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Formulation of Red Beet (*Beta Vulgaris*. L) and *Aloe Vera* Gel Extracts as Anti-Aging

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Abstract

Anti-Aging can prevent or slow down the effects of skin aging. This study aims to formulate extracts of beetroot (Beta vulgaris. L) and Aloe Vera (Aloe vera) in gel preparations and test their anti-aging effectiveness. The tools used are skin analyzer and moisture checker. Methods of implementation Beet extraction was extracted with 96% ethanol solvent, and aloe vera extract from the juicer. The irritation test on 12 volunteers used nettle extract cream with the highest concentration of 0.5%. Anti-aging activity testing used 12 female volunteers aged 19-22 years, who were divided into 4 groups, namely 3 volunteers (A; Blank), administration of beetroot extract gel (B. vulgaris. L) and A. vera (B) : 3%), (C: 6%), and (D: 9%). 3. Parameters measured include moisture content, number of pores and wrinkles. Data distribution was analyzed using the One sample Kolmonogrov-Smirnov Test method. Then proceed with the analysis of the One-Way Anova method. The results of research on beet (B. vulgaris. L) and Aloe Vera (A. vera) gel preparations can be formulated in a gel dosage form. pH 6.9, W/O emulsion type, viscosity 2500-3500 cps, non-irritating, and stable on storage for 28 days. Beet fruit extract (B. vulgaris L) and aloe vera viscous extract (A. vera) can be formulated in the form of an anti-aging gel that can provide an anti-aging effect at the best concentration, namely at the 9% concentration increasing skin moisture to 40.24%; smaller pores 0.53%; and reduce wrinkles by 0.33%.

Keywords: *Beta vulgaris , Aloe vera, Anti Aging, Formulation, Extraction*

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INTRODUCTION

Berastagi is a regency in North Sumatra. The temperature of 26°C with an altitude of 1300 meters above sea level makes Berastagi an area where many farmers cultivate beets (*Beta vulgaris*). The processing of this fruit is still limited to making syrup or boiling it. However, this preparation is less desirable because of its bitter, earthy taste (Amila et al., 2022). Beetroot (*B. vulgaris* L.) is a plant that contains lots of betalain compounds. main source

of natural red dye. One of the innovations in the use of beets is the manufacture of beet flour. The results of the phytochemical screening test showed that beetroot (*B. vulgaris* L.) flour contains alkaloids, tannins, saponins, flavanoids, steroids, sugar glycosides, and polyphenols. Characterization of beet flour with a moisture content of 9.28%, total ash content of 0.99%, acid insoluble ash content of 0.82% and water-soluble extract content of 0.82%, it can be concluded that the characterization of beetroot flour meets the requirements of Materia Media Indonesia (MMI) (Hasibuan et al., 2021; Marbun et al., 2022). Organoleptic tests were carried out by 20 panelists, with the assessment criteria as many as 9 panelists liked taste, 6 panelists liked aroma, 12 panelists liked maroon color, 12 panelists liked texture, and 11 panelists had acceptance for beet flour (Maimunah et al., 2021). Some wrinkles are clearly visible around the eye, mouth and neck area (Kurniawan, 2011). Compounds that can counteract free radicals are antioxidants (Darmawan, 2013).

One of the natural ingredients native to Indonesia that has the potential as an antioxidant is beetroot (*Beta vulgaris* L.) and Aloe vera (*Aloe vera*). In this case beets and aloe vera have activity as antioxidants which can neutralize free radicals that damage skin cells (Lukman et al., 2021). The results showed that there is betacyanin pigment in red beets which belongs to the flavonoid group with an antioxidant activity of 79.73 ppm in the very strong antioxidant category (Princess, 2016). The red color of fresh beets is caused by the pigment betacyanin, a nitrogen-containing compound (Mastuti, 2010).

Aloe vera contains vitamins B1, B2, B6, B12, C, β-carotene, minerals, enzymes, polysaccharides, polysaccharide compounds, and organic acids which dissolve in water and fat. Prayoga (2023). Functions as an anti-inflammatory and reduces the number of free radicals and superoxide radicals by reducing the production of prostaglandin E2 derived from arachidonic acid (Yohana, 2019). Gel preparations have good distribution on the skin, have thixotropic properties so that they are easily spread evenly when applied, do not leave marks, do not leave an oil film on the skin, do not contaminate clothing and provide a cooling effect due to evaporation of water so that they are easily washed off with water (BPOM RI, 2014).

