



## Comparison of Anti-Aging Effect Between Vitamin B3 and Provitamin B5 Using Skin Analyzer

Surjanto<sup>1\*</sup>, Julia Reveny<sup>1</sup>, Juanita Tanuwijaya<sup>1</sup>, Anthony Tias<sup>1</sup>, Calson<sup>1</sup>

<sup>1</sup>Department of Pharmaceutical Technology, Faculty of Pharmacy, University of Sumatera Utara, Indonesia, 20155 Jl. Tri Dharma No. 5, Pintu 4, Kampus USU, Medan, Indonesia, 20155.

**Abstract** : Great skin is a status symbol. It's a reflection of health and well-being, youthfulness and vitality. Today, with a little effort anyone can have great skin. Niacinamide (vitamin B3) and d-panthenol (provitamin B5) are widely used in cosmetics products, especially skin care products because it is able to improve the signs of premature aging. Sheet mask is easy to use and able to increase the penetration of active substances into the skin than other product form. The aim of this research is to compare effect of vitamin B3 and provitamin B5 as anti-aging in sheet mask. Evaluation of sheet mask preparation includes homogeneity test, viscosity test, pH test, stability test, irritation test, and anti-aging effect using the skin analyzer device. Parameters measured include moisture, evenness, pores, spots and wrinkles. The results showed that d-panthenol had better effect on increasing skin moisture and improve skin evenness, meanwhile niacinamide had better effect on reducing pore size, spot, and wrinkle. The higher concentration of the vitamin in the essence can enhance the effect of anti-aging.

**Keywords** : anti-aging, vitamin B3, provitamin B5, sheet mask, comparison, skin analyzer.

### Introduction

Skin aging is a complex biological process influenced by a combination of endogenous and exogenous factors, which leads to structural and physiological alterations in the skin layer as well as changes in skin appearance, especially on the sun-exposed skin areas<sup>1</sup>.

There are many cosmetic materials that are claimed to have anti-aging effects when used topically<sup>2</sup>. Vitamin are organic compounds required in small quantities for normal function and typically obtained from the diet. Because there are essential nutrients, a few of them in a wide array of biochemical processes, they certainly have potential to have beneficial effects across a wide spectrum of skin problems<sup>3</sup>.

Vitamin B3 (niacinamide) serves as a precursor to a family of endogenous enzyme co-factors, specifically nicotinamide adenine dinucleotide (NAD), its phosphorylated derivative (NADP), and their reduced forms (NADH, NADPH) which involved in many enzymatic reactions in the skin, and thus have potential to influence many skin processes<sup>4</sup>.

Pro-vitamin B5 (panthenol), the biologically active alcohol analogue of pantothenic acid is a pro-vitamin of the B-complex group that is a normal constituent of skin and hair. Dermatologist have long been aware of the value of panthenol in the preservation of skin health<sup>5</sup>.

The principle of using mask is Occlusive Dressing Treatment (ODT) which can help the penetration of active substance 5-50 times. Sheet mask is one of the type of mask that made of non-woven, pulp, biocellulose, etc. Sheet mask has excellent sealing properties which can improve the effects of active substances in moisturizing, whitening, anti-aging and other aspects<sup>6</sup>.

## Experimental

### Apparatus

Laboratory glassware (Pyrex), Brookfield viscometer, pH meter (Eutech Instrument), and Skin Analyzer (Aramo).

### Material

Vitamin B3 (niacinamide), Provitamin B5 (d-panthenol), glycerin, butylene glycol, sodium polyacrylate, methyl paraben, ethanol, PEG-40 hydrogenated castor oil, perfume, distilled water, foil bag and sheet mask (Beyond)

### Preparation of sheet mask's essence

The components of the formulation were shown in Table 1.

Sodium polyacrylate was mixed with glycerin and butylene glycol in mortar (mixture 1). Methyl paraben was dissolved in hot water (mixture 2). Admixed mixture 1 and 2 gradually and add the vitamin, PEG-40 HCO, ethanol, and perfume then homogenized it.

**Table1. Formula of sheet mask's essence**

Component	Concentration (%)					
	N1	N2	N3	P1	P2	P3
Vitamin B3	1	3	5	-	-	-
Provitamin B5	-	-	-	1	3	5
PEG-40 <i>Hydrogenated castor oil</i>	0,1	0,1	0,1	0,1	0,1	0,1
Butylene glycol	5	5	5	5	5	5
Glycerin	5	5	5	5	5	5
Sodium polyacrylate	0,2	0,2	0,2	0,2	0,2	0,2
Methyl paraben	0,2	0,2	0,2	0,2	0,2	0,2
Ethanol	3	3	3	3	3	3
Perfume	1 drop	1 drop	1 drop	1 drop	1 drop	1 drop
Distilled water ad	100	100	100	100	100	100

Note: N = niacinamide, P= d-panthenol

### Physical Quality Evaluation of the Preparation

#### Homogeneity test

A certain amount of preparations were applied on a piece of glass or other suitable transparent material, preparations should show a homogeneous composition and no visible coarse grains.

