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Formulation and Physical Stability Evaluation of a Night Cream Containing Snail Secretion Filtrate and Niacinamide

Elianasari[1*], Rafi Ahmad[1], Siti Berkah Naimah[1], Nabila Najwa Hazar[1], Rera Destina[1], Amalia Lathifah Widyadari[1]

1. Cosmetic Engineering Study Program, Institut Teknologi Sumatera, South Lampung, 35365, Indonesia

***Corresponding Email: elianasari@km.itera.ac.id**

ABSTRACT

Snail secretion filtrate and niacinamide are cosmetic ingredients commonly used to support skin hydration and barrier function. This study aimed to formulate and evaluate the preliminary physical stability of a night cream containing 3.3% snail secretion filtrate and 2.4% niacinamide. The cream was prepared as an oil-in-water emulsion and evaluated for organoleptic properties, homogeneity, pH, initial viscosity, emulsion type, spreadability, and stability using a cycling test at 4°C and 40°C. The formulation was white, semisolid, homogeneous, had a melon fragrance with a slight base odor, and was classified as an oil-in-water emulsion. After the cycling test, the pH increased from 6.21 to 6.47, while spreadability decreased from 6.95 cm to 6.45 cm. Both values remained within acceptable ranges for topical creams. Initial viscosity ranged from 7040 to 1935 mPa·s at rotational speeds of 6–30 rpm. No phase separation or observable changes in color, odor, texture, homogeneity, or emulsion type were found after testing. The formulation showed acceptable preliminary physical stability.

Key words: snail mucin, niacinamide, night cream, anti-aging, physical stability

INTRODUCTION

Skin aging is a complex biological process influenced by the interaction of intrinsic and extrinsic factors. Intrinsic factors are associated with physiological processes, genetic regulation, and age-related decline in cellular function, whereas extrinsic factors are mainly triggered by ultraviolet radiation, pollution, oxidative stress, and lifestyle. These factors may reduce collagen and elastin synthesis, increase the activity of matrix metalloproteinases (MMPs), and decrease glycosaminoglycan content, which plays an important role in maintaining skin hydration and elasticity (Lee et al., 2016; Shin et al., 2023). Clinically, these changes are characterized by dry and dull skin, reduced firmness, and the appearance of fine lines and wrinkles.

The development of anti-aging cosmetics is currently not only focused on aesthetic effects but also directed toward supporting skin barrier function, improving hydration, and promoting skin regeneration. One active ingredient widely used in the K-beauty trend is snail secretion filtrate, commonly known as snail mucin. Snail mucin has been reported to contain various bioactive components, including glycoproteins, glycosaminoglycans, allantoin, peptides, glycolic acid, lactic acid, and antioxidant components, which contribute to hydration, tissue repair, and the maintenance of skin health (Marchlewicz et al., 2024). A systematic review also reported that snail mucin-based products have the potential to improve skin texture, increase hydration, and support several indicators of skin health (Aflatooni et al., 2023).

In addition to snail mucin, niacinamide, or vitamin B3, is a cosmetic active ingredient widely used in skin care due to its benefits in improving skin barrier function, hyperpigmentation, inflammation, and signs of aging. Mechanistically, niacinamide can support ceramide synthesis, reduce transepidermal water loss (TEWL), provide antioxidant effects, and improve skin tone by inhibiting melanosome transfer (Boo, 2021). The combination of snail mucin and niacinamide in a night cream formulation may provide a more comprehensive skin care approach, as snail mucin acts as a humectant and skin-regenerating ingredient, while niacinamide supports barrier repair and improves skin appearance.

Several previous studies have investigated the use of snail mucin in topical and cosmetic preparations. Laneri et al. (2019) formulated a cosmetic cream containing Helix aspersa mucus and evaluated its moisturizing effect through skin hydration and TEWL parameters. Daud et al. (2018) developed an emulgel containing Achatina fulica snail slime and evaluated its physical properties, including organoleptic characteristics, homogeneity, pH, viscosity, spreadability, irritation, hedonic properties, and cycling stability. More recently, Pagano et al. (2024) demonstrated that snail slime could be incorporated into a physically stable and easily spreadable oil-in-water emulgel system. Meanwhile, niacinamide has been extensively studied as a cosmetic active ingredient. Boo (2021) described the role of niacinamide in skin barrier repair, antioxidant activity, pigmentation control, and anti-aging care, while Dănilă et al. (2024) reported that niacinamide-containing emulsions exhibited good physicochemical, microbiological, and stability characteristics as potential cosmeceutical products.

