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FORMULATION OF SOLID BLUSH ON PREPARATION FROM ETHANOL EXTRACT OF MIANA LEAVES (*Coleus scutellarioides* (L) Benth) AS A NATURAL COLORANT

Meli Restiani[1*], Rastria Meilanda[2], Sri Budiasih[3]

Bachelor of Pharmacy Department, Faculty of Health Sciences,
Mitra Bunda Institute of Health, Indonesia
melirestiani264@gmail.com[1], rastria.m@gmail.com[2],*
sribudiasihh9@gmail.com[3]
**Corresponding author*
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ABSTRACT

Synthetic dyes used in blush-on preparations may cause skin irritation and have limited stability, while miana leaf (Coleus scutellarioides (L.) Benth) contains anthocyanins that have potential as a natural colorant. This study aimed to investigate the use of miana leaf extract as a natural colorant in solid blush-on preparations and evaluate their physical characteristics, stability, irritation potential, and hedonic acceptance. Miana leaf extract was obtained through maceration using 96% ethanol and formulated into solid blush-on preparations at concentrations of 8%, 16%, and 24% (F1, F2, and F3), with F0 as the control without extract. The preparations were evaluated for organoleptic properties, homogeneity, friability, stability, irritation potential, and hedonic acceptance. The results showed that all formulas had a smooth texture, rose oil scent, and homogeneous appearance. None of the formulas cracked when dropped from a height of 10 cm, while cracking occurred in F1, F2, and F3 at 20 cm, and all formulas cracked at 30 cm. The preparations remained stable in form and scent during 21 days of storage, although slight color fading was observed in F1, F2, and F3 during the third week. The irritation test involving 28 volunteers showed no signs of redness, itching, or swelling. F3 was the most preferred formulation in the hedonic test. It can be concluded that miana leaf extract can be formulated as a natural colorant in solid blush-on preparations that are stable, non-irritating, and sensorially acceptable.

Keywords: *Blush on, natural coloring, miana (Coleus scutellarioides (L.) Benth.) leaves, stability, irritation test.*

INTRODUCTION

Cosmetic preparations are widely used to enhance appearance, particularly decorative cosmetics such as blush-on, which are applied to the cheeks to provide a more attractive facial appearance. Colorants are therefore an important component of blush-on preparations because they determine the visual characteristics and consumer appeal of the product. However, the increasing demand for cosmetic products with safer and more natural ingredients has encouraged the exploration of plant-derived colorants as alternatives to synthetic colorants. Plant-derived pigments, including anthocyanins, have attracted considerable attention because of their potential applications in cosmetic formulations and their diverse biological properties (Brudzyńska et al., 2021; Malik et al., 2023).

Anthocyanins are water-soluble pigments responsible for red, purple, and blue colors in many plants and are considered promising natural colorants for cosmetic

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applications. Nevertheless, their utilization in formulations is challenging because anthocyanins are sensitive to environmental and formulation factors, including light, temperature, pH, oxygen, and metal ions. These factors can accelerate pigment degradation and consequently cause changes in color intensity and product appearance (Cai et al., 2022; Enaru et al., 2021; Yang et al., 2022). Therefore, the development of a natural anthocyanin-based colorant for cosmetic preparations should not only consider its ability to produce an attractive color but also its physical characteristics, stability, safety, and acceptability.

Several studies have investigated the incorporation of plant-derived pigments into blush-on preparations. Sari et al. (2021), for example, formulated blush preparations using red beetroot extract and demonstrated the potential of plant pigments as natural coloring agents. Amaliasari et al. (2021) developed blush-on containing red dragon fruit peel extract and reported that increasing extract concentration affected the characteristics and color of the preparation, with the highest concentration showing favorable results. Akmal et al. (2023) also demonstrated the potential of *Hibiscus sabdariffa* flower extract as a natural colorant in blush-on cream. These studies indicate that plant extracts can be incorporated into cosmetic preparations while providing desirable color characteristics. However, the suitability of a natural pigment cannot be determined solely from its coloring ability, since formulation characteristics, physical stability, irritation potential, and consumer acceptance are also important considerations.

Miana (*Coleus scutellarioides* (L.) Benth) is an ornamental plant characterized by its distinctive reddish-colored leaves and has been reported as a potential source of anthocyanin pigments. Kaban et al. (2022) demonstrated the utilization of miana leaf extract as a natural colorant in lip cream preparations, indicating its potential for cosmetic applications. However, previous research involving miana extract has primarily focused on lip cosmetic preparations, while its application specifically as a natural colorant in solid blush-on remains less explored. This distinction is important because the characteristics of a pigment may differ depending on the dosage form, composition of the base, and application site. Consequently, findings from lip preparations cannot be directly assumed to represent the performance of miana extract in solid blush-on formulations.