#### pH measurements

Determining pH of the preparation is done by using a pH meter. Instrument must first be calibrated using pH neutral buffer solution (pH 7.01) and acidic pH buffer solution (pH 4.01) until the instrument shows the pH values. Then, washed the electrode with distilled water then dried with paper towels. Place the electrode in the essence, pH of the essence appears in the display.

### Viscosity measurements

Determination of viscosity is made by using a Brookfield viscometer with 62 as the number of spindle and 12 as the speeds.

### Stability test

A total of 100 grams of each formula were put into plastic pots. Furthermore, the observations are in the form of changes in consistency, color and scent at the time of the preparation is finished as well as in storage for 12 weeks at room temperature.

### Irritation test

Irritation test conducted on 24 volunteers with patch test technique by attaching the preparation on the back of the ear.

### Anti-Aging Effect test

Using Aramo SG<sup>®</sup> skin diagnosis system. Treatment conducted for 4 weeks by applying the mask once a week. Parameters measured including moisture, evenness, pore, spot and wrinkles. Each formula consists of 3 volunteers.

### Volunteer

24 volunteers were used to conduct this experiment who has been analyzed beforehand for having signs of premature aging, such as dry skin, wrinkles and black spots.

The criteria of volunteers are :

1. Women
2. Age between 20-25 years
3. No medical history associated with allergies.

## Results and Discussion

### Physical Quality Evaluation of the Preparation

The result of physical quality evaluation of the preparations were shown in table 2.

**Table 2. Physical quality evaluation of the preparation**

Parameter	Formula					
	N1	N2	N3	P1	P2	P3
Homogeneity	✓	✓	✓	✓	✓	✓
pH	6.00	6.07	6.10	6.60	6.70	6.70
Viscosity (cps)	866.7	733.3	533.3	275	300	325
Stability	Stable	Stable	Stable	Stable	Stable	Stable
Irritation	-	-	-	-	-	-

Note: ✓ = homogeneous, - = no irritation

Based on the data in Table 2 above shows that each formula was homogeneous. pH value was 6.00-6.70 which was within the range of permitted pH requirements for cosmetics (5-8). Viscosity value for each formulawere not undergo changes during storage. Each formula were stable during storage and were non-irritating to the skin and it can be said that the overall preparation sheet masks are safe to use.

### Anti-aging test

The comparison of the effect of anti-aging between niacinamide and d-panthenol on volunteers' skin were shown in Figure 1, Figure 2, Figure 3, Figure 4, and Figure 5.