Nevertheless, studies specifically focusing on the development of an anti-aging night cream based on the combination of snail secretion filtrate and niacinamide in an oil-in-water emulsion system, along with preliminary physical stability evaluation, remain limited. Such evaluation is important because the quality of cosmetic products is not solely determined by the biological potential of their active ingredients but also by emulsion stability, user acceptability, and the uniform distribution of active ingredients within the formulation base. Therefore, this study aimed to develop an anti-aging night cream formulation based on snail mucin and niacinamide and to evaluate its preliminary physical stability. The evaluated parameters included organoleptic characteristics, homogeneity, pH, viscosity, emulsion type, spreadability, and cycling stability. The findings of this study are expected to provide preliminary information regarding the physical feasibility of a snail mucin–niacinamide night cream formulation as a candidate anti-aging cosmetic preparation.

MATERIAL AND METHODS

Material

The materials used in this study were distilled water, snail secretion filtrate, stearic acid, cetyl alcohol, white illipe butter, propylene glycol, glycerin, niacinamide, tocopherol, phenoxyethanol, triethanolamine (TEA), and fragrance. The instruments used included beakers, measuring cylinders, an analytical balance, a hot plate or water bath, a thermometer, a mortar and pestle, spatulas, watch glasses, a digital pH meter, a Brookfield viscometer, a stopwatch, a homogenizer, and spreadability test apparatus.

Methods

Formulation of the Anti-Aging Night Cream Based on Snail Secretion Filtrate and Niacinamide

The night cream was prepared using a hot emulsification method to produce an oil-in-water (O/W) emulsion, with modifications based on the procedures reported by Dănilă et al. (2024) and Pagano et al. (2024). All ingredients were weighed according to the formula (Tabel 1). The aqueous phase was prepared by mixing glycerin, propylene glycol, and a portion of distilled water, followed by heating to 70°C. The oil phase was prepared by mixing stearic acid, cetyl alcohol, and white illipe butter, and was heated at the same temperature until homogeneous. Separately, niacinamide and snail mucin were dissolved in a small amount of distilled water to prepare the active

ingredient mixture. After both the aqueous and oil phases reached 70°C, the oil phase was slowly added to the aqueous phase while being homogenized at 8000 rpm until a homogeneous emulsion was formed. The emulsion was continuously stirred while the temperature was gradually reduced to approximately 40°C. During the cooling phase, the active ingredient mixture, phenoxyethanol, tocopherol, and fragrance were added and mixed until uniformly dispersed. The final preparation was transferred into a clean container for physical evaluation.

Table 1. Formulation of the anti-aging night cream based on snail mucin and niacinamide

Ingredient	Formula (%)	Function
Snail secretion filtrate	3.30	Anti-aging active ingredient
Niacinamide	2.40	Barrier-supporting and brightening active ingredient
Stearic acid	9.00	Emulsifier and cream-structuring agent
Cetyl alcohol	1.20	Co-emulsifier and viscosity enhancer
White illipe butter	1.00	Emollient
Propylene glycol	1.20	Humectant
Glycerin	5.00	Humectant
Tocopherol	0.05	Lipid antioxidant
Phenoxyethanol	0.50	Preservative
Triethanolamine	0.05	pH adjuster and emulsification aid
Fragrance	0.05	Fragrance agent
Distilled water	Ad 100	Solvent/aqueous phase

Physical Evaluation of the Preparation

The physical properties of the anti-aging night cream were evaluated through organoleptic observation, homogeneity, viscosity, pH, emulsion type, spreadability, and cycling stability tests.

Organoleptic test

The organoleptic test was conducted visually and sensorially using the senses to assess the physical characteristics of the preparation, including color, odor, texture, and consistency. Observations were performed before and after the

cycling test to identify any physical changes in the preparation (Pratiwi et al., 2021).

Homogeneity test

The homogeneity test was performed by placing approximately 1 g of cream on a clean and dry glass slide and spreading it evenly to form a thin layer. The preparation was visually observed for the presence of coarse particles, lumps, or non-uniformly mixed components. The cream was considered homogeneous when it showed a smooth and uniform texture without visible lumps or coarse particles (Pratiwi et al., 2021).