METHOD

The research method used is experimental research. This research includes sample identification, sample preparation, plant identification carried out at the Medanense Herbarium (MEDA). The materials for this research were beetroot extraction, making extract from aloe vera, phytochemical screening, characterization examination, pH preparation stability test, skin irritation test for volunteers, viscosity test, preparation homogeneity check, gel preparation test as an anti-aging effect on 12 volunteers. This research was conducted at the Laboratory of Sari Mutiara University, Indonesia from March to June 2023.

Tools and Materials

The tools used in this research method are as follows: drying cabinet, viscosity, beaker glass, laboratory glassware, blender, mortar, water bath, glass object, knife, porcelain cup, hot plate, dropper, parchment paper , spatula, spatula, sieve (mesh 60) ,

plastic pot, aluminum foil, pH meter, rotary evaporator , skin analyzer, stir bar, and digital balance.

The materials to be used in this research method are as follows: sample (a combination of beetroot extract and aloe vera juice), distilled water, 96% ethanol, acetic acid anhydride, concentrated hydrochloric acid, concentrated nitric acid, concentrated sulfuric acid, amyl alcohol, beetroot extract, aloe vera extract, Methyl paraben, BHT, HPMC, Propylene Glycol, Propyl paraben).

Volunteers

Volunteers aged 20-30 years with the following criteria Female able-bodied, Age between 20-30 years, No history of disease related to allergies, Willing to volunteers (Ditjen POM, 1985).

Preparation of Simplicity

Wet sorting, wet weighing, washing with running water, draining, then chopping and then drying in a drying cupboard at ± 40°C and simplicity is obtained. Then grinded using a blender and obtained beet powder (*Beta vulgaris* L) and aloe vera (*Aloe vera*). Dried simplicia shows that it can be easily crushed when squeezed. Dry sorting, cleaned, weighed to find out the dry weight of the test material (DepKes RI, 2008).

Preparation of Beetroot Extract

As much as 500 grams of mashed beetroot is macerated with 1 liter of 96% ethanol. The maceration process was carried out by soaking the simplicia powder in 96% ethanol solvent. The comparison between the powder and the solvent used in this study was 1:10. The length of time required for the maceration process is 1 day. During the maceration and remaceration processes, stirring is carried out every day with the aim that the extraction process of the substance in the simplicia occurs perfectly. The powder bath is then filtered and separated between the filtrate (liquid) and the dregs formed. The maserate filtrate obtained from maceration and remaceration is then mixed together. The filtrate mixture that has been separated is then evaporated using a rotary evaporator until a thick extract is formed (Hidayaturahmah, 2016).

Preparation of Aloe Vera Extract

As much as 4 kg of aloe vera, then washed clean, then cut into small pieces and weighed to get the weight, then the fresh simplicia was mashed using a juicer, then 3 liters of aloe vera juice was obtained.

Gel Preparation Formulation

The concentrations of beetroot extract used in the manufacture of anti-aging gel preparations were 3%, 6% and 9%, respectively. The basic formulation of a gel without beetroot ethanol extract and aloe vera extract was made as a blank. The design formula is explained as in the following table 1.

Formulation of Gel

R/ HPMC 3 g
Propilenglikol 15 g
Metil paraben 0,18 g
Propil paraben 0,05 g
BHT 0,1 g
Aquadest Ad100 ml

Table 1. Formulation of gel

Materials	Rate (%)			
	Blanko F0	**Formula I 3 %**	**Formula II 6%**	**Formula III 9%**
Beetroot extract	-	3	6	9
Aloe Vera extract	-	5	10	15
HPMC	3	3	3	3
Propilenglikol	15	15	15	15
BHT	0,1	0,1	0,1	0,1
Aquadest	Ad 100	Ad 100	Ad 100	Ad 100

Preparation of Gel Base

HPMC was first developed in 20 ml of aquadest (Rahmawanty et al., 2014), left for approximately 30 minutes (Wigati & Lilies, 2016). After the flowers are added methyl paraben and propyl paraben which have been dissolved with propylene glycol and then crushed until homogeneous, add the remaining water needed (Prayoga & Hasibuan, 2021). 0.05 g of beetroot extract was weighed, put into a mortar, added the base gel little by little while grinding until homogeneous and finally added enough to reach 100 g (Budiman et al., 2015).

Preparation Evaluation

Homogenity Check

Homogenity check is done by using a glass object. A certain amount of preparation is smeared on a piece of transparent glass and covered with a glass object, then observed. The preparation must be homogeneous and free from coarse granules (Chen et al., 2016).

Observation of Preparation Stability

Stability check includes shape, color and smell observed visually. The preparation is declared stable if the color, smell and shape do not change visually during 4 weeks of storage. Observations were made at room temperature (Sianipar et al., 2023).

Determination of pH of Preparations

The pH test was carried out using a pH meter. The pH tool is calibrated with a buffer solution every time a measurement is taken. The electrode that has been cleaned is dipped into the sample to be examined. The pH value on the pH meter scale is read and recorded (Ditjen POM, 2014).

Viscosity Determination

Determination of viscosity using a Brookfield viscometer. The preparation was put in a glass until it reached a volume of 100 ml, then spindle 62 was lowered until it was immersed in the formulation. The tool is turned on by pressing the ON button. The spindle speed is set at 12 rpm, the scale is read (dial reading) where the red needle moves stably (Prayoga, 2021). The value of viscosity (η) in centipoise (cps) is obtained from the reading scale (dial reading) multiplied by the correction factor (f) (Wigati & Lilies, 2016). Examination of the viscosity of the cream using a Brookfi led viscometer. The results of the viscosity test for all cream preparations were in the range of 28,000-34,000 cps. Good cream viscosity ranges from 2000-50000 (Martin et al., 2012).

Irritation Testing of Preparations for Volunteers

The irritation test was carried out on a combination formulation of beetroot extract and aloe vera extract as anti-aging in gel preparations. This experiment was carried out on 12 volunteers for each formula by applying the preparation to the skin of the inner forearm 3 times a day at intervals of 8 hours for 2 consecutive days (Wasitatmadja, 1997; Latifah, 2007).

Anti Aging Effect Test

The anti-aging test used 12 volunteers and divided into 4 groups, namely: Group I: 3 volunteers for the blank formula, Group II: 3 volunteers for the formula with a gel concentration combined with beetroot extract and aloe vera extract at a concentration of 3%, Group III: 3 volunteers for the formula with a gel concentration of a combination of beetroot extract and aloe vera extract at a concentration of 6%, Group IV: 3 volunteers for a formula with a gel concentration of a combination of beetroot extract and aloe vera extract at a concentration of 9%. Previously, measurements were made of the skin condition of the backs of volunteers' hands with test parameters including moisture content, pores, and wrinkles using a skin analyzer. Then the gel is spread evenly on the back of the hand, the gel is applied based on the group that has been set above. Basting is done 1 time a day evenly every day for 4 weeks. Changes in skin condition were measured every 4 weeks using a skin analyzer (Hasibuan et al., 2023).

Data Analysis Methods

The research data were analyzed using the SPSS (Statistical Product and Service Smirnov) 22 program. First, the data were analyzed using the One sample Kolmonogrov-Smirnov Test method to determine its normality and homogeneity tests. Then proceed with the analysis of the One-Way Anova method to determine the average difference between groups. If there is a difference, it is continued with the Post Hoc Tukey HSD test to see the real difference between treatments.

RESULTS AND DISCUSSION

Results of Beet Simplicia and Aloe Vera Extracts

Extraction by maceration using 96% ethanol solvent to extract compounds contained in both simplicia which are non-polar. Extraction results from 500 grams of

beets that have been evaporated with a rotary evaporator with a temperature of ±50°C to obtain a thick extract of 103 grams blackish brown (Fitriya et al., 2014). Juicer results from 4 kg of aloe vera using the juicer method. The resulting macerate was then evaporated using a water bath thermostat at a temperature of 60 °C and a fresh dark brown viscous extract was obtained as much as 35.4 grams, and a yield of 1.18 grams.

