium Sorbate, Linalool, Butylpheny Methylpropional* *Ingredients from certificated agriculture	softersmoother skinwithout feeling tight
Sumber Ayu Lulur Mandi Susu Body Scrub	Water, Stearic Acid, Polyethylene, Cassava, Glycerine, Cetearyl Alcohol, Zea Mays Starch, Glycol Distearate, Tea-Laureth Sulfate, Potassium Hydroxide, Lactic Acid, Acrylates/C10-30 Alkyl Acrylate Crosspolymer, Perfume, **Niacinamide**, Hydrolyzed Milk Protein, Methyl Paraben, Titanium Dioxide, Etidronic Acid, Methylisothiazolinone, Tocopheryl Acetate, Sodium Ascorbyl Phosphate, Coconut Oil Base DEA	Sumber Ayu white body Scrub with extra cleansing & extra fragrance for better scrub results, and enriched with whitening complex.

IV. Niacinamide Bodyscrub EvaluationPhysical evaluation

1. Homogenity

Apply product to glass or other materials which is transparent, the preparationmust show a homogeneous arrangement (Ditjen POM, 1979).

2. Organoleptic

Visual observations include color, smell and consistency.

3. Density

Observation of bodyscrub density using 10.677 ml pycnometer volume at 20°C.

4. Viscosity

The viscosity determined with a Brookfield cone and plate, calibrated with standard silicon solution.

5. Stability

Accelerated stability tests are carried out under different conditions intended to seechanges in the storage conditions. In this test, samples were stored in a climatic chamber at 40 ° ± 2 ° C and relative humidity (RH) 75% ± 5%. Stability parametersmeasured such as odor, color, and emulsion separated during 12-week storage at intervals observations when the preparation is complete, storage 0 (completed), 2, 4, 6, 8, 10 and 12 weeks (National Health Surveillance

Agency, 2005).

6. pH

pH determination using pH meter.

7. Emulsion type

Type of emulsion can be determined by phase dilution and staining with methyleneblue.

Claim evaluation

Skin analyzer (A- one tab) consists of several measuring devices, namely two cameras (60x and 10x magnification), humidity checker and oil gauge foam sticks, There are also UV lamps that are used to sterilize the camera so that skin irritation does not occur due to alternating usage on different skin. Skin analyzer is equipped with light color settings (blue, pink and orange). Blue light (normal 1) is used to be able to see oil, skin surface, pores and wrinkles. Orange lights (polarizing) are used to see spots and pigmentation. Whereas the pink light (normal 2) is used to see keratin on the skin (Aramo, 2012).

Table 1: Skin Analyzer Parameter (Aramo, 2012).

Atribute	Parameter (%)		
Moisture	**Dehydration**	**Normal**	**Hydration**
	0-29	30-50	51-100
Evennes	Smooth	Normal	Rough skin
	0-31	32-51	52-100
Spot	Less	Normal	More spot
	0-19	20-39	40-100
Wrinkle	Less wrinkle	Wrinkle	More wrinkle

Sensory evaluation

The evaluation was based on the determination by a team of experts by means of differential methods: adhesion, effect of pillows, spreading, absorption, greasiness, smoothness in relation to the standard (commercial product). A three-scale assessment has been established: "better", "the same", "worse" in relation to a reference sample, and it was given what % of respondents expressed such an opinion (Malysa Anna and Makwina Witkoska, 2017).

Niacinamide analysis in cosmetics

Methods for the determination of niacinamide in cosmetics using HPLC (C. H. Lin, Wu, and Huang 2007; Cheng, Chen, and Zhu 2010; Yang et al. 2011) and micellar electrokinetic capillary chromatography with field-amplified sample injection (Sun and Wu 2013) have

been reported. The maximum absorbances of niacinamide at 213 and 262nm, respectively.

Niacinamide, is water soluble, must extracted from cosmetic product that many ingredients, such as waxes, oils, and pigments (Winter 2009) that are lipophilic and do not dissolve in water. To extract the analytes and fully disperse the sample, cosmetics (0.1 g) were dissolved in 5mL of methanol in a 50-mL centrifuge tube, followed by sonication to disperse the lipophilic mixture. Deionized water was added to 50mL, and the solutions were vortexed and centrifuged.

V. CONCLUSION

Niacinamide can be developed into a body scrub with jojoba beads as exfoliating agent with the benefits of remove dead skin cells, cleanse and remove dirt, hydrates the skin, and make the skin smooth. This body scrub can be evaluated by physical evaluation, claim evaluation, sensory evaluation, and analysis of niacinamide in cosmetics. This product can be a potential product and the popularity of scrubs as personal care product has become a recent trend and this is anticipated to drive the market over the next few years.

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