Viscosity test

Viscosity was measured using a Brookfield viscometer. The cream was placed in a beaker, and spindle number 4 was attached to the instrument. Measurements were performed at different rotational speeds until stable viscosity readings were obtained. The viscosity values were expressed in mPa·s (Azkiya et al., 2017).

pH test

The pH test was performed by weighing 1 g of cream and diluting it with 10 mL of distilled water. The pH value was measured using a calibrated pH meter. This test was conducted to ensure that the pH of the preparation was within an appropriate range for topical application and was unlikely to cause skin irritation (Pratiwi et al., 2021).

Emulsion type test

The emulsion type was determined using the dilution method. A small amount of cream was dispersed in water, and its ability to mix with the aqueous phase was observed. If the cream dispersed or mixed uniformly in water, the preparation was classified as an oil-in-water (O/W) emulsion. Conversely, if the cream did not mix with water, it was classified as a water-in-oil (W/O) emulsion (Nur Fadilah et al., 2023).

Spreadability test

The spreadability test was performed by weighing 0.5 g of cream and placing it on a watch glass or flat glass surface. The sample was covered with another glass plate and loaded with a 125 g weight for 1 minute. The spreading diameter was then measured using a ruler. A good spreadability value for cream preparations generally ranges from 5 to 7 cm (Tungadi et al., 2023).

Cycling test

The cycling test was conducted to evaluate the preliminary physical stability of the preparation against temperature changes. The cream was stored at 4°C for 24 hours and then transferred to 40°C for another 24 hours. This temperature sequence was considered one cycle and was repeated. After the test, the preparation was re-evaluated for changes in organoleptic properties, homogeneity, pH, emulsion type, spreadability, and possible phase separation (Zam Zam & Musdalifah, 2022).

RESULT AND DISCUSSION

The physical evaluation of the preparation was conducted to determine the initial characteristics and physical stability of the anti-aging night cream formulated with *snail secretion filtrate* and niacinamide. The observed parameters included organoleptic properties, homogeneity, pH, viscosity, emulsion type, spreadability, and physical changes after the cycling test. The organoleptic test was performed to observe the physical appearance of the cream preparation, including its color, odor, and texture (Elya et al., 2013). The resulting formulation was a white, semisolid cream with a melon fragrance and a slight base odor, and it appeared visually homogeneous (Figure 1). The preparation showed a relatively consistent appearance before and after the cycling test. Small bubbles were observed on the cream surface, which were presumed to result from air entrapment during the homogenization process. These bubbles were more appropriately considered an appearance-related effect of the manufacturing process rather than a primary indicator of emulsion instability, as long as they were not accompanied by phase separation, color change, odor alteration, or lump formation (Tabel 1).

Figure 1. Appearance of the anti-aging night cream based on snail mucin and niacinamide

The homogeneity test was conducted to observe the uniformity of the ingredients in the cream formulation. A cream preparation is considered homogeneous when no visible coarse particles or aggregates are present in the formulation (Elya et al., 2013). This test was performed by visually observing the color distribution and the uniformity of the cream components on a transparent glass surface. The results showed on table 2 that the preparation remained homogeneous both before and after the cycling test. This parameter is important because the cream contains two main active ingredients, namely *snail secretion filtrate* and niacinamide, which must be evenly distributed within the cream base to ensure consistent product quality during each application.

Table 2. The Organoleptic observation results of the cream preparation

Observation	Before cycling test	After cycling test
Color	White	White
Odor	Melon fragrance with a slight base odor	Melon fragrance with a slight base odor
Texture	Semisolid with visible bubbles in the preparation	Semisolid with visible bubbles in the preparation

The pH test was conducted to determine the chemical characteristics of the cream formulation. According to SNI 16-4954-1998, the acceptable pH range for cream preparations is 3.5–8.0 (Elmitra, 2019). The pH value of a topical preparation should comply with the recommended range to minimize the risk of skin irritation. Preparations with excessively acidic pH values may irritate the skin, whereas highly alkaline preparations may cause dryness or scaling. The pH of cream preparations can be influenced by temperature, humidity, and storage duration (Suhery et al., 2016). In this study, the pH of the cream slightly increased from 6.21 to 6.47 after the cycling test (Tabel 3). This change was relatively small and remained within the acceptable range for topical preparations. Maintaining an appropriate pH is important because formulations that are too acidic or too alkaline may increase the risk of irritation and reduce user comfort. The slight increase in pH after testing may be attributed to temperature exposure, storage time, and changes in the equilibrium of components in the aqueous phase during thermal stress conditions (Budianor et al., 2022).

