Formulation of facial cleansing gels using *Aloe vera* as natural surfactant

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**Abstract.** This study aims to make facial wash gel made from *Aloe vera* as a natural surfactant. The design based research experimental method used includes the phytochemical screening analysis of samples of *A. vera* extract, making *A. vera* gel with the addition of carbomer 960 to the aloe extract solution with a percentage of 0.5%, 0.7% and 2%, selection of essential oils according to the needs of facial skin. Furthermore, making Aloe gel as a facial wash by adding carbomer 960 with a percentage of 0.5%, 0.7%, 2% then add triethanolamine to alkaline the *A. vera* extract to form a stable gel according to the characteristics of the Indonesian national standard (SNI 2588:2017). This facial wash utilizes secondary metabolites contained in *A. vera*. The results showed that *A. vera* extract used positively contained flavonoid, triterpenoid, saponin and polyphenol compounds. The best formulation of facial wash gel has been successfully obtained from the addition of carbomer 960 with a percentage of 0.7%, triethanolamine eight drops, moringa seed oil 1ml, virgin coconut oil 1ml, one drop of lavender oil, whey kefir five drops, and natural E 2 capsules. The organoleptic results of *A. vera* gel as facial wash include having an aroma following the added essence, soft texture, gel form, cloudy white color, feeling relaxed or cold when applied to facial skin, and without foam having a pH of 5 according to SNI.

1. **Introduction**

Cleanliness is something very important that must be considered because the environment around is not as clean as in the past, and there are many various bacteria, dust, and pollution which later cause a lot of impurities and diseases [1]. Disorders that often occur, namely on the skin, especially on the skin, namely the emergence of acne. Usually, acne occurs during puberty due to hormonal changes. Pilosebaceous blockage and inflammation are generally triggered by the bacteria *Propionibacterium acnes*, *Staphylococcus epidermidis*, and *Staphylococcus aureus* [2]. A face that is not clean will cause acne, so to prevent the occurrence of these problems need handling from the outside or from inside the body. One of them is handling from outside the body by using non-soap facial cleanser [3].

Facial cleansers are a major requirement for the community because they are able to clean the face from dust, pollution, the rest of the cosmetics and protect the face from sun exposure [4]. Then the dirty face will cause a new problem that is easy to grow zits that can reduce self-confidence, oiliness, itching, and others. One herbal product that is often used to cleanse the face is *Aloe vera* (*A. vera* (L.)). *A. vera*, which is native to Africa, which has a thick fleshy physical characteristic, has spiny sides, is long and narrow at its edges, green, and has slimy leaf flesh. All parts of *A. vera* can be used both for body care and acne prone skin and there is a content of kaolin which has benefits for the exfoliation process to remove dead skin [3].
Acne treatment can be done by reducing soap, helping to exfoliate dead skin cells so as not to invite the gathering of bacteria [5]. Natural products are believed to be safer than antibiotics. One herbal product that is often used for acne treatment is Aloe vera (A. vera (L.)). So that we want to make liquid soap for the face to make it more practical. Where this A. vera cleanser is safe for sensitive skin, environmentally friendly, does not pollute the environment and to rinse it does not require a large amount of water so it can save clean water.

2. Methods

Plant material used in facial cleansing gel formulations, namely aloe vera (Aloe barbadensis Miller). Aloe vera plants extract are purchased from an online marketplace, origin from Soreang area of Bandung. This plant has storage of water reserves which functions as moisturizing the skin, antiseptic, and can soften the skin.

2.1. Formulation of Aloe vera extract the facial cleansing gel

Prepare 1 gram aloe vera extract, mix aloe extract into 200 grams of aquadest, stir until homogeneous, measure pH of the solution, add 0.5%, 0.7%, 2% carbomer 940, stir until homogeneous, measure pH of the solution, add triethanolamine until the solution reaches pH 5, add whey kefir 5 drops to reach pH 5 gel form add moringa seed oil, virgin coconut oil, natural E, stir until evenly mixed, pack in container [6]. Then the phytochemical test was carried out in groups of flavonoids, tannins, polyphenols, saponins and terpenoids/steroids [7].