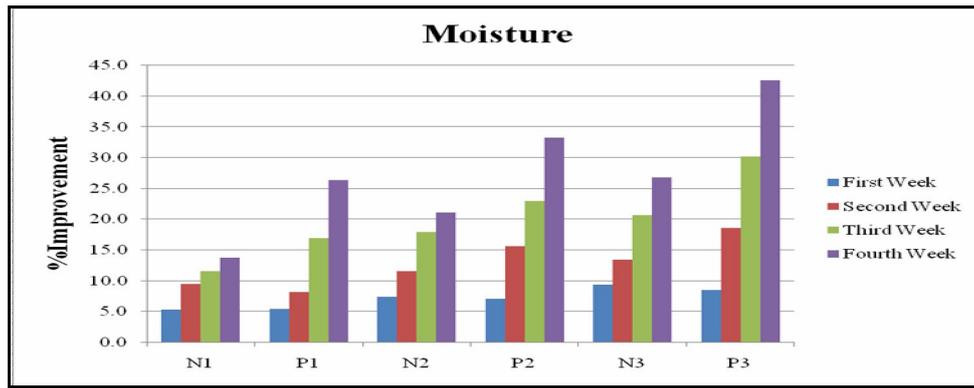


Figure 1.Improvement of skin moisture (%)in 4 weeks treatment

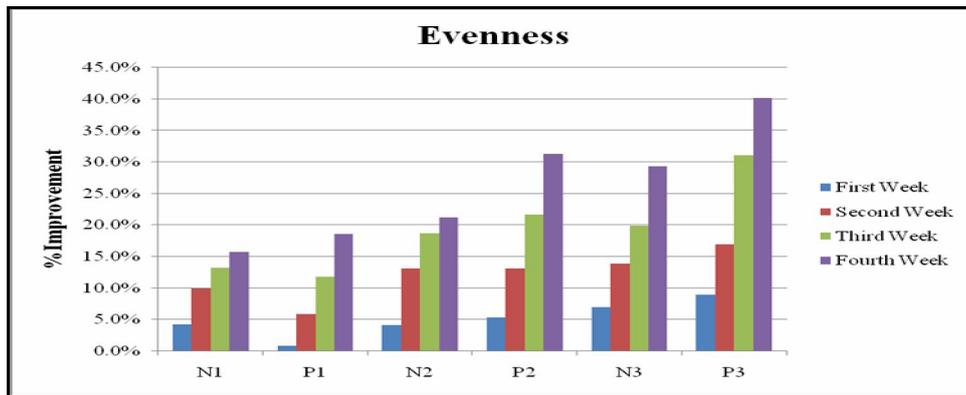


Figure 2.Improvement of skin evenness (%) in 4 weeks treatment

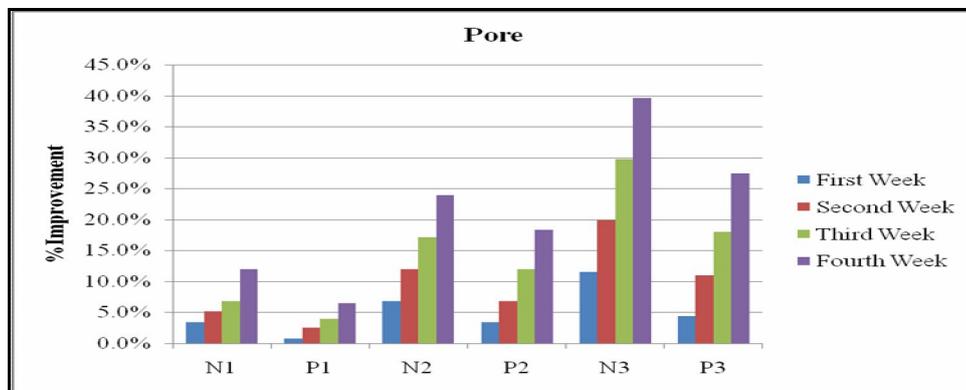


Figure 3.Improvement of skin pore (%) in 4 weeks treatment

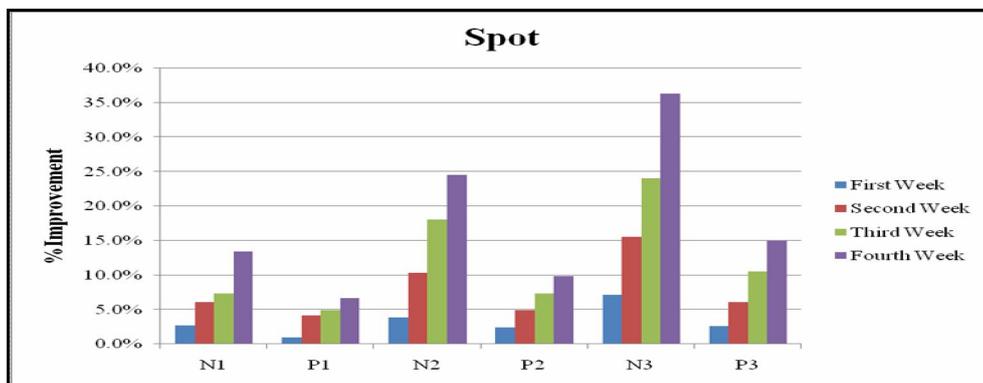
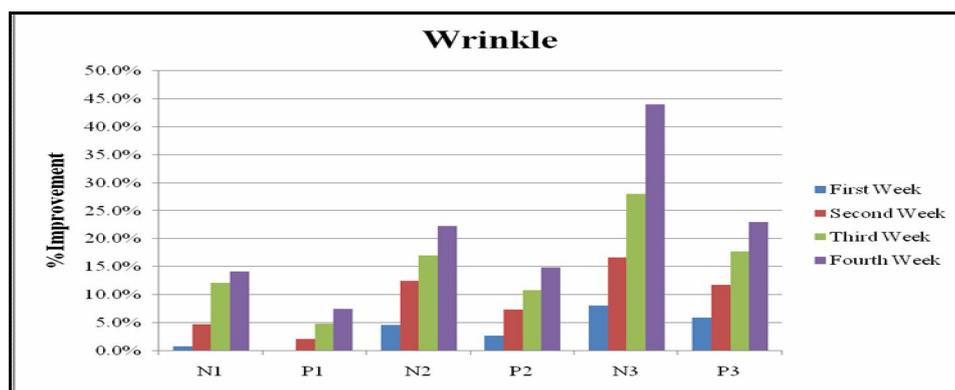


Figure 4.Improvement of skin spot (%) in 4 weeks treatment



**Figure 5.Improvement of skin wrinkle (%) in 4 weeks treatment**

From Fig 1. Fig 2, Fig 3, Fig 4, and Fig 5, can be seen that d-panthenol had better effect on increasing skin moisture and improve skin evenness, meanwhile niacinamide had better effect on reducing pore size, spot, and wrinkle.

Topical provitamin B5 (d-panthenol) has the following effect on skin:

- Natural humectant that attracts water from the atmosphere and also can improve, strengthen, revitalize the outer skin protection (stratum corneum and epidermis), thereby reducing water loss which keep maintaining softness, smoothness and elasticity of the skin<sup>7,8</sup>.
- Enhance the proliferation of fibroblasts in the dermis layer that increase collagen synthesis that serves to strengthen the elasticity of the walls of the pore canals<sup>9</sup>.
- Promotes the synthesis of Glutathione which is known to have antioxidant properties which inhibiting melanin synthesis by binding free radicals and peroxides that contribute to the formation of melanin thus reducing spots on the face<sup>10</sup>.
- Increases the proliferation of fibroblasts in the dermis which is the middle layer of skin where wrinkles are formed and also increases the synthesis of all the components of the skin matrix, such as collagen, elastin and glycans<sup>7</sup>.

**Topical vitamin B3 (niacinamide)has the following effect on skin:**

- Increases epidermal production of skin barrier lipids (ceramides) and also skin barrier layer proteins and their precursors (keratin, involucrin, filaggrin), leading to the observed enhancement of barrier function as determined by reduced transepidermal water loss (TEWL)<sup>4</sup>.
- Reduces surface sebum in human skin specifically in the glyceride and fatty acid components of skin surface sebum. These changes are accompanied by reductions in the appearance of rough skin texture and pore size<sup>3</sup>.
- Interferes with the interaction between keratinocytes and melanocytes, thereby inhibiting melanogenesis. It also modulates the protease-activated receptor (PAR-2) that is involved in the transfer of melanosomes from melanocytes to surrounding keratinocytes<sup>11</sup>.
- Increase in collagen production may cause wrinkle reduction, elevates histone acetyltransferase (HAT) activity in human fibroblasts, and reduces excess dermal glycosaminoglycans that are characteristic of photodamaged or wrinkled skin<sup>12</sup>.

## Conclusion

Results indicate that provitamin B5 (d-panthenol) has better effect on increasing skin moisture and improve skin evenness, meanwhile niacinamide had better effect on reducing pore size, spot, and wrinkle. The higher concentration of the vitamin in the essence can enhance the effect of anti-aging.

## Acknowledgements

We would like thank to Faculty of Pharmacy, University of Sumatera Utara for supporting this project.

## References

1. Baki, G., and Alexander, K.S., Introduction to Cosmetic Formulation and Technology, John Wiley & Sons, Inc, New Jersey, 2015, 235-237.
2. Draelos, Z.D., and Thaman, L.A, Cosmetic Formulation of Skin Care Products, Taylor & Francis Group, New York,2006, 170-174.
3. Farris, P.K., Cosmeceuticals And Cosmetic Practice. John Wiley & Sons Ltd, UK,2014, 103-107.
4. Draelos, Z.D., Cosmetic Dermatology Products and Procedures, John Wiley & Sons Ltd, UK, 2010, 321-323.
5. Camargo, F.B., Skin Moisturizing Effects of Panthenol-based Formulations. University of Sau Paulo, Brazil, 2011, 1-2.
6. Lee, C.K., Assessments Of The Facial Mask Materials In Skin Care, Thesis, Department of Cosmetic Science, Chia-Nan University of Pharmacy and Science,Taiwan, 2013, 10-19.
7. Todorov, G., Panthenol For Skin Hydration, Healing, Revitalization and More, 2015, <http://www.smartskincare.com/treatments/topical/panthenol.html>.
8. Ebner, F., Heller, A., and Tausch, I., Topical use of dexpanthenol in skin disorders,Technical University of Munich, Germany2002, 1-2.
9. Dreyfuss, D, How to Make Enlarged Pore Smaller, 2015, <http://www.dgplasticsurgery.com/how-to-make-enlarged-pores-smaller>.
10. Slyshenkov, V.S., Dorota ,D., and Lech, W., Pantothenic Acid and Pantothenol Increase Biosynthesis of Glutathione By Boosting Cell Energetics, Nencki Institute of Experimental Biology, Poland, 2004, 1-2.
11. Sarkar, R., Arora, P., and Garg, K.V., Cosmeceuticals for Hyperpigmentation: What is Available?,J Cutan Aesthet Surg, 2013, 6(1):4-11.
12. Kawada, A., Konishi, N., Oiso, N., Kawara, S., and Date, A., Evaluation of Anti-Wrinkle Effects Of A Novel Cosmetic Containing Niacinamide, Journal of Dermatology, 2008, 35(10): 637-642.

\*\*\*\*\*