Another important issue concerns the stability of anthocyanin pigments in cosmetic preparations. Anthocyanins may undergo degradation during storage, particularly when exposed to unfavorable environmental conditions, resulting in fading or other changes in product appearance (Enaru et al., 2021; Lu et al., 2023). Thus, research on miana-based blush-on should evaluate not only whether the extract produces an appropriate color but also whether the resulting preparation maintains acceptable physical characteristics during storage. In addition, because blush-on is applied directly to the skin, evaluation of irritation potential is necessary to provide preliminary evidence of its safety. Consumer acceptance through hedonic evaluation is also relevant because a technically acceptable formulation may not necessarily be preferred by users.

Based on the evaluation of previous studies, a research gap remains regarding the application of miana leaf extract as an anthocyanin-based natural colorant in solid blush-

on, particularly through an integrated evaluation of organoleptic properties, homogeneity, friability, stability, irritation potential, and hedonic acceptance. Previous research has demonstrated the potential of miana leaf extract as a natural colorant in blush-on preparations, including its effects on physical characteristics, color intensity, irritation potential, and sensory acceptance (Suryanita et al., 2024). However, the application of miana leaf extract specifically in a solid blush-on formulation with an integrated evaluation of physical characteristics, stability, irritation potential, and hedonic acceptance remains limited. This study therefore aimed to formulate solid blush-on preparations containing miana leaf extract at different concentrations and evaluate their physical characteristics, stability, irritation potential, and hedonic acceptance. The originality of this study lies in the utilization of miana leaf extract specifically in a solid blush-on dosage form and in the comprehensive evaluation of its performance as a natural cosmetic colorant (Suryanita et al., 2024).

RESEARCH METHOD

This study employed a quantitative experimental design to formulate solid blush-on preparations containing miana (*Coleus scutellarioides* (L.) Benth) leaf extract as a natural colorant. Four formulations were prepared, consisting of a control formulation without miana extract (F0) and three formulations containing miana leaf extract at concentrations of 8% (F1), 16% (F2), and 24% (F3). The selection of graded extract concentrations was based on previous research demonstrating the potential of miana leaf extract as a natural colorant in blush-on preparations, in which increasing extract concentrations produced progressively more intense coloration (Suryanita et al., 2024). In the present study, the concentrations of 8%, 16%, and 24% were selected as graded concentration levels to further evaluate the effect of increasing miana leaf extract concentration in a solid blush-on dosage form. The preparations were evaluated for organoleptic properties, homogeneity, friability, stability, irritation potential, and hedonic acceptance.

Fresh miana leaves weighing 250 g were collected from Kampung Lembang Jaya, Nongsa, Batam. The leaves were selected based on their freshness, red coloration, intact condition, and absence of holes or tears. The collected plant material was botanically identified at the Herbarium of Universitas Andalas, Padang, to confirm its identity as *Coleus scutellarioides* (L.) Benth.

The collected leaves were cleaned and weighed, then blended until the plant material was adequately reduced in size. The material was transferred into a glass container and subjected to maceration using 96% ethanol acidified with citric acid at a material-to-solvent ratio of 1:4. After maceration, the resulting extract was concentrated using a rotary evaporator at 40°C and subsequently concentrated using a water bath until the desired extract consistency was obtained.

The solid blush-on formulation was adapted from Butar-Butar et al. (2022) with modification by incorporating miana leaf extract as the natural colorant. The formulations consisted of F0 without extract, F1 with 8% extract, F2 with 16% extract, and F3 with

24% extract. Kaolin (10%) was used as an absorbent, zinc stearate (3%) as an adhesive, isopropyl myristate (1%) as a binder, methyl paraben (0.3%) as a preservative, ferulic acid (0.3%) as an antioxidant, and talc ad 100% as a filler. All ingredients were weighed according to the formulation. Kaolin, zinc stearate, methyl paraben, and half of the required talc were triturated until finely mixed. The miana leaf extract was separately mixed with the remaining half of the talc until evenly distributed. The extract–talc mixture was then combined with the other powdered ingredients, followed by the addition of isopropyl myristate and ferulic acid. The mixture was mixed until homogeneous, passed through a 100-mesh sieve, transferred into blush-on containers, and compacted to form a solid preparation at room temperature.