Table 3. The Physicochemical evaluation results of the cream preparation

Observation	Before cycling test	After cycling test
pH	6.21	6.47
Homogeneity	Homogeneous	Homogeneous
Viscosity	7040 mPa·s at 6 rpm; 3195 mPa·s at 12 rpm; 1935 mPa·s at 30 rpm	Not tested due to insufficient sample quantity
Emulsion type	Oil-in-water (O/W)	Oil-in-water (O/W)
Spreadability	6.95 cm	6.45 cm

The viscosity test was conducted to determine the consistency of the anti-aging night cream formulated with snail mucin and niacinamide. A good viscosity range for cream preparations is generally reported to be 2,000–50,000 cP (Erwiyani et al., 2018). The initial viscosity of the preparation decreased as the rotational speed increased, with values of 7040 mPa·s at 6 rpm, 3195 mPa·s at 12 rpm, and 1935 mPa·s at 30 rpm (Tabel 3). This pattern indicates a shear-thinning flow behavior, in which viscosity decreases under increasing shear stress. Such behavior is commonly observed in semisolid preparations, including creams, and is advantageous for topical application because the product maintains adequate consistency in the container but becomes easier to spread when applied to the skin. However, the viscosity after the cycling test could not be compared because the remaining sample was insufficient; therefore, the interpretation of the rheological stability of the preparation remains limited.

The emulsion type test was conducted to determine whether the cream was a water-in-oil (W/O) or oil-in-water (O/W) emulsion using the dilution method. A cream that cannot be diluted with water is classified as a water-in-oil (W/O) emulsion, whereas a cream that can be diluted or dispersed in water is classified as an oil-in-water (O/W) emulsion (Nonci et al., 2016). The results showed that the preparation remained an oil-in-water (O/W) emulsion both before and after the cycling test (Tabel 3). This emulsion type is suitable for a night cream because it provides a relatively light, easily spreadable, less greasy, and comfortable feel on the skin. The absence of emulsion type alteration after testing indicates that the dispersion system was able to maintain its emulsion structure during exposure to alternating temperatures. The stability of the emulsion type was also supported by base components such as stearic acid, cetyl alcohol, and triethanolamine, which contributed to the formation and strengthening of the emulsion structure.

The spreadability test was conducted to evaluate the ability of the cream preparation to spread on the skin. A good spreadability value for cream preparations generally ranges from 5 to 7 cm, indicating that the cream can spread adequately on the skin surface (Nurjanah et al., 2019). In this study, the spreadability of the preparation decreased from 6.95 cm to 6.45 cm after the cycling test (Tabel 3). Although a slight decrease was observed, the value remained within the acceptable range for cream preparations. This result indicates that the formulation was still easy to apply and did not undergo consistency changes that could interfere with user comfort.

Overall, the evaluation results indicated that the night cream formulation based on *snail secretion filtrate* and niacinamide demonstrated good preliminary physical stability. This was shown by the absence of significant changes in color, odor, texture, homogeneity, emulsion type, and phase separation after the cycling test. However, long-term stability claims cannot yet be established because the evaluation was limited to preliminary physical testing, and post-cycling viscosity data were not available.

CONCLUSION

The anti-aging night cream formulated with snail secretion filtrate and niacinamide showed good preliminary physical stability. The cream was white, semisolid, homogeneous, had a melon fragrance with a slight base odor, and was classified as an oil-in-water (O/W) emulsion. After the cycling test, no significant changes were observed in color, odor, texture, homogeneity, emulsion type, or phase separation. The pH slightly increased from 6.21 to 6.47, while spreadability decreased from 6.95 cm to 6.45 cm; however, both values remained within acceptable ranges for topical preparations. These findings indicate that the formulation maintained acceptable physical characteristics after exposure to alternating temperature conditions. However, long-term stability cannot yet be confirmed because the study was limited to preliminary physical evaluation and post-cycling viscosity data were unavailable. Further studies should include complete stability testing, post-cycling viscosity measurement, microbiological evaluation, irritation testing, and efficacy assessment on skin hydration and elasticity. Optimization of the homogenization process is also recommended to minimize air bubble formation.

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