2.2. Comparative evaluation of prepared gels

2.2.1. The organoleptic test. The organoleptic test was conducted to determine the quality of facial cleansing gel from aloe vera extract based on the human senses. The facial cleansing gel from aloe extract is given to ten respondents with three different formulations. Respondents observed color, texture, smell, and effects when applied to the skin [8].

2.2.2. The pH, homogeneity, viscosity, and clean power test. The pH test was carried out at a concentration of carbomer 960 0.5%; 0.7%; 2%. Gel preparations were measured using pH meters. The homogeneity test was carried out by smearing the sample on the petri dish and then observing it [9]. The viscosity test is carried out to determine the viscosity of facial cleansing gel from aloe vera extract. The tool used is a viscometer with the appropriate spindle and speed [10]. The clean power test refers to Wilkinson and Moore [11] is the process of cleaning the surface of the skin with various modifications to stains / foreign objects applied to the surface of the skin.

3. Result and discussion

Aloe vera is a plant that has many benefits and is usually used as a basic ingredient in medicines and cosmetics. Besides functioning as an antiseptic, A. vera can also soften and moisturize the skin [11].

The Aloe barbadensis Miller species is widely used by the community because it has many advantages, namely: the size of the leaves is large, pest resistant, and safe to use for cosmetics, many contain good nutrients for the body as shown below [3]. This study purpose to make a facial cleanser by utilizing secondary metabolites contained in A. vera extract.

Based on table 1 the aftereffects of the phytochemical trial of A. vera separate demonstrated that the A. vera separate utilizing the freeze-dried technique contained four groups of flavonoids, steroids/triterpenoids, polyphenols, and tannins.

3.1. A. vera gel formulation

To get a facial cleansing gel from A. vera extract formulations need to be done with several different treatments. This is to find out the best results based on the organoleptic test, pH test, and viscosity test.
Table 2 shows the formulations used in the manufacture of *A. vera* extract facial cleansing gels in the presence of differences in the addition of carbomer 960 which is 0.5%; 0.7%; 2%. Moreover, it will affect the pH of the gel and the thickness of the gel that will be produced.

### Table 1. Phytochemical screening test of *A. vera* extract.

| No | Phytochemical test | *A. vera* Extract | Information |
|----|--------------------|-------------------|-------------|
| 1  | Flavonoid          | Positive          | Color changes occur in the solution of *A. vera* extract |
| 2  | Tannin             | Positive          | Color changes become greenish |
| 3  | Saponin            | Negative          | There is a slight build-up like foam |
| 4  | Polyphenols        | Positive          | The green color changes occur |
| 5  | Steroid/triterpenoid | Positive     | An orange change occurs |

The addition of whey kefir to the facial cleanser gel formulation functions as a lightening agent. The main determinant of color or skin pigmentation is melanin. Melanin synthesis in melanocyte cells occurs through the process of melanogenesis which is a combination of enzymatic catalysis processes and chemical reactions. The enzymatic reaction of melanogenesis is a reaction catalyzed by the enzyme tyrosinase. Tyrosinase enzyme is a glycoprotein which plays a very important role in the process of forming skin pigments and also in whey kefir containing lactic acid is a group of alpha hydroxyl acids (AHAs) which can brighten the skin [10].

### Table 2. *A. vera* gel formulation.

| No | Composition            | F1 % | F2 % | F3 % |
|----|------------------------|------|------|------|
| 1  | *A. vera* extract      | 0.50 | 0.50 | 0.50 |
| 2  | Aquades                | 99.50| 99.50| 99.50|
| 3  | Carbomer 960          | 0.50 | 0.70 | 2.00 |
| 4  | Triethanolamine       | 0.40 | 0.32 | 0.62 |
| 5  | Whey kefir            | 0.10 | 0.10 | 0.10 |
| 6  | Lavender oil          | -    | -    | 0.02 |
| 7  | Orange oil            | 0.07 | 0.07 | -    |
| 8  | Moringa seed oil      | 0.50 | 0.50 | 0.50 |
| 9  | Virgin Coconut Oil    | 0.50 | 0.50 | 0.50 |
| 10 | Phenoxyetanol         | 0.50 | 0.50 | 0.50 |