The organoleptic evaluation was performed by observing approximately 1 g of each preparation for color, odor, and texture. Homogeneity was evaluated by spreading a small amount of the preparation thinly and evenly on a glass slide and observing it under light. The preparation was considered homogeneous when no coarse particles were observed. Friability was evaluated by dropping each preparation three times onto a wooden surface from heights of 10, 20, and 30 cm. After each drop, the preparation was observed for changes in shape, cracks, or breakage.

Stability evaluation was conducted by storing the preparations at room temperature (20–26°C) for 21 days. Observations were performed weekly by examining changes in physical form, color, and odor of each formulation. The irritation test was conducted on 28 volunteers who met the predetermined inclusion criteria and were willing to participate in the study. A suitable amount of each preparation was applied to the volunteers' normal skin, and the test area was covered for at least 24 hours. After the exposure period, the test area was observed for signs of irritation, including redness, swelling, and itching. Prior to participation, the volunteers were informed about the test procedure and provided informed consent.

The hedonic test was conducted to determine the panelists' level of preference for the formulations. Thirty panelists aged 17–28 years participated in the evaluation. The assessed attributes included color, comfort, adhesion, and ease of application. Each attribute was evaluated using a five-point preference scale ranging from 1 (very dislike) to 5 (very like).

The data were obtained as primary data directly from the laboratory experiments and evaluations of the solid blush-on preparations. Organoleptic, homogeneity, friability, stability, and irritation data were analyzed descriptively and presented in tables accompanied by narrative descriptions. Hedonic test data were analyzed by calculating the mean score for each attribute and formulation and were presented in tabular form and visualized using a radar chart.

RESULTS AND DISCUSSION

Botanical Identification and Characteristics of Miana Leaf Extract

Botanical identification was conducted to confirm the identity of the plant material used in the study. The identification was performed at the Herbarium of Universitas

Andalas by examining the leaves, stems, and flowers. The results confirmed that the plant used in this study was *Coleus scutellarioides* (L.) Benth. Accurate botanical identification is an important initial step in research involving plant-derived ingredients because differences in plant species can affect the chemical composition and characteristics of the resulting extract. The confirmed identity therefore provides a basis for associating the observed color characteristics with the intended miana plant material.

Miana leaves were extracted using maceration with 96% ethanol acidified with citric acid. The maceration process was selected because it does not require direct heating, which is advantageous for plant pigments that may be sensitive to elevated temperatures. In the present study, the leaves were blended before extraction and macerated for two days. Citric acid was incorporated into the extraction solvent to maintain an acidic environment that can support anthocyanin stability. The concentrated extract obtained after rotary evaporation and water-bath treatment was characterized as a thick extract with a dark-red color, characteristic odor, and bitter taste. The organoleptic characteristics of the miana leaf extract are presented in Table 1.

Table 1. Organoleptic Characteristics of Miana Leaf Extract

Parameter	**Observation**
Physical form	Thick extract
Color	Dark red
Odor	Characteristic odor of miana leaf extract
Taste	Bitter

The dark-red appearance of the extract is consistent with the presence of plant pigments capable of producing red-to-purple coloration. Anthocyanins are among the major natural pigments responsible for these color ranges and have received considerable attention as alternatives to synthetic colorants. However, their application is affected by environmental factors such as pH, temperature, oxygen, light, and metal ions, which can alter pigment stability and color intensity (Brudzyńska et al., 2021; Enaru et al., 2021; Lu et al., 2023; Malik et al., 2023).

The use of acidified ethanol is therefore relevant to the extraction of anthocyanin-containing plant material. The acidic environment can help maintain the colored anthocyanin form, while ethanol provides an appropriate extraction medium for obtaining plant constituents. Similar extraction approaches have also been used in natural-colorant research for cosmetic preparations. Amaliasari et al. (2021), for example, used 96% ethanol with citric acid in the extraction of red dragon fruit peel for blush-on formulation.

The extraction procedure used in this study consequently provides a reasonable basis for obtaining a colored miana leaf extract for incorporation into a solid blush-on preparation. Nevertheless, because the present study did not quantitatively determine the anthocyanin content of the extract, the dark-red color should be interpreted as an organoleptic indication of pigment presence rather than as quantitative evidence of anthocyanin concentration.

Formulation and Organoleptic Characteristics of Solid Blush-On

The solid blush-on formulations were prepared using miana leaf extract at concentrations of 8%, 16%, and 24%, designated F1, F2, and F3, respectively. F0 served as the control formulation without miana leaf extract. The formulation process involved mixing the powder components, incorporating the miana extract with talc, adding the remaining ingredients, sieving the mixture through a 100-mesh sieve, and subsequently compacting the preparation into blush-on containers. The organoleptic characteristics of the solid blush-on formulations are presented in Table 2.

Table 2. Organoleptic Characteristics of Solid Blush-On Formulations

Formula	Miana Extract	Color	Texture	Odor
F0	0%	White	Smooth	*Oleum rosae*
F1	8%	Light pink	Smooth	*Oleum rosae*
F2	16%	Pink	Smooth	*Oleum rosae*
F3	24%	Dark pink	Smooth	*Oleum rosae*

The results demonstrated a clear concentration-dependent change in color. F0 remained white because it did not contain miana leaf extract, whereas F1, F2, and F3 produced progressively stronger pink coloration with increasing extract concentration. This finding indicates that the miana extract successfully functioned as a coloring component in the solid blush-on formulation. The progressive color intensity is consistent with the contribution of plant pigments to cosmetic coloration and with previous blush-on studies using plant-derived extracts.

Similar concentration-dependent color changes have been reported in other natural-colorant blush-on formulations. Sari et al. (2021) demonstrated the use of red beetroot extract as a natural colorant in several blush preparations, while Amaliasari et al. (2021) reported that red dragon fruit peel extract could provide coloration in blush-on formulations. LV et al. (2023) and Rahayu et al. (2022) likewise developed blush-on preparations containing teak leaf extract and observed that natural extracts influenced the color characteristics of the formulations. The physical appearance of the solid blush-on formulations containing different concentrations of miana leaf extract is presented in Figure 1.



Figure 1. Solid blush-on formulations containing different concentrations of miana leaf extract.

The smooth texture observed in all formulas indicates that the incorporation of miana extract did not produce an obvious deterioration in the physical texture of the compact preparations. This result is important because natural extracts can potentially affect the powder structure, compactness, and application properties of solid cosmetics. In this study, the formulation process, including powder mixing and sieving, apparently produced sufficiently uniform preparations for subsequent evaluation.

The use of a natural colorant is also relevant from the perspective of cosmetic formulation development. Plant-derived colorants are increasingly investigated for cosmetic applications because they can provide color while reducing dependence on synthetic pigments. However, the principal challenge is that natural pigments may have lower stability than conventional synthetic colorants. Brudzyńska et al. (2021) emphasized that natural pigments have potential for cosmetic applications but their practical use is influenced by physicochemical stability and formulation compatibility.

Homogeneity of Solid Blush-On Preparations

Homogeneity testing was conducted to determine whether the formulation components and miana extract were uniformly distributed throughout the preparations. The preparations were applied to a glass surface and examined for the presence of coarse particles or agglomerates. All formulations, including F0, F1, F2, and F3, showed no coarse particles and exhibited evenly distributed color. The homogeneity characteristics of the solid blush-on formulations are presented in Table 3.

Table 3. Homogeneity of Solid Blush-On Formulations

Formula	Observation	Interpretation
F0	No coarse particles; color evenly distributed	Homogeneous
F1	No coarse particles; color evenly distributed	Homogeneous
F2	No coarse particles; color evenly distributed	Homogeneous
F3	No coarse particles; color evenly distributed	Homogeneous

The homogeneous appearance indicates that increasing the concentration of miana extract from 8% to 24% did not result in visible aggregation within the formulation. This finding is important because an uneven distribution of pigment could lead to inconsistent color application during use. A homogeneous preparation is therefore desirable for cosmetic products intended to deliver consistent coloration.

The present finding is comparable with previous studies of natural-colorant blush-on preparations. Kaban et al. (2022), for example, reported homogeneous formulations containing miana leaf extract in lip cream preparations, demonstrating that miana extract could be incorporated into a cosmetic base while maintaining acceptable physical characteristics. Similar findings have also been reported in blush-on formulations using other natural colorants, in which plant-derived pigments were successfully incorporated while maintaining acceptable homogeneity and physical characteristics of the preparations. The present study is consistent with these findings, as all solid blush-on formulations containing miana leaf extract showed homogeneous characteristics.

However, unlike previous studies using other natural colorants or different cosmetic dosage forms, the present study specifically applied miana leaf extract in a solid blush-on formulation, indicating its potential as a natural colorant in this particular dosage form.

The result is also consistent with Rahayu et al. (2022), who reported acceptable homogeneity in blush-on formulations containing teak leaf extract. Thus, the present study extends previous findings by demonstrating that miana leaf extract can also be distributed homogeneously in a compact solid blush-on system.

Friability and Mechanical Resistance

The friability test was performed to evaluate the ability of the solid blush-on preparations to withstand mechanical impact. Each formulation was dropped three times from heights of 10, 20, and 30 cm. At 10 cm, none of the formulations showed cracking. At 20 cm, F0 remained intact, whereas F1, F2, and F3 showed cracking in two of the three trials. At 30 cm, all formulations cracked in all three trials. The friability/cracking responses of the solid blush-on formulations are presented in Table 4.

Table 4. Friability/Cracking Response of Solid Blush-On Formulations

Formula	10 cm	20 cm	30 cm
F0	0/3 cracked	0/3 cracked	3/3 cracked
F1	0/3 cracked	2/3 cracked	3/3 cracked
F2	0/3 cracked	2/3 cracked	3/3 cracked
F3	0/3 cracked	2/3 cracked	3/3 cracked

The progressive increase in cracking with increasing drop height indicates that mechanical impact influenced the structural integrity of the compact preparations. At 10 cm, the impact was insufficient to produce visible cracking in any formulation. At 20 cm, the greater impact resulted in cracking of the extract-containing formulas, while the control remained intact. At 30 cm, the mechanical force was sufficient to cause cracking in all formulations.

The difference between F0 and the extract-containing formulas at 20 cm may indicate that incorporation of the extract influenced the mechanical characteristics of the compact mass. However, this interpretation should remain cautious because the compaction process was performed manually. The amount and uniformity of compression could therefore have contributed to differences among the formulations.

This result is consistent with the general principle that greater impact energy increases the likelihood of structural damage in compacted solid preparations. Similar observations have been reported in previous blush-on research. Butar-Butar et al. (2022), as cited in the original study, also evaluated the resistance of solid blush-on against mechanical impact using a drop test. The present findings therefore support the use of mechanical resistance testing as an important evaluation for compact cosmetic preparations. The results of the friability test for the solid blush-on formulations are illustrated in Figure 2.

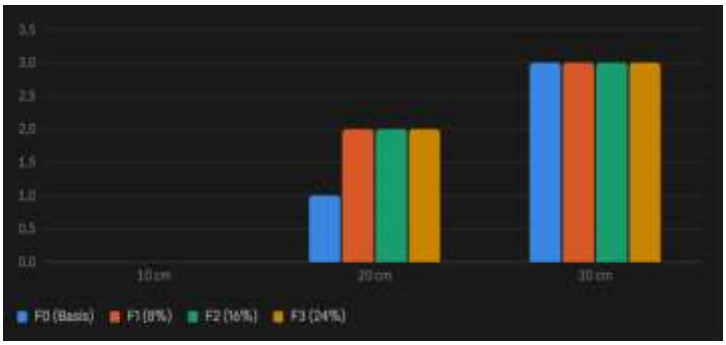


Figure 2. Diagram of the friability test results.

The mechanical performance of the preparations should nevertheless not be interpreted as a complete assessment of packaging durability. Real-world transportation involves repeated vibration, compression, and impact under different conditions. Future research should therefore evaluate hardness, breaking force, compact density, or standardized mechanical strength in addition to the simple drop test.

Physical Stability During Storage

The stability evaluation was conducted over 21 days with weekly observations of the physical form, odor, and color of the preparations at room temperature. All formulations remained solid throughout the observation period. The odor of all formulations remained consistent with *Oleum rosae* during the three-week observation period. The stability results for the physical form of the solid blush-on formulations are presented in Table 5.

Table 5. Stability of the Physical Form

Formula	Week 1	Week 2	Week 3	Interpretation
F0	Solid	Solid	Solid	Stable
F1	Solid	Solid	Solid	Stable
F2	Solid	Solid	Solid	Stable
F3	Solid	Solid	Solid	Stable

The physical form remained unchanged across all formulas, indicating that the incorporation of miana extract at concentrations up to 24% did not cause visible softening, liquefaction, or structural collapse during the 21-day observation period. This is a positive finding for the physical feasibility of the formulation. The stability results for the odor of the solid blush-on formulations are presented in Table 6.

Table 6. Stability of Odor

Formula	Week 1	Week 2	Week 3	Interpretation
F0	*Oleum rosae*	*Oleum rosae*	*Oleum rosae*	Stable
F1	*Oleum rosae*	*Oleum rosae*	*Oleum rosae*	Stable

F2	*Oleum rosae*	*Oleum rosae*	*Oleum rosae*	Stable
F3	*Oleum rosae*	*Oleum rosae*	*Oleum rosae*	Stable

The odor stability suggests that no obvious change in the sensory odor profile occurred during the three-week storage period. However, the color response differed among formulations. F0 remained white, whereas the pink coloration of F1, F2, and F3 showed slight fading during the third week. The original observations classified the color of the extract-containing formulations as slightly less stable by week 3. The color stability results of the solid blush-on formulations are presented in Table 7.

Table 7. Stability of Color

Formula	Week 1	Week 2	Week 3	Interpretation
F0	White	White	White	Stable
F1	Light pink	Light pink	Slightly faded light pink	Stable
F2	Pink	Pink	Slightly faded pink	Stable
F3	Dark pink	Dark pink	Slightly faded dark pink	Stable

The fading observed in the extract-containing formulas is particularly relevant because anthocyanins are known to be sensitive to environmental conditions. Light, temperature, oxygen, pH, and metal ions can influence anthocyanin stability and may lead to pigment degradation or changes in color intensity (Benucci et al., 2022; Cai et al., 2022; Enaru et al., 2021; Novais et al., 2022; Zang et al., 2022).

The observed fading should therefore not be interpreted as proof of a specific degradation mechanism because the present study did not quantitatively measure anthocyanin concentration before and after storage. Instead, the result demonstrates a visible change in color intensity during storage. This distinction is important because color change can be influenced by several formulation and environmental factors.

Similar concerns have been observed in natural-colorant cosmetic formulations. Rahayu et al. (2022) reported changes in the color characteristics of teak-leaf blush-on and associated the change with instability of anthocyanin-containing pigments. The present study therefore supports the broader observation that the incorporation of anthocyanin-containing extracts into cosmetic formulations may provide attractive initial coloration but requires attention to storage stability.

The stability result contributes directly to the main research question concerning the feasibility of miana extract as a natural colorant. The formulation remained physically intact for 21 days, but the slight fading of the colored formulations indicates that physical stability and pigment stability should be considered separately. A product may remain physically intact while its colorant undergoes gradual changes.

Future studies should therefore include instrumental color measurements, such as CIELAB parameters, together with quantitative anthocyanin determination. Longer-term stability testing under controlled temperature and light conditions would also provide stronger evidence regarding the suitability of miana extract for cosmetic applications. Xue et al. (2024) highlighted the importance of controlling environmental factors and using

stabilization strategies when developing anthocyanin-based products.

Irritation Potential of the Formulations

The irritation evaluation involved 28 volunteers. The preparations were applied to the skin of the arm using a closed patch-test approach for 24 hours. No visible redness, swelling, or itching was observed in the volunteers after exposure to F0, F1, F2, or F3. The irritation test results of the solid blush-on formulations are presented in Table 8.

Table 8. Irritation Test Results

Reaction	F0	F1	F2	F3
Redness	None	None	None	None
Swelling	None	None	None	None
Itching	None	None	None	None

The absence of visible irritation under the conditions of this test provides preliminary evidence that the formulations were well tolerated by the tested volunteers. Importantly, the result was consistent across all concentrations of miana extract, including the highest concentration of 24%.

The result is relevant because natural origin does not automatically guarantee the absence of adverse skin reactions. Cosmetic preparations may cause irritation due to the extract itself, excipients, preservatives, fragrances, or interactions among formulation components. Therefore, irritation testing remains an important part of preliminary cosmetic formulation evaluation. The assessment of botanical cosmetic ingredients also requires consideration of their potential to cause skin sensitization and other adverse reactions, particularly because plant-derived ingredients may contain multiple constituents with different safety profiles (Johnson et al., 2023; Pan et al., 2021).

The present result is also consistent with previous research involving miana extract in cosmetic preparations. Kaban et al. (2022) reported that miana leaf extract could be formulated into lip cream and that the resulting preparations did not produce irritation in their evaluation.

However, the absence of irritation in this study should not be interpreted as definitive proof that the preparation is universally safe for all users. The test involved a limited number of volunteers and evaluated visible reactions over a relatively short exposure period. Therefore, the appropriate interpretation is that no visible irritation was observed under the experimental conditions used in this study.

Further studies involving larger populations, controlled dermatological assessment, repeated-use exposure, and standardized safety protocols would strengthen the safety profile of miana-based cosmetic formulations.

Hedonic Acceptance of Solid Blush-On

The hedonic evaluation was conducted to determine panelists' acceptance of the formulations based on four parameters: color, comfort, adhesion, and ease of application.

The results showed that increasing the concentration of miana extract generally improved the acceptance of the formulations compared with the control. The hedonic acceptance results of the solid blush-on formulations are presented in Table 9.

Table 9. Hedonic Acceptance of Solid Blush-On Formulations

Evaluation paramater	F0	F1	F2	F3
Color	2.6	4.0	4.5	4.3
Comfort	3.6	3.9	4.2	4.2
Adhesion	3.8	4.1	4.2	4.3
Ease of application	4.0	4.3	4.2	4.4

The color parameter showed the greatest difference among the formulations. F0 obtained a mean score of 2.6 because it did not contain miana extract and therefore remained white. In contrast, F1, F2, and F3 produced increasingly attractive pink shades. F2 obtained the highest color score of 4.5, indicating that the 16% extract concentration produced the most preferred color among the tested formulations.

The result suggests that increasing extract concentration does not necessarily produce a linear increase in color preference. Although F3 contained the highest extract concentration and produced the darkest pink color, its color score of 4.3 was slightly lower than that of F2. This may indicate that panelists preferred a moderate pink intensity rather than the darkest color.

The finding is important because it demonstrates that the concentration producing the strongest color is not necessarily the concentration producing the highest sensory acceptance. Similar observations have been reported in studies of natural-colorant blush-on formulations, where different extract concentrations produced different color intensities and levels of consumer preference. Rahayu et al. (2022), for example, found that the lowest tested teak-leaf extract concentration was the most preferred in their blush-on formulation. Similar variation in color characteristics and sensory responses has also been observed in blush-on formulations containing other plant-derived colorants, indicating that increasing natural-colorant concentration may alter color intensity without necessarily resulting in a proportional increase in preference (Iskandar et al., 2022; Kim & Shin, 2024).

The comfort scores increased from 3.6 in F0 to 4.2 in F2 and F3. Similarly, adhesion increased from 3.8 in F0 to 4.3 in F3. These results indicate that the addition of miana extract did not negatively affect the sensory properties of the preparation. The extract-containing formulations remained acceptable in terms of application-related characteristics.

The ease-of-application scores were also relatively high, with F3 obtaining the highest value of 4.4. This finding is consistent with the organoleptic observation that all formulations had a smooth texture. The combination of smooth texture and acceptable adhesion may have contributed to the favorable application scores.

Overall, F3 showed the highest overall mean hedonic score based on the four evaluated parameters, whereas F2 produced the highest score specifically for color. Therefore, F3 can be considered the most preferred overall formulation in this study, while F2 can be considered the most preferred formulation in terms of color.

This distinction is important for formulation development. A cosmetic product must balance color intensity with application properties and overall sensory acceptance. A formulation that produces an intense pigment but is excessively dark may not necessarily be preferred for daily cosmetic use.

Overall Contribution, Limitations, and Future Research

Taken together, the findings demonstrate that miana leaf extract can function as a natural colorant in solid blush-on preparations. The extract produced a clear concentration-dependent color response, with F1 producing light pink, F2 producing pink, and F3 producing dark pink. All formulations remained homogeneous and had smooth textures. During the 21-day observation period, the formulations maintained their solid form and odor, while slight color fading was observed in the extract-containing formulations (F1–F3). Thus, the physical form and odor remained stable throughout the observation period, whereas the color showed a slight change over time.

The study therefore addresses the main questions posed by the research by demonstrating the technical feasibility of incorporating miana leaf extract into a solid blush-on formulation. Previous studies have explored the use of miana leaf extract as a natural colorant in lip cream and lip-color preparations, including evaluations of physical characteristics, stability, irritation, and acceptability (Kaban et al., 2022). Miana leaf extract has also been investigated specifically in cream blush-on preparations, with evaluations including physicochemical properties, irritation, and hedonic acceptance (Suryanita et al., 2024). However, these studies primarily focused on semi-solid or cream-based preparations. In contrast, the present study applies miana leaf extract to a solid blush-on dosage form and integrates the evaluation of physical characteristics, stability, irritation potential, and hedonic acceptance. Thus, the novelty of this study lies in the development and comprehensive evaluation of miana leaf extract as a natural colorant in a solid blush-on formulation, providing an alternative dosage form to previously reported miana-based cosmetic preparations. The findings also show that the formulation can achieve acceptable physical characteristics, preliminary skin tolerability, and favorable sensory acceptance.

The results are consistent with previous studies demonstrating the potential of plant extracts as natural cosmetic colorants. Natural pigments from beetroot, dragon fruit peel, teak leaves, miana leaves, and other botanical sources have been incorporated into blush-on or other decorative cosmetic preparations with varying degrees of physical and sensory acceptability.

Nevertheless, several limitations should be considered. First, the compaction process was performed manually because a dedicated pressing device was unavailable. Consequently, compression pressure could not be controlled uniformly among

preparations. This limitation may have influenced differences in mechanical resistance among formulas. The original study explicitly identified manual compaction as a limitation.

Second, the stability evaluation was performed outside controlled laboratory stability conditions because of limitations in maintaining stable room temperature. Therefore, the 21-day stability results should be interpreted as preliminary physical observations rather than formal accelerated or long-term stability data.

Third, the present study evaluated color stability visually rather than by instrumental color measurement or quantitative determination of anthocyanin content. Consequently, although slight fading was observed in F1, F2, and F3, the magnitude of pigment degradation cannot be quantified from the present data. This is particularly relevant because anthocyanins are highly sensitive to environmental factors, and visible color change may arise through several chemical and physical mechanisms (Cai et al., 2022; Xue et al., 2024).

Future studies should therefore investigate the chemical stability of miana pigments using quantitative anthocyanin analysis and instrumental color measurement. Controlled stability studies under different light, temperature, humidity, and packaging conditions would also help determine the factors responsible for the observed fading. Stabilization strategies, including copigmentation, encapsulation, or other delivery systems, may be considered because these approaches have been reported to improve anthocyanin stability (Xue et al., 2024).

Further formulation optimization should also consider standardized compaction pressure and mechanical strength testing. This would provide more objective information regarding the resistance of the solid blush-on during handling and transportation. Additional safety studies with larger populations and standardized dermatological assessments would also strengthen the evidence regarding skin tolerability.

Overall, the present findings support the potential of miana leaf extract as a natural colorant for solid blush-on. The 24% formulation (F3) achieved the highest overall hedonic acceptance, while the 16% formulation (F2) produced the highest color preference. Thus, the findings indicate that miana extract can provide an attractive natural color while maintaining acceptable physical and sensory characteristics. Beyond its application in blush-on, the use of miana leaf extract may contribute to the development of plant-based natural colorants for cosmetic formulations and support the exploration of locally available botanical resources as alternatives to synthetic colorants. Recent literature has highlighted the growing potential of natural plant pigments for applications in cosmetics and other consumer products, while also emphasizing the importance of pigment stability, preservation, and suitable formulation strategies for broader application (Lu et al., 2023; Malik et al., 2023). Miana leaf extract has also demonstrated potential as a natural colorant in other cosmetic preparations, including cream blush-on, supporting its broader applicability in decorative cosmetics (Suryanita et al., 2024). However, further research is required to establish long-term chemical stability, standardized mechanical performance, and broader safety before the formulation can be considered for more

advanced cosmetic development.

CONCLUSION

Miana leaf extract (*Coleus scutellarioides* (L.) Benth) can be utilized as a natural colorant in solid blush-on formulations, as demonstrated by the development of pink colorations in formulations F1, F2, and F3 with increasing extract concentrations, while the control formulation (F0) remained white. Physical evaluation showed that all formulations (F0–F3) had a smooth texture, *Oleum rosae* odor, and homogeneous color distribution without coarse particles. In the friability test, none of the formulations cracked at a drop height of 10 cm, cracking began to occur in F1, F2, and F3 at 20 cm, and all formulations cracked at 30 cm, indicating greater susceptibility to cracking as impact height increased. During 21 days of storage, the formulations remained stable in terms of physical form and odor, although slight color fading was observed in F1, F2, and F3 during the third week. The hedonic evaluation showed that F3 achieved the highest overall panelist preference, while F2 received the highest score specifically for color. In the irritation test, no visible irritation reactions were observed in the 28 volunteers after 24 hours under the test conditions. Overall, the findings indicate that miana leaf extract has potential as a natural colorant for solid blush-on preparations, with F2 and F3 showing favorable physical and sensory characteristics. Further studies are recommended to improve color stability, particularly through the incorporation of suitable stabilizing or antioxidant agents and controlled storage conditions.

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