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# KARAKTERISTIK NANOKRIM TABIR SURYA KOMBINASI BONGGOL PISANG KEPOK DAN MESOKARP SEMANGKA MERAH

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**Abstract**

*Plant parts deemed as waste, such as banana corm and watermelon mesocarp, show promise as raw materials for cosmetics when processed using nanocream technology. This study aimed to assess the characteristics of nanocream creams combining these extracts. The characterization of the nanocream creams included organoleptic testing, homogeneity testing, pH testing, nanocream type testing, spreadability testing, stability testing, viscosity testing, antioxidant activity testing using the DPPH method, and sunscreen activity evaluation through SPF determination using UV-Vis spectrophotometry. The research results show that the organoleptic properties of all formulations are semi-solid, with a white to yellowish color. The type of cream for all formulations is oil-in-water, and homogeneous. The pH values for FI, FII, and FIII are 6.37, 6.2, and 6.2, respectively (pvalue=0.017), the spreadability values are 5.94, 5.72, and 5.64 respectively (p=0.024), the viscosity values are 5635, 5339, and 5181, respectively (p<0.05), the antioxidant activity is indicated by $IC_{50}$ values of 66.39, 24.50, and 56.45 respectively, while the SPF values are 0.95, 0.87, and 1.01 repectively. The resulting nanocream demonstrate favorable organoleptic characteristics, pH, homogeneity, spreadability, and viscosity meeting the required standards, with the highest antioxidant activity observed in FII and no significant sunscreen potential in any of the formulations.*

**Keywords:** *antioxidant, characteristic, nanocream*

**Abstrak**

Bagian tanaman yang dianggap limbah, seperti bonggol pisang dan mesokarp semangka, menunjukkan potensi sebagai bahan baku kosmetik ketika diproses menggunakan teknologi nanokrim. Penelitian ini bertujuan untuk menilai karakteristik nanokrim yang menggabungkan ekstrak tersebut. Karakterisasi nanokrim meliputi uji organoleptis, uji homogenitas, uji pH, uji tipe nanokrim, uji daya sebar, uji stabilitas, uji viskositas, uji aktivitas antioksidan menggunakan metode DPPH, dan evaluasi aktivitas tabir surya melalui penentuan nilai SPF menggunakan spektrofotometri UV-Vis. Hasil penelitian menunjukkan bahwa sifat organoleptis dari semua formulasi adalah semi-solid, dengan warna putih hingga kekuningan. Tipe krim untuk semua formulasi adalah minyak dalam air dan homogen. Nilai pH untuk FI, FII, dan FIII adalah 6,37; 6,2; dan 6,2, secara berturut-turut (nilai p=0,017), nilai daya sebar adalah 5,94; 5,72; dan 5,64 (p=0,024), nilai viskositas adalah 5635; 5339; dan 5181 (p<0,05), aktivitas antioksidan ditunjukkan oleh nilai $IC_{50}$ sebesar 66,39; 24,50; dan 56,45, secara berturut-turut, sedangkan nilai SPF adalah 0,95; 0,87; dan 1,01. Nanokrim yang dihasilkan menunjukkan karakteristik organoleptis, pH, homogenitas, daya sebar, dan viskositas yang memenuhi standar yang diperlukan, dengan aktivitas antioksidan tertinggi yang diamati pada FII dan tidak ada potensi tabir surya yang signifikan pada formulasi manapun.

**Kata Kunci:** antioksidan, karakteristik, nanokrim

## 1. Introduction (Bold, Verdana 9, capital for the first letter)



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The utilization of plant parts deemed as waste remains at the level of fulfilling everyday needs. The corm of the Kepok banana, for instance, are primarily used for vegetables and animal feed (Apriyanti & Balfas, 2019; Wadhani et al., 2021) . heoretically, Kepok banana corm hold potential as raw materials for pharmaceuticals and cosmetics. Traditionally, the leaves of Kepok banana corm are believed to nourish hair, possess antibacterial properties, function as functional food ingredients, and contain antioxidants (Fawzia N F, 2011; Pongsipulung et al., 2012; Purnamasari, 2013; Wenas et al., 2020). Kepok banana corm extract contains flavonoids (Rahmawati et al., 2021), and its chromophore groups can absorb UV light, granting the extract UV protective capabilities akin to sunscreen (Agusta et al., 2021). he mesocarp of red watermelon, the white part of the fruit, is abundantly available as watermelons grow independently of seasonal variations (Adnyana et al., 2014).The red watermelon mesocarp is known to contain alkaloids, steroids, and flavonoids (Hanum et al., 2019; Jusnita & Tridharma, 2019). Research on watermelon mesocarp also reveals antioxidant activity, consistent with the findings of Putri (Hanum et al., 2019), which indicate that the extract of red watermelon mesocarp exhibits antioxidant properties.

**Commented [R12]:** Give the formula of flavonoid compound

**Commented [R13]:** Give the chemistry formula this antioxidant…

Nanotechnology represents a rapidly advancing technological field. In medicine and cosmetics, nanotechnology significantly enhances drug delivery systems due to particle sizes in the nano scale of 10-1000 nm(Hanum et al., 2019). The utilization of natural substances as raw materials for pharmaceuticals and cosmetics remains limited, primarily due to issues such as solubility, active ingredient absorption, low bioavailability, and stability. These challenges are addressed by employing nanotechnology methods to formulate preparations. (Jusnita & Syurya, 2019). This study investigates the formulation of a cream using nanoemulsion techniques.

Nanocream, or nanoemulsion, is a topical pharmaceutical preparation applied directly to the skin. It is a drug delivery system composed of oil and water phases combined with surfactants and co-surfactants. Nanocreams have particle sizes ranging from 100-600 nm(Chevalier & Bolzinger, 2019; Hanifah et al., 2019; Rahman & Herdaningsih, 2021). The advantages of nanoemulsions include their ability to encapsulate a high amount of active ingredients, and to prevent issues such as cracking and creaming due to their large surface area and high energy. (Chevalier & Bolzinger, 2019; Sahu et al., 2014).

This research aims to evaluate the potential of a nanocream formulated with a combination of banana corm and red watermelon mesocarp extracts as an antioxidant and sunscreen. Antioxidant activity will be assessed based on $IC_{50}$ values using the DPPH method, while sunscreen activity will be evaluated in vitro based on SPF values using UV-Vis spectrophotometry according to the Mansur equation.

## 2. Methodology

### 2.1. Material

The materials utilized in this research include banana corm, red watermelon mesocarp, ethanol p.a. (Onemed), TEA, stearic acid, acetyl alcohol, nipagin, nipasol, glycerin, and aquadest (PT. Brataco). The equipment employed in this study comprises an analytical balance (Ohaus), beakers (Pyrex), weighing bottles, a rotary evaporator (Ika), UV-Vis spectrophotometer (Genesys), volumetric flasks (Pyrex), test tubes (Iwaki), and a grinder (Mierrui).

### 2.2. Preparation of Banana Corm Extract and Red Watermelon Mesocarp Extract

The banana corm, which have been thoroughly washed, weighed, sliced, and dried, are then macerated using 70% ethanol and evaporated to obtain a concentrated extract of the banana corm. The same procedure is applied to the red watermelon mesocarp.

### 2.3. Formulation of Nanocream Combining Banana Corm Extract and Red Watermelon Mesocarp Extract

**Table 1. Formulation of Nanocream Combining Extracts of Kepok Banana Corm and Red Watermelon Mesocarp**

| | Presentage | | |
|---|---|---|---|
| **Bahan** | **F1** | **F2** | **F3** |

**Commented [R14]:** Typo?????? ( material???)

| | | | |
|---|---|---|---|
| BCE | 1 | 1,5 | 0,5 |
| RWME | 1 | 0,5 | 1,5 |
| Stearat Acid | 5 | 5 | 5 |
| Setil Alcohol | 0,2 | 0,2 | 0,2 |
| Gliserol | 1 | 1 | 1 |
| TEA | 0,4 | 0,4 | 0,4 |
| Propyl Paraben | 0,02 | 0,02 | 0,02 |
| Metyl Paraben | 0,02 | 0,02 | 0,02 |
| Aquadest | Add 100 | Add 100 | Add 100 |

BCE : Banana Corm Extract
RWME : Red Watermelon Mesocarp Extract

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The formulation of nanocream, based on the research by Hanifah and Rahman (Hanifah et al., 2019; Rahman & Herdaningsih, 2021) was modified as follows: the base materials were blended using a mixer according to the formula outlined in Table. 1 for 15 minutes. Active substances were then added and mixed for an additional 20 minutes, followed by sonication for 30 minutes. The nanocream was subsequently packaged and prepared for testing.