### 3.2. Organoleptic test

Organoleptic was performed to show the quality of facial cleansing gel from *A. vera* extract that had been made with a concentration of carbomer 960 of 0.5%; 0.7%; 2%. The results of the organoleptic analysis were obtained in table 3.
Based on table 3 these data indicate that the colors produced from the three formulations made are cloudy white but in the third formulation in the addition of 2% carbomer 960 gel colors to white, this is influenced by the color of carbomer which is white powder. While the first formula and the two carbomer concentrations are not so much, only 0.5% and 0.7% so that the resulting color is slightly cloudy white. Then the odor produced from the three formulations that have been added to essential oils is orange essential oil and lavender essential oil. The texture or thickness of the first formulation of the respondents rated it runny, in the second formulation the texture was rather thick and in the formulation three the texture was very thick. This is due to the difference in carbomer concentration added causing the viscosity of each facial cleansing gel from A. vera extract to be different [10].

Table 3. Organoleptic test results of A. vera extract facial cleansing gel.

| Organoleptic Test | Assessment criteria | Product |
|-------------------|----------------------|---------|
|                   |                      | A | B | C |
| Aroma             | Very fragrant        | 0 | 6 | 0 |
|                   | Pretty fragrant      | 8 | 4 | 1 |
|                   | Not fragrant         | 2 | 0 | 9 |
| Color             | White                | 0 | 0 | 0 |
|                   | Rather white         | 0 | 0 | 1 |
|                   | Murky white          | 9 | 9 | 8 |
|                   | Transparent          | 1 | 1 | 1 |
|                   | Dark brown           | 0 | 0 | 0 |
|                   | Light brown cloudy   | 0 | 0 | 0 |
|                   | Brownish yellow      | 0 | 0 | 0 |
| Viscosity         | Very thick / gel     | 0 | 0 | 10 |
|                   | A bit thick / gel    | 0 | 10 | 0 |
|                   | A bit runny          | 10 | 0 | 0 |
|                   | Very runny           | 0 | 0 | 0 |
|                   | Runny                | 0 | 0 | 0 |
| Effect            | Very cold            | 1 | 1 | 1 |
|                   | It's rather cold     | 4 | 4 | 3 |
|                   | Not cold             | 0 | 0 | 1 |
|                   | Hot                  | 0 | 0 | 0 |
|                   | Rather hot           | 0 | 0 | 0 |
|                   | Not hot              | 5 | 5 | 6 |

Information: A: Formula carbomer 960 0,5%; B: Formula carbomer 960 0,7%; C: Formula carbomer 960 2%

3.3. pH analysis
Normal skin has a pH around 4.5-6.5. When cleaning your face with soap, the pH value of the skin will increase. It is necessary for facial cleansers to neutralize the pH value of the face so that the pH of the face will not exceed pH 7.

The results of pH analysis showed that facial cleansing gel from A. vera extract was following SNI 2588: 2017, which states that skin pH is around 4.5-8. This means that three formulations are suitable for use as facial cleansing gels. As for the economic aspects and effectiveness, the addition of triethanolamine in formulation one will be less, compared to formulation 2 and formulation 3.

Table 4. Physical characteristics of A. vera extract facial cleansing gel.

| No | Formulation | pH on triethanolamine addition | Viscosity (cP) | Homogeneity |
|----|-------------|--------------------------------|----------------|-------------|
|    |             | Before                        | After  |                      |              |
| 1.  | 1           | 4,3                           | 5,0    | 1624                  | homogeneous  |
| 2.  | 2           | 4,0                           | 5,0    | 1480                  | homogeneous  |
| 3.  | 3           | 3,6                           | 5,0    | Over limit            | homogeneous  |

3.4. Viscosity test
The viscosity test is carried out to determine the thickness of a solution. For the results of the viscosity, the test can be seen in table 4.
The resulting gel viscosity shows that the higher the carbomer concentration, the higher the viscosity of the gel [6]. Then the viscosity of a gel other than influenced by carbomer gel is also influenced by triethanolamine which functions as a stabilizer pH.

3.5. Homogeneity test

The homogeneity test was carried out by smearing the sample on the petri dish and then observing it. The gel is based on A. vera extract which is evenly dispersed. Can be seen the results of the observations in Figure 1.

Figure 1. a) formulation 1; b) formulation 2; c) formulation 3.

The homogeneity test of the three formulations showed homogeneity because it did not produce clots when applied to petri dishes. Based on the conditions of preparation it was declared homogeneous, namely the absence of clots or particles not separated. Factors that can influence gel homogeneity are the stirring process in a mixture of facial cleansing gel ingredients from A. vera extract [10].

| Table 5. The results of the clean power test of facial cleansing gel from Aloe vera extract |
| --- |
| **Formulation** | **Stain before Testing Clean Power** | **Stain after Clean Power Testing** | **Clean Power Indicator** | **Information** |
| --- | --- | --- | --- | --- |
| 1 | Foundation stain 0.02 grams | Cleaning gel 0.20 grams | | Shows the value of indicator 4 on the number of effective gels as much as 0.20 grams |
| 2 | Foundation stain 0.02 grams | Cleansing gel as much as 0.15 grams | | Shows the value of indicator 4 on the number of effective gels as much as 0.15 grams |
| 3 | Foundation stain 0.02 grams | Cleansing gel as much as 0.10 grams | | Shows the value of indicator 4 on the number of effective gels as much as 0.10 grams |
3.6. Clean power test

Clean power test is the process of cleaning the surface of the skin from unwanted stains / foreign objects. To clean it can use washers/cleaners [11]. Based on table 5 observations of clean power tests, it can be seen that facial cleansing gels from A. vera extract are able to lift foundation stains on the back of the hand. Clean power is a characteristic that must be possessed by soap products or cleaners that are capable of removing impurities. Measuring net strength can be done by applying powder/foundation stains on the back of the hand then cleaning it with a facial cleansing gel from A. vera extract.

4. Conclusion

Based on the results of research that has been done it can be concluded that A. vera extract contains bioactive compounds that are very beneficial for facial skin. The compounds contained are groups of flavonoids, tannins, polyphenols, and triterpenoid compounds. The metabolic compounds contained in A. vera extract can be used for facial cleansing gel products from A. vera extract without soap and are safe for sensitive skin. With an effective and economical formulation on adding carbomer 960 0.5% and pH 5.

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References

[1] Gusviputri N I A, Njoo M P S, Aylianawati 2013 Pembuatan Sabun Dengan Lidah Buaya widya Tek. 12 pp. 11–21
[2] Ridwan A, Astutik W S and Astutik Y D 2010 Putri Yang Mengalami Jerawat (Akne Vulgaris) Jurnal AKP 1 1 pp. 19–21
[3] Azirah H 2019 Study Kinematika Gel Lidah Buaya Kesehatan andalas 25 pp. 1–13
[4] Ariyani S B, Pertiwi Y K and Asmawit 2018 Pengaruh Penambahan Pengawet dan Uji Aktivitas Antibakteri Escherichia coli pada Sediaan Gel Lidah Buaya Teknol. Proses Dan Inov. Ind. 3 1
[5] Sawarkar N S J H A, Khadabadi S S, Mankar D M, Farooqui I A 2010 Development and Biological Evaluation of Herbal Anti-Acne Gel Int. J. PharmTech Res. 2 11 pp. 1778–1780
[6] Dewi C C and Saptarini N M 2017 Review Artikel: Hidroksi Propil Metil Selulosa Dan Karbomer Serta Sifat Fisikokimianya Sebagai Gelling Agent farmaka 14 pp. 1–10
[7] Faskalia M A W 2014 Skrining Fitokimia, Uji Aktivitas, Antioksidan Dan Uji Sitotoksik Ekstrak Metanol Pada Akar Dan Kulit Batang Soma (Ploiarium alternifolium) JKK 3 3 pp. 1–6
[8] Sari R and Ferdinan A 2017 Pengujian Aktivitas Antibakteri Sabun Cair dari Ekstrak Kulit Daun Lidah Buaya Antibacterial Activity Assay of the Liquid Soap from the Extract of Aloe vera Leaf Peel Abstrak pharm Sci Res 4 3 pp. 111–120
[9] Prihannensia M, Winