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FORMULATION OF TOMATO FRUIT EXTRACT (*Solanum lycopersicum* L.) FACIAL TONER WITH VARIATIONS IN SURFACTANTS

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ABSTRACT
Toner is a facial care product used to cleanse the skin of dirt and refresh the face. Tomatoes (Solanum lycopersicum L.) are a natural source of antioxidants rich in vitamin A, vitamin C, beta-carotene, potassium, and lycopene. The objective of this study was to formulate a facial toner made from tomato fruit extract by observing the effect of varying surfactant concentrations on the formulation. This research was conducted experimentally. Four toner formulations were made with varying surfactant concentrations: F0 (0%), F1 (5%), F2 (7.5%), and F3 (10%). The resulting toners were then tested for stability over 6 cycles using the cycling test method. The evaluation of these formulations included organoleptic testing, homogeneity testing, viscosity testing, and pH testing. The results of the study of facial toner formulations of tomato fruit extract (Solanum lycopersicum L.) with variations in surfactant concentrations in F1 and F2 showed that the formulations were stable in organoleptic tests, homogeneity tests, and pH tests but were not stable in viscosity tests, while F0 and F3 only met the requirements for pH testing. The conclusion from the results of all cycles in the stability test was that variations in surfactant concentration affected the physical stability of the toner formulation. Based on the study, there was no stable formula.
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***Keywords**: Solanum lycopersicum L., surfactant, tomato fruit extract, toner.*

INTRODUCTION

The outermost organ of the body, the skin, covers the entire body surface and functions to protect it from external factors. Everyone has different skin conditions, which are influenced by various factors such as lifestyle habits and hormones. The skin requires protection and care, especially the skin on the face. Dry, oily, normal, acne-prone, and combination skin types require special care (Mardhiyah & Rosalina, 2023).

Compounds that have the ability to prevent other compounds from being oxidized by free radicals are known as antioxidants (Agustina et al., 2017). Quoted from Ode W, et al., (2020), basically, the human body can also produce antioxidants through endogenous hormones. Due to high external exposure to the skin, these compounds are unable to protect the body, resulting in the body needing antioxidants from external sources (Ode et al., 2020).

Tomatoes or *Solanum lycopersicum* L. are one of the best natural sources of antioxidants from fruit (Ariyanti et al., 2020). Tomatoes are rich in chemicals, including folic acid, malic acid, citric acid, flavonoids, alkaloids, trigonelline, chlorine, minerals, and vitamins (B1, B2, B6, C, F, and lycopene) (Nirmala et al., 2021). Lycopene, a carotenoid compound in tomatoes, has the potential to be a very beneficial antioxidant for human health, especially for the skin (Purwanti et al., 2022).

In English, *skincare* consists of two words, namely "skin" and "care." Therefore, *skincare* can generally be referred to as "skin care." *Skincare* includes products produced from a pharmaceutical process designed to maintain skin health. These products can be applied to the body's surface to keep the skin clean, healthy, and well-maintained. In addition, *skincare* is a series of actions that help keep the skin healthy, improve appearance, and alleviate skin problems (Telang et al., 2024).

Toner is a *skincare* product that helps cleanse the skin and refresh it. Toners are water-based solutions or mixtures of water and other active ingredients, with or without alcohol (Al et al., 2023). In toner preparations, the formula used is a water base and excipients, usually including active ingredients, humectants, emollients, surfactants, fragrances, and preservatives. Humectants can retain water in the preparation and help maintain the stability of the ingredients for a long time. Glycerin is the most commonly used humectant in cosmetics manufacturing (Nurjanah et al., 2024).

Surfactants are compounds commonly found in cleaning products and have various functions, including acting as *solubilizing* and *stabilizing* agents (Al et al., 2023). Toners are generally made using water as the main ingredient, while additional ingredients include active substances, humectants, emollients, surfactants, and preservatives. One factor that affects the quality, stability, and solubility of facial toner products is surfactants (Al et al., 2023).

Polysorbate 20 is a type of non-ionic surfactant that has the advantage of being non-toxic and non-irritating, making it ideal for use as an additive in cosmetic products (Noor et al., 2023). Based on research by Karami et al. (2023), the use of polysorbate 20 in toner formulations with concentrations of 5% and 5.65% produced stable results.

Based on this, the were interested in conducting further research covering the fields of pharmaceutical technology and natural ingredients to formulate a tomato fruit extract (*Solanum lycopersicum* L.) toner preparation with varying surfactant concentrations to determine the effect of surfactant concentration on the toner preparation. This research is expected to provide information about the chemical compound content found in tomatoes and its use in the wider community, especially in the field of cosmetics or skin care.

The objectives of this study were to develop a tomato fruit extract (*Solanum lycopersicum* L.) formulation into a toner preparation, to test the stability and evaluate the physical quality of the toner formulation, and to determine the effect of surfactant concentration on the formulation. The findings of this research are expected to provide scientific evidence for utilizing tomato fruit extract in cosmetic applications and contribute to the development of natural-based skincare products.

RESEARCH METHOD

This study used an experimental method at the Laboratory of the Faculty of Pharmacy, Health, and Science, Muhammadiyah University Kuningan. The study was conducted by making facial toner preparations from tomato fruit extract (*Solanum lycopersicum* L.) with three formulations. Each formulation varied in the concentration of the surfactant, namely Polysorbate 20. Formulation 0 contained 0% Polysorbate 20, formulation 1 contained 5% Polysorbate 20, formulation 2 contained 7.5% Polysorbate 20, and formulation 3 contained 10% Polysorbate 20. After the preparation was made, evaluation and stability testing of the preparation were carried out using the *cycling test* method. The test parameters observed included organoleptic testing (shape, color, smell, and taste), homogeneity, viscosity, and pH.

The variables in this study were dependent variables. Dependent variables are variables whose values are influenced by independent variables or other factors. The dependent variable in this study was the toner formulation. Meanwhile, the independent variables were tomato fruit extract and surfactant variations, with F0 as the control without surfactant, F1 at 5%, F2 at 7.5%, and F3 at 10%.

The data obtained from each tomato fruit extract facial toner formulation was analyzed according to the type of data. A normality test was performed using the *Shapiro-Wilk* test to ensure that the data distribution met the parametric assumptions. If the normality assumption was not met, a non-parametric *Kruskal-Wallis* test was performed. After determining the data, data analysis was continued using the *One Way ANOVA* test to determine whether there were significant differences between toner formulas F0, F1, F2, and F3. All data analysis was performed using SPSS version 27 and *Microsoft Excel software.*

RESULT AND DISCUSSION

Determination Results

In this study, the tomato fruit determination stage was carried out at the Laboratory of the Faculty of Pharmacy and Health, Muhammadiyah University Kuningan. The purpose of plant determination was to confirm the identity of the plants used in the study. The determination results showed that the tomato fruit (*Solanum lycopersicum* L.) sample from the *Solanaceae* family was the plant used in this study.

Extraction of Tomato Fruit (*Solanum lycopersicum* L.)

In this study, fresh tomatoes were obtained from farmers' plantations in Pajajar Village, Majalengka. A total of 3.5 kg of fresh tomatoes were used, yielding 100 grams of dry powder. The dry powder was soaked in 500 mL of 96% ethanol. The selection of 96% ethanol was intended to produce an optimal amount of active ingredients that could easily penetrate cells and extract all active substances, whether polar, semipolar, or nonpolar, with low toxicity (Otniel Paonganan & Laila Vifta, 2022). The method used for the tomato fruit extraction process was maceration. Extraction was carried out by soaking 100 grams of dried simplisia in 500 ml of 96% ethanol for 3 days while stirring occasionally. Every 24 hours, remaceration was carried out by replacing the solvent with a new one in the same ratio as during the first maceration.

The filtrate produced from the extraction process was concentrated using *a water bath* at a temperature of 50°C until thick. From this extraction, 27.77 grams of thick extract was obtained. After obtaining the extract, extract standardization was carried out, which included specific and non-specific parameters.

Standardization of Tomato Fruit Extract (*Solanum lycopersicum* L.) Specific Parameters

The specific parameter standardization of the extract in this study was conducted through organoleptic testing. The tomato fruit extract was dark reddish brown in color, viscous in consistency, and had a distinctive tomato aroma.

Non-Specific Parameters

Extract Yield

The final results of tomato fruit (*Solanum lycopersicum* L.) extraction can be seen in the following table:

Table 1. Extract Yield Results

Description	Results
Extract Weight	27.8 grams

Weight of Simplisia	100 grams
Extract Yield	27.8

The extract yield produced was 27.8%. This level is in accordance with general standards because, according to the Indonesian Herbal Pharmacopoeia (2017), the yield of concentrated extracts must be at least 10%. This yield represents the amount and efficiency of the extract obtained from the material and is also related to the content of active compounds in the extract (Senduk et al., 2021). With a value of 27.77%, which far exceeds the minimum limit, this yield can be categorized as a high-quality extract that meets quality requirements.

Moisture Content

The moisture content test on tomato fruit extract (*Solanum lycopersicum* L.) meets the requirements. The results of the moisture content test can be seen in Table 2.

Table 2. Extract Yield Results

Test	Moisture Content	Requirements
Tomato fruit extract	17.88	≤ 30

The water content of the extract obtained from this test is 17.88%. According to Voight (2005), the moisture content varies depending on the type of extract, namely dry extract has a moisture content of less than 10%, thick extract ranges from 5-30%, and liquid extract is more than 30% (Aji Purnama et al., 2020). Based on this, the moisture content of this tomato fruit extract meets the requirements because it is a thick extract.

Phytochemical Screening of Tomato Fruit Extract (*Solanum lycopersicum* L.)

The phytochemical screening of tomato fruit extract (*Solanum lycopersicum* L.) yielded the following results:

Table 3. Results of Tomato Fruit Extract Screening

Component	Compound Group	Results	Description
Tomato fruit extract	Flavonoids	+	Forms yellow color Amyl alcohol
	Saponin	+	Forms stable foam
	Tannin	-	Does not form a dark blue color
	Alkaloid	-	No white precipitate formed

Description: (+) Positive
(-) Negative

The phytochemical test results of tomato fruit extract were positive for flavonoids and saponins, and negative for tannins and alkaloids. This test was conducted to identify the presence or absence of secondary metabolites in the sample, commonly referred to as a qualitative test.

Based on the flavonoid screening test, the results obtained showed a positive reaction, indicated by a color change in the tomato fruit extract sample from light green to orange after adding concentrated hydrochloric acid (HCl) and magnesium powder (Mg) (Mailuhu et al., 2017). This test proves that tomato fruit extract contains flavonoid compounds.

The saponin test showed a positive reaction, marked by the appearance of stable foam or bubbles. The tannin test gave a negative result, with no dark blue color forming, indicating that the sample did not contain tannin compounds.

The alkaloid test yielded negative results due to the absence of colored precipitation. According to Maihulu (2017), positive results in the alkaloid test are indicated by the formation of colored precipitation when the sample reacts with certain reagents. Dragendorff's reagent produces a red precipitate, Wagner's reagent forms a brown precipitate, while Mayer's reagent produces a white precipitate. The color of this precipitate indicates the presence of alkaloids in the tested sample. In this study, Mayer's reagent was used, and after observation, no white precipitate formed in the sample. Therefore, it can be concluded that there are no alkaloid compounds in tomato fruit extract.

Evaluation and Stability Test of Tomato Fruit Extract (Solanum lycopersicum L.) Facial Toner

Organoleptic Test

Based on the results of the organoleptic test conducted on the tomato fruit extract facial toner preparations F0, FI, F2, and F3 before and after the accelerated stability test (*cycling test*), the results were the same, as shown in the following table:

Table 4. Organoleptic Test Results for Facial Toner Tomato Fruit Extract (Solanum lycopersicum L.)

Test	Cycle	Organoleptic Testing			
		F0	F1	F2	F3
Form	0	Liquid	Liquid	Liquid	Liquid
	1	Liquid	Liquid	Liquid	Liquid
	2	Liquid	Liquid	Liquid	Liquid
	3	Liquid	Liquid	Liquid	Liquid
	4	Liquid	Liquid	Liquid	Liquid
	5	Liquid	Liquid	Liquid	Liquid
	6	Liquid	Liquid	Liquid	Liquid
Color	0	Golden brown	Golden brown	Golden brown	Golden brown
	1	Golden brown	Golden brown	Golden brown	Golden brown
	2	Golden brown	Golden brown	Golden brown	Golden brown
	3	Golden brown	Golden brown	Golden brown	Golden brown
	4	Golde	Golden	Golden	Golden

		n brown	brown	brown	brown
	5		-colored chocolate	e Golden Brown	e Golden Brown
	6	Golden chocolate	Golden chocolate	Golden chocolate	Golden brown
Smell	0	Distinctive tomato smell	Characteristic tomato smell	Characteristic tomato smell	Characteristic tomato smell
	1	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes
	2	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	Characteristic tomato smell
	3	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	Distinctive tomato smell
	4	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	Distinctive tomato smell
	5	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	Distinctive tomato smell
	6	The characteristic smell of tomatoes	The distinctive smell of tomatoes	The distinctive smell of tomatoes	Characteristic tomato smell

Description: F0 = 0% surfactant concentration (control)
F1 = surfactant concentration 5%
F2 = surfactant concentration 7.5%
F3 = surfactant concentration 10%

Organoleptic testing was conducted to assess the physical characteristics of facial toners through direct observation using the five senses, such as observing the shape or texture, color, and smelling the aroma of the formulated products (Al et al., 2023).

The results of organoleptic observations conducted before stability testing, or in the initial cycle (cycle 0), showed that the four formulas were similar in terms of shape or texture, color, and aroma. Both preparations were liquid with a clear brown color and had a distinctive tomato aroma. This liquid form is in accordance with toner specifications, considering that if the toner has a consistency that is too thick, it has the potential to cause a sticky feeling during use, which in turn can interfere with the user's comfort in using facial toner products (Noor et al., 2023). The golden brown color of the toner formulation is obtained from the addition of tomato fruit extract. The characteristic aroma of tomato fruit also comes from the natural aroma of tomato fruit.

Organoleptic stability was observed using a *cycling test* method for 12 days, which included 6 cycles for the four formulations. The results obtained were consistent and showed no significant differences when compared to the conditions before the stability test, namely from the initial cycle (cycle 0) to cycle 6. The facial toner formulation has a liquid form, golden brown color, and characteristic tomato fruit aroma. This is in line with the research conducted by (Al et al., 2023).

In this study, the modified variable was the concentration of polysorbate 20 surfactant. In general, polysorbate 20 had a very small effect on the characteristics of the product's form, color, and aroma. The tomato extract toner showed good organoleptic stability before and after stability testing. Therefore, variations in surfactant concentration did not significantly affect the organoleptic stability of the tomato extract facial toner before and after stability testing.

Homogeneity Test

Based on the homogeneity test on the tomato fruit extract facial toner formulation, the results are shown in the following table:

Table 5. Homogeneity Test of Facial Toner

Test	Cycle	Formulation			
		F0	F1	F2	F3
Homogeneity	0	Homogeneous	Homogeneous	Homogeneous	Liquid
	1	Homogeneous	Homogeneous	Homogeneous	Not homogeneous
	2	Homogeneous	Homogeneous	Homogeneous	Not Homogeneous
	3	Homogeneous	Homogeneous	Homogeneous	Not Homogeneous
	4	Homogeneous	Homogeneous	Homogeneous	Not Homogeneous
	5	Non-Homogeneous	Homogeneous	Homogeneous	Not Homogeneous
	6	Not Homogeneous	Homogeneous	Homogeneous	Not Homogeneous

Description: F0 = 0% surfactant concentration (control)
F1 = surfactant concentration 5%
F2 = surfactant concentration 7.5%
F3 = surfactant concentration 10%

Homogeneity testing was carried out using visual observation of toner samples placed in *a beaker glass*. This observation aimed to assess the uniformity of coarse particle distribution in the preparation, so that the extent to which the particles were homogeneously mixed could be determined (Noor et al., 2023).

Homogeneity testing in cycle 0 or before stability testing was conducted showed that F0, F1, F2, and F3 were homogeneous, meaning that the particles were evenly mixed so that the preparation appeared clear.

After stability testing, no significant differences were found in F1 and F2, so the preparations appeared homogeneous and clear. Toner preparations meet the homogeneity criteria if all components in the formulation are thoroughly mixed and completely dissolved, resulting in a final product with a clear and consistent appearance ( ) without any visible particles or deposits. This perfect dissolution indicates that the active ingredients and excipients in the toner are evenly distributed throughout the preparation phase, which is very important to ensure the effectiveness and stability of the product during storage and use (Al et al., 2023).

However, in cycle 2, particles were found in F3, while in cycle 5, particles were found in F0, indicating that both formulations were not homogeneous. This was characterized by the presence of particles that were not evenly mixed, resulting in formulations with physical inconsistencies that could affect the stability and consistency of the product during use. Polysorbate 20 is known to help improve homogeneity by reducing the interfacial tension between the water and oil phases, thereby maintaining evenly dispersed particles (Al et al., 2023). However, variations in surfactant concentration of 0% and 10% did not produce a homogeneous preparation. This condition is in line with several previous studies that reported that variations in polysorbate 20 concentration do not always guarantee optimal homogeneity and require further formulation optimization to achieve stability and uniformity of the toner preparation. Thus, in this study, variations in surfactant concentration affect the homogeneity of tomato fruit extract facial toner preparations.

Viscosity Test

Table 6. Viscosity Test of Tomato Fruit Extract Facial Toner (Solanum lycopersicum L.)

Viscosity (cPs)				
Formula	Cycle	Mean^{2}± SD	Standard (cPs)	p-value (ANOVA)
F0	0	1.5 ± 0.35		
	1	1.5 ± 0.35		
	2	6.1 ± 1.13		
	3	8.8 ± 0.12	1.24 – 5	0.944
	4	9.6 ± 0		
	5	7.6 ± 0.56		
	6	12.2 ± 0.35		
FI	0	2.8 ± 1.64		
	1	4.7 ± 0.42		

	2	4.8 ± 0.23		
	3	8.1 ± 0.49	1.24 – 5	0.944
	4	9 ± 0		
	5	9.9 ± 0.09		
	6	8.4 ± 0.29		
F2	0	2.83 ± 1.64		
	1	1 ± 0		
	2	4 ± 0		
	3	8 ± 0	1.24 – 5	0.944
	4	9 ± 0		
	5	11.6 ± 0.047		
	6	9.2 ± 0.28		
F3	0	4.6 ± 0.23		
	1	2.5 ± 0		
	2	4.8 ± 0.08		
	3	10.43 ± 0.32	1.24 – 5	0.944
	4	15 ± 0		
	5	11 ± 0		
	6	5.3 ± 0.49		

Note: F0 = 0% surfactant concentration (control)
F1 = surfactant concentration 5%
F2 = surfactant concentration 7.5%
F3 = surfactant concentration 10%
cPs = *centipoise* (viscosity unit)

Table 4.6 shows the viscosity results of the toner formulation before and after the stability test. Before the stability test or cycle 0, F0 gave a viscosity result with an average of 1.5 cPs, F1 with an average of 2.8 cPs, F2 with an average of 2.83 cPs, and F3 with an average of 4.6 cPs. Thus, in cycle 0, the facial toner preparations met the viscosity requirement of < 5 cPs (Al et al., 2023). However, after the 4th stability test, the 4 formulations experienced a significant increase and decrease in viscosity. The increase in viscosity exceeded the requirement range of > 5 cPs.

The normality test was performed using the *Shapiro-Wilk* method because the sample size was < 50. The analysis results showed that the significance value (Sig.) for all toner formulas (F0, F1, F2, F3) was greater than 0.05. This indicates that the data is normally distributed. Thus, the normality assumption is met, and the analysis can proceed to the next stage.

Homogeneity testing used *the Levene Test* to determine whether the data variation in each formula group was homogeneous. The test results showed that the significance value was > 0.05

for the viscosity parameter, indicating that the data was homogeneous. For the viscosity parameter, the ANOVA significance value was 0.944 (> 0.05), meaning that there was no significant difference between the formulas.

The increase in viscosity in the preparation may be caused by extreme temperature changes. These temperature changes trigger modifications in the structure of the surfactant polymer in the formulation, causing the polymer chains to become looser or tighter, which ultimately increases the viscosity value of the product (Forestryana et al., 2024).

In addition, the inhomogeneity of particle distribution in the formulation also contributes to viscosity inconsistency, where unevenly mixed particles can cause changes in texture and viscosity. Other factors such as the concentration of active ingredients and excipients, as well as the possibility of suboptimal interactions between formula components, may also play a role in this viscosity instability (Noor et al., 2023).

pH Test

Table 7. pH Test of Tomato Fruit Extract Facial Toner (Solanum lycopersicum L.)

pH				
Formula	Cycle	$Mean^2$ ± SD	Standard	p-value (ANOVA)
F0	0	5.1 ± 0		
	1	5.1 ± 0		
	2	5.2 ± 0		
	3	4.9 ± 0	4.5 – 5.5	0.631
	4	5.1 ± 0		
	5	5.02 ± 0.0047		
	6	4.8 ± 0		
FI	0	5.3 ± 0.094		
	1	5.3 ± 0.047		
	2	5.3 ± 0.047		
	3	4.8 ± 0.047	4.5 – 5.5	0.631
	4	5.01 ± 0.012		
	5	5 ± 0		
	6	5 ± 0		
F2	0	5.23 ± 0.047		
	1	5.2 ± 0		
	2	5.3 ± 0		
	3	4.8 ± 0	4.5 – 5.5	0.631
	4	4.7 ± 0.047		
	5	4.8 ± 0		

	6	4.8 ± 0		
F3	0	5.4 ± 0		
	1	5.3 ± 0.04		
	2	5.2 ± 0		
	3	4.86 ± 0.4	4.5 – 5.5	0.631
	4	4.9 ± 0.047		
	5	4.9 ± 0		
	6	4.8 ± 0		

The pH test results before the stability test were obtained with an average of F0 (5.1), F1 (5.3), F2 (5.3), and F3 (5.4). Thus, the facial toner preparation meets the facial skin pH requirement of 4.5–5.5 (Noor et al., 2023). The ideal pH of facial skin should be in the acidic range, around 4.5 to 5.5. If the skin's pH is too acidic, below this value, the skin can experience irritation and inflammation. This condition makes the skin feel sore, more sensitive, and can cause acne due to bacterial growth. Excessive acidity can also disrupt the skin's natural protective function, thereby interfering with cell turnover, hydration, and the skin's barrier function (Sembiring. Br.S Yuni et al., 2021). Conversely, if the skin's pH is too alkaline, above the ideal range, the skin's acid mantle, which serves to maintain natural moisture, will be damaged. Skin that is too alkaline will become dry, rough, prone to flaking, and highly susceptible to irritation such as redness, itching, and a burning sensation (Topan Ramdani et al., 2021).

The data results were analyzed statistically, and the normality test using the *Shapiro-Wilk* test showed significance for the four formulas, i.e., >0.05, so it can be concluded that the pH evaluation data results are normally distributed. This was followed by a homogeneity test, which showed a significance value based on *the mean* of <0.05, but based on the median and *trimmed mean*, the value was >0.05. This indicates that the data can be considered relatively homogeneous. Therefore, the parametric ANOVA test can still be used. The ANOVA significance value = 0.631 (> 0.05) indicates that there is no significant difference between the formulas.

After conducting stability testing for the four formulas, the results can be seen in Table 4.7, which shows the pH results of the facial toner preparations during the stability test. In each cycle, there was a decrease in pH, but it was not too significant, and the changes were still within the pH range for facial skin, so the pH testing of these toner preparations met the requirements.

Conclussion

This study successfully developed tomato fruit extract (*Solanum lycopersicum* L.) into a toner preparation, demonstrating that surfactant concentration significantly influences the physical characteristics of the formulation. Formulations F1 and F2 exhibited good stability and met most physical evaluation parameters including organoleptic properties, homogeneity, and pH (both before and after stability testing), although viscosity requirements were not achieved. In contrast, formulations F0 and F3 only satisfied pH requirements, failing to meet other physical evaluation criteria. These findings confirm that optimal surfactant concentration is critical for achieving desirable toner properties. Future research should focus on optimizing viscosity-enhancing agents, conducting long-term stability studies under various storage conditions, evaluating the bioactivity and efficacy of the formulation on human skin, and exploring the synergistic effects of combining tomato extract with other natural ingredients to enhance product performance and consumer acceptability."

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