### 2.4. Evaluation of the Physical Properties of Nanocreams Combining Extracts of Banana Corm and Red Watermelon Mesocarp

The physicochemical evaluation of the nanocreams includes organoleptic testing, homogeneity testing, pH testing, nanocream type testing, spreadability testing, stability testing, and viscosity testing (Hanifah et al., 2019; Rahman & Herdaningsih, 2021).

### 2.5. Determination of Antioxidant Activity of a Nanocream Combining Banana Corm Extract and Red Watermelon Mesocarp Extract Using the DPPH Method

The determination of antioxidant activity was performed according to Kartika's study with slight modifications (Rahman et al., 2021). Nano creams FI, FII, and FIII (with three replicates each) were weighed at 1 g each, dissolved in 10 mL of ethanol p.a., filtered, and then 1 mL of the solution was combined with 2 mL of 2,2-diphenyl-1-picrylhydrazyl (DPPH). The mixture was incubated for 30 minutes at 30°C. Absorbance was measured using UV-Vis spectrophotometry at the maximum wavelength of DPPH. The antioxidant activity of the samples, determined by the extent of DPPH radical scavenging, was calculated by measuring the percentage inhibition of DPPH absorption.

**Commented [R16]:** Give the function Of DPPH in this method ???
Give the chemistry formula with chemdraw aplications

### 2.6. Determination of SPF Value in vitro for the Nanocream Combining Extracts of Banana Corm and Red Semangka Mesocarp

The in vitro SPF evaluation was conducted using UV-Vis spectrophotometry in accordance with previously established research with minor modifications (Andini et al., 2023) . The nanocream formulations FI, FII, and FIII (with 3 replicates) were dissolved in ethanol in 100 mL volumetric flasks. The solution was subjected to ultrasonication for 5 minutes and then filtered. An aliquot of 5 mL of the filtrate was transferred to a 50 mL volumetric flask and subsequently diluted with ethanol. The solution was analyzed at wavelengths ranging from 290 to 320 nm with ethanol as the blank. The absorbance results were used to calculate the SPF value using the Mansur equation.

**Commented [R17]:** Explain this method

### 2.7. Data Analysis

**Commented [R18]:** The formula make mathematic application not picture

Data analysis in this study was conducted using descriptive methods. Antioxidant values and SPF values were measured at each concentration, with three replicates. The determination of antioxidant values was calculated using the formula provided below (1), followed by IC50 calculation. .................................... (1)

**Commented [R19]:** Explain this….?>

$$\% \, Inhibisi = \frac{Abs.blanko - Abs.sampel}{Abs.Blanko} \times 100\%$$

The SPF values were analyzed using the Mansur method:

$$SPF_{spectrophootometric} = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda) \quad \text{.................................... (2)}$$

**Commented [R110]:** Idem The formula make mathematic application not picture

All data are presented as mean ± standard deviation and statistically analyzed using SPSS software version 17 (Amini et al., 2020).

## 3. Results and Discussion

### 3.1. Results

The nanocreams formulated with a combination of active ingredients were tested for physicochemical properties, antioxidant activity, and SPF value. The results of each test for the respective formulations are presented in Table 2.

**Table 2. Results of Testing Nanocreams with a Combination of Banana Pseudostem Extract and Red Watermelon Mesocarp.**

| Test | Result | | | Description |
|---|---|---|---|---|
| | FI | FII | FIII | |
| Organoleptic | | | | The organoleptic |
| Form | Semi-Solid | Semi-Solid | Semi-Solid | evaluation of each |
| Color | Off-white | Off-white | Off-white | formulation yielded |
| Odor | Distinctive | Distinctive | Distinctive | identical results. |
| Homogenity | No undissolved solids | No undissolved solids | No undissolved solids | Homogen |
| pH | 6,37 ± 0,02 | 6,20 ± 0,01 | 6,2 ± 0,01 | Compliant* |
| Type | O/W | O/W | O/W | Oil-in-Water |
| Spreadibility | 5,94 ± 0,56 | 5,72 ± 0,29 | 5,64 ± 0,43 | Compliant** |
| Stability | Intact | Intact | Intact | Stable |
| Viscosity | 5635 ± 1.52 | 5339 ± 1.73 | 5181 ± 1.15 | Compliant*** |
| IC50 | 66,39 | 24,50 | 56,45 | - |
| SPF | 0,95 ± 0,01 | 0,87 ± 0,01 | 1,01 ± 0,01 | Lacks protective properties |

*Skin pH requirements 4.5-6.5 (Maulina, 2021), **Spreadibility requirements 5-7 (Noviardi et al., 2019), ***Viscosity requirements 2000-50.000 (Noviardi et al., 2019)

**Commented [R111]:** Beside description give picture of result

### 3.2. Discussion

The preparation of nanocream involves several critical stages in the process. Initially, the base materials are mixed using a mixer for 15 minutes, according to the formula outlined in Table 1. This mixture is then combined with the designated active ingredients. Following the addition of the active substances, the mixture is homogenized using the mixer for 20 minutes to ensure even distribution. The final step involves sonication, conducted for 30 minutes, to produce a stable nano dispersion and achieve the desired particle size (Fatmasari, 2022; Jafari & McClements, 2018). This process aims to attain uniform particle distribution and enhance the bioavailability of the active ingredients within the nanocream formulation (Sitti Zubaydah et al., 2022) and in accordance with the results of previous research the particle size is in the range of 600-800 nm.

Based on the research findings, the nanocreams for all three formulations exhibited a semi-solid consistency with a yellowish-white color and a characteristic aroma of the extract, as no fragrance was added during preparation. During the homogenization testing, the formulations were found to be homogeneous. Homogeneity is essential to ensure uniform distribution of active ingredients throughout the matrix, which is crucial for maintaining product efficacy. Homogeneity mitigates the risk of particle agglomeration or coalescence, which could compromise the physical and chemical stability of the product. Furthermore, a homogeneous nanoemulsion enhances the penetration of active ingredients into the skin or other biological targets, as nano-sized particles have a larger surface area and interact more readily with biological membranes (Amini et al., 2020; Sari & Susiloningrum, 2022). Therefore, homogeneity in nanocreams not only ensures product stability but also maximizes the efficacy and safety of the product.

The nanocream produced from the research meets the requirements to ensure compatibility and avoid irritation or damage to the skin(Indarto et al., 2022). Nanocream formulations that fall outside this range can disrupt the skin's natural balance, leading to irritation or inflammation (Nurhidayati, 2020). he research findings indicate that the addition of various natural ingredients significantly affects the resulting pH values, with a p-value of 0.017 ($p < 0.05$). The incorporation of natural substances into the nanocream can influence the pH of the formulation, depending on the chemical properties of the natural ingredients (Jafari & McClements, 2018). Oleh karena itu, penting untuk mengukur dan menyesuaikan pH nanokrim setelah penambahan Therefore, it is essential to measure and adjust the pH of the nanocream after adding natural ingredients to ensure the product remains within the appropriate pH range for skin application

he nanocream developed in this study demonstrates an oil-in-water (O/W) type of nanocream, which is an emulsion system where oil is dispersed in a continuous aqueous phase, using surfactants as emulsifiers to maintain system stability (Niknam et al., 2020). n an O/W formulation, the oil phase is dispersed in the water phase in the form of small droplets, imparting a light and non-greasy texture to the cream. The effects on the skin include effective hydration due to the dominant water phase and the ability to absorb quickly without leaving oily residue. O/W creams are commonly used in cosmetics and dermatology for products requiring a fresh and non-greasy sensation, and for applications that avoid a shiny appearance (Ezeuko et al., 2020; Niknam et al., 2020).

In the formulation of nanocream with varying concentrations of banana plantain pseudostem extract and red watermelon mesocarp extract, the spreadability values still meet the required standards, with a p-value of 0.024 indicating a significant difference in the extracts used in each formulation. The viscosity values also comply with the requirements, and statistical analysis shows a p-value < 0.05, leading to the same conclusion: that the addition of extracts results in significant differences in the viscosity of each formulation.

The spreadability and viscosity of the nanocream are highly influenced by the variation in the concentration of natural ingredients incorporated into the formulation. Spreadability refers to the nanocream's ability to evenly distribute when applied to a surface, which is often affected by its viscosity. Viscosity, a measure of a liquid's resistance to flow, serves as a crucial parameter in determining how easily the nanocream can be applied and spread (Noviardi et al., 2019). Higher concentrations of natural ingredients can increase the crème's viscosity due to the greater concentration of active substances in the formulation, potentially leading to increased flow resistance (Sari & Susiloningrum, 2022), this can reduce the crème's spreadability, making it more difficult to apply evenly on the skin. Conversely, lower concentrations of natural ingredients may result in lower viscosity, allowing the nanocream to spread more easily but potentially compromising the stability and efficacy of the active ingredients (Ezeuko et al., 2020; Jafari & McClements, 2018). Therefore, there is a trade-off between spreadability and viscosity that must be considered when designing nanocream. Adjustments in the concentration of natural ingredients should be made cautiously to achieve the desired balance between ease of application and formulation stability (Sari & Susiloningrum, 2022).

Stability testing using centrifugation is a method for evaluating the stability of a formulation, such as nanocreams, by accelerating the phase separation process that typically takes longer under normal conditions (Nurhidayati, 2020). In this test, the sample is placed in a centrifuge machine and spun at high speeds. This process generates centrifugal force that separates components based on their density. If the test results indicate that the formulation does not exhibit phase separation, such as oil-water separation or aggregation, it can be concluded that the formulation is stable. Stability in this context means that the ingredients within the formulation are well-dispersed and the interactions between components are sufficiently strong to prevent separation or breakdown of the emulsion during centrifugation (Fatmasari, 2022). Therefore, the conclusion drawn is that the nanocream formulation demonstrates good physical stability, which is crucial for the product's quality during storage and use.

The next characteristic assessed is the antioxidant activity of each nanocream formulation. The IC50 values obtained varied, with IC50 representing the concentration of an active substance in the nanocream required to inhibit 50% of the target activity, such as enzymes or free radicals(Fraga & Oteiza, 2011). he IC50 value is often used to evaluate the potential of a compound in neutralizing free radicals. A lower IC50 value indicates a higher antioxidant potential of a compound, as it requires a lower concentration to achieve a 50% inhibition effect (Alibade et al., 2022; Fauziyah et al., 2019; houssemeddine Sellami et al., 2020). The study results show that the compound with an IC50 value of 24.50 in formulation II has higher antioxidant potential

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**Commented [R113]:** Give range pH… this research..???

**Commented [R114]:** typo

**Commented [R115]:** Give kind ths surfactant or emulsiers

**Commented [R116]:** What the meaning this term….?????

**Commented [R117]:** Typo, salah tulis??????

**Commented [R118]:** Typo…. Salah tulis

**Commented [R119]:** Rpm….??? how this speed ??? give value…..

**Commented [R120]:** What enzym

**Commented [R121]:** Give the definition of free radical compared to the formulation I with an IC50 value of 66.39 and formulation III with an IC50 value of 56.45, as it requires a lower concentration to achieve the same inhibitory effect. This indicates that the active ingredient ratio in formulation II (1.5:0.5) is more effective in counteracting oxidation caused by free radicals, which is important for protecting against cellular damage (Noviardi et al., 2019).

SPF (Sun Protection Factor) is a measure of how well a sunscreen product protects the skin from UVB radiation, which is a primary cause of sunburn and can contribute to skin cancer (Lestari et al., 2021; Sari & Fitrianingsih, 2020; Syarifah et al., 2022). However, SPF only measures protection against UVB, not UVA radiation, which can also damage the skin and cause premature aging (Andini et al., 2023; Nadhifah & Sudarti, 2023). T he study results indicate that even the formulation with the highest SPF value (1.01) does not provide adequate protection, as the minimal protection category is SPF 2 (Sari & Fitrianingsih, 2020).

## 4. Conclusion

The research findings indicate that the organoleptic properties of all formulations are semi-solid, with colors ranging from white to yellowish. The type of cream for all formulations is oil-in-water and homogeneous. The pH values for FI, FII, and FIII are 6.37, 6.2, and 6.2, respectively (p-value = 0.017). The spreadability values are 5.94, 5.72, and 5.64 (p-value = 0.024), and the viscosity values are 5635, 5339, and 5181 ($p < 0.05$). The antioxidant activity is reflected by IC50 values of 66.39, 24.50, and 56.45, respectively, while the SPF values are 0.95, 0.87, and 1.01. The produced nanocreams exhibit organoleptic characteristics, pH, homogeneity, spreadability, and viscosity that meet the required standards, with the highest antioxidant activity observed in FII, and no significant sunscreen potential in any of the formulations.

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