Figure 1. Anti-Aging Gel Preparation of Beetroot Extract (*B. vulgaris*) and Aloe Vera (*A. vera*)

Results of Phytochemical Screening

The results of the phytochemical screening test of beet extract (*Beta vulgaris*) contain chemical compounds of alkaloids, flavonoids, saponins, and tannins, and the results of the phytochemical screening tests of beet extract (*Beta vulgaris*) contain chemical compounds of flavonoids, saponins, tannins, and terpeneoids.

Homogeneity Check

Dosage Stability Check

Examination of the stability of the ethanol extract gel preparations of beetroot (*Beta vulgaris*. L) and Aloe vera (*Aloe vera*) included color and odor forms which were observed visually. The preparation is declared stable if the shape, color and odor do not change visually during storage from the first week to the fourth week and the gel preparation is stored at room temperature. The results of the physical stability examination of the gel preparations did not change significantly in terms of appearance, both color, smell and shape during 4 weeks of storage. The results of the ethanol extract gel preparations of beetroot (*Beta vulgaris*. L) and Aloe vera (*Aloe vera*) can be seen in **Table 2**. The results of observations of the stability of beetroot extract gel preparations (*Beta vulgaris*. L) and Aloe vera (*Aloe vera*).

Examination of the pH of the Preparations

Determination of the pH of beetroot and aloe vera gel preparations using a pH meter (Atc) with storage for 4 weeks: blank pH 7.4, 3% pH 7.1, 6% pH 6.8, and 9% pH 6.4.

Tabel 2. Dosage Stability Check

Preparation	Parameter	Observation time (Week)			
		1	2	3	4
F0 (Blanko)	Form	Th	Th	Th	Th
	Color	Cl	Cl	Cl	Cl
	Aroma	Ty	Ty	Ty	Ty
F1 (3%)	Form	Th	Th	Th	Th
	Color	Br	Br	Br	Br
	Aroma	Ty	Ty	Ty	Ty
F2 (6%)	Form	Th	Th	Th	Th
	Color	DB	DB	DB	DB
	Aroma	Ty	Ty	Ty	Ty
F3 (9%)	Form	Th	Th	Th	Th
	Color	DB	DB	DB	DB
	Aroma	Ty	Ty	Ty	Ty

Code Information: Th=(Thick); Cl=(Clear); Ty=(Typical); Br=(Brown); DB=(Dark Brown)

Irritation Test

Gel preparations of beetroot extract (Beta vulgaris) and aloe vera (Aloe vera) which were formulated by 12 volunteers did not experience irritation. This refers to an experiment conducted on 6 volunteers. 500 mg of the preparation is rubbed behind the skin of the back of the hand with a diameter of 3 cm, then left for 24 hours without causing skin irritation (Maimunah *et al.,* 2020).

Viscosity Test

Viscosity testing of beetroot and aloe vera gel preparations, based on the results of the viscosity, was carried out for 4 weeks, tested once a week for 4 weeks, for each concentration, F1 (3%) 2500, F2 (6%) 3000, and F3 (9%) 3500 determined with a Brookfield viscometer with a spindle of 07 and a speed of 5 rpm.

Results of Activity Testing of Anti-Aging Gel Against Volunteers

Testing the effectiveness of anti-aging using the Aram Huvis API-100 skin analyzer. The test parameters include: measurement of moisture, pore size, and measurement of wrinkles. Measuring anti-aging activity begins with measuring the initial skin condition prior to treatment. Data distribution was analyzed using the One sample Kolmonogrov-Smirnov Test method. Then proceed with the analysis of the One-Way Anova method. This is done in order to see the effect of the gel used in restoring the skin. to see the differences between the formulas. This test was carried out on all treatments that were examined every week for 28 days.

Moisturizer

Measurement of water content was carried out on 12 volunteers. Measurements were made using a skin analyzer and measuring the skin moisture on the back of the volunteer's hand before and after use for 4 weeks. The results of measuring the skin moisture on the back of the volunteer's hand from the first week to the fourth week.

The data obtained was analyzed using SPSS 22. The data was entered into the

SPSS 22 program and then tested for normality and homogeneity of the data, and the results of data analysis obtained normal and homogeneous data. Furthermore, the data were analyzed using the One Way Anova test to determine the significant difference in the ability of the gel preparations to moisturize the skin of the back of the hands for volunteers after use in weeks 1, 2, 3 and 4. And in the first week and week 1, p <0 .05 which shows that the difference in the ability of the gel to moisturize the skin of the back of the hand is significant.

Table 3. Results of water content (moisture) on the skin

Formula	Volunteers	Percentage of Water Content (%)					Percent per week
		Initial conditions	Using (Week)				
			1	2	3	4	
F0	1	20	21	22	24	25	0,25%
	2	23	24	25	26	27	0,17%
	3	22	23	24	25	26	0,18%
	Average	**21,66**	**22,66**	**23,66**	**25**	**26**	**25,16%**
Comparison	1	34	35	37	38	40	0,17%
	2	36	38	39	40	41	0,13%
	3	35	37	40	41	42	0,2%
	Average	**30**	**36,66**	**38,66**	**39,66**	**31**	**30,03%**
F1	1	26	27	28	29	31	0,19%
	2	27	29	30	31	32	0,18%
	3	25	26	27	28	30	0,2%
	Average	**29**	**27,33**	**28,33**	**29,33**	**34,66**	**33,14%**
F2	1	29	30	32	33	35	0,20%
	2	28	29	30	32	33	0,17%
	3	30	32	33	35	36	0,2%
	Average	**31**	**30,33**	**31,66**	**33,33**	**41**	**37,48%**
F3	1	31	31	35	36	37	0,19%
	2	32	32	36	37	38	0,18%
	3	34	34	37	38	40	0,17%
	Average	**32,33**	**32,33**	**36**	**37**	**38,33**	**40,24%**

Information :
F0 : Blanko (Gel base)
F1 : beetroot and aloe vera extract gel 3%
F2 : beetroot and aloe vera extract gel 6%
F3 : beetroot and aloe vera extract gel 9%

At weeks 2, 3 and 4, a p value <0.05 was obtained, indicating that there was a significant difference in the ability of the gel to moisturize the skin of the back of the hands. To find out the differences in each concentration of the gel preparation formula in increasing the moisture of the skin of the back of the hands of each volunteer, it will be followed by a Post Hoc test. Tukey HSD. It can be concluded that there are differences in each concentration of the Gel preparation formula in significantly improving the skin of the back of the hand in each volunteer. And from the data obtained through checking the skin analyzer and analyzed using SPSS 15 that the Gel preparation that is the best in moisturizing the skin of the back of the hand is the Hada Labo positive control and at the concentration of the preparation formula, namely Gel Concentration F1.

Wrinkle measurements were performed on 15 volunteers. Measurements were made using a skin analyzer and measuring the water content of the skin on the hands of volunteers before and after use for 4 weeks. Where in the graph above which has the highest water content value, namely the best water content value, which is seen from the results of measurements of the initial conditions, the first, second, third and fourth weeks and the results obtained are the highest levels are Comparator, F3 concentration, F2 concentration, F1 concentration and Blank is the lowest water content among various formulas. According to Aramo (2012) dehydration 0-29; Normal 30-50; Hydration 51-100.

Pore

Pore measurements were performed on 12 volunteers. Measurements were made using a skin analyzer and measuring the skin pores on the back of the volunteer's hand before and after use for 4 weeks. The results of the pore measurements of the back of the volunteer's hand started from the first week to the fourth week.

Table 4. Pore measurement results data

Formula	Volunteer	Large Pores					Percent per week
		Initial conditions	Using (Week) 1	2	3	4	
F0	1	45	43	41	35	32	0,23%
	2	43	42	40	33	28	0,34%
	3	42	41	39	34	27	0,35%
	Average	**43,33**	**42**	**40**	**34**	**29**	**1,66%**
Comparison	1	38	34	32	26	18	0,52%
	2	37	31	28	22	16	0,56%
	3	39	30	26	20	15	0,61%
	Average	**38**	**31,66**	**28,66**	**22,66**	**16,33**	**1,42%**
F1	1	40	39	37	33	24	0,4%
	2	38	37	35	30	23	0,43%
	3	42	41	40	31	22	0,47%
	Average	**40**	**39**	**37,33**	**31,33**	**23**	**1,40%**
F2	1	40	39	37	28	20	0,5%
	2	39	37	35	26	21	0,46%
	3	41	38	36	29	23	0,43%
	Average	**35**	**38**	**36**	**31**	**21,33**	**1,38%**
F3	1	40	35	34	25	20	0,5%
	2	39	37	35	24	18	0,53%
	3	38	36	33	23	17	0,55%
	Average	**39**	**36**	**34**	**24**	**18,33**	**0,53%**

Information : Small 0-19, Large 20-39, Very Large 40-100
F0 : Blanko (Gel Base)
F1 : beetroot and aloe vera extract gel 3%
F2 : beetroot and aloe vera extract gel 6%
F3 : beetroot and aloe vera extract gel 9%

Wrinkle measurements were performed on 15 volunteers. Measurements were made using a skin analyzer and measuring skin pores on the hands of volunteers before

and after use for 4 weeks. Where in the graph above which has the lowest pore value, namely the best pore value, which is seen from the results of measurements of the initial conditions, the first, second, third and fourth week and the results obtained, namely the lowest pore value are Comparator, concentration of F3, concentration of F2, concentration of F1 and blank is the highest pore value among the various formulas.

The smaller the pore value, the better the quality of the skin. The smaller the spot value, the better the skin is on a scale of 0-19. Good skin has a wrinkle value on a scale between 0-19. The smaller the wrinkle value, the better the skin quality (Aramo, 2012).

Wrinkle

Wrinkle measurements were carried out on 12 volunteers. Measurements were made using a skin analyzer and measuring the skin wrinkles on the back of the volunteer's hand before and after use for 4 weeks. The results of measuring the wrinkles on the back of the volunteer's hand started from the first week to the fourth week.

Table 5. Wrinkle measurement results

Formula	Volunteer	Wrinkle					Percent per week
		Initial Condition	Using (Week) 1	2	3	4	
F0	1	35	33	30	25	21	0,4%
	2	33	31	28	26	22	0,33%
	3	32	29	27	24	20	0,37%
	Average	**33,33**	**31**	**28,3**	**25**	**21**	**0,42%**
Comparison	1	25	22	19	17	15	0,4%
	2	24	21	18	16	14	0,41%
	3	22	19	16	14	12	0,45%
	Average	**25**	**22**	**19,3**	**16,6**	**14,6**	**0,41%**
F1	1	30	28	26	24	21	0,1%
	2	31	27	25	23	20	0,35%
	3	29	26	23	21	19	0,34%
	Average	**33,33**	**31**	**28,3**	**25**	**21**	**0,36%**
F2	1	28	25	23	21	19	0,32%
	2	27	24	21	19	17	0,37%
	3	26	23	20	18	16	0,38%
	Average	**27**	**24**	**21,3**	**19,3**	**17,3**	**0,35%**
F3	1	27	24	21	19	16	0,40%
	2	25	22	19	16	15	0,40%
	3	23	20	18	15	13	0,43%
	Average	**30**	**27**	**24,6**	**20**	**20**	**0,33%**

Information :
F0 : Blanko (Gel Base)
F1 : beetroot and aloe vera extract gel 3%
F2 : beetroot and aloe vera extract gel 6%
F3 : beetroot and aloe vera extract gel 9%

Wrinkle measurements were performed on 15 volunteers. Measurements were made using a skin analyzer and measuring skin wrinkles on the hands of volunteers before and after use for 4 weeks. Where in the graph above which has the lowest wrinkled value,

namely the best wrinkled value, which is seen from the results of measurements of the initial conditions, the first, second, third and fourth weeks and the results obtained are the lowest wrinkled levels are Comparison, F3 concentration, F2 concentration, F1 concentration and blank is the highest wrinkle value among various formulas.

If the skin is often exposed to sunlight continuously, it can make the pores enlarge because dead skin cells accumulate (Bogadenta, 2012). Collagen is very closely related to the appearance of wrinkles or wrinkles (Ali et al., 2014).

CONCLUSION

Beetroot extract (Beta vulgaris L) and aloe vera infusion (Aloe vera) can be formulated in a homogeneous anti-aging gel dosage form with a pH of 6.9, an A/M emulsion type, a viscosity of 2500-3500 cps, non-irritating and stable at storage for 28 days. Beet fruit extract (Beta vulgaris L) and aloe vera viscous extract (Aloe vera) can be formulated in the form of an anti-aging gel capable of providing an anti-aging effect at the best concentration, namely at a concentration of 9% by increasing skin moisture 40.24%; smaller pores 0.53%; and reduce wrinkles 0.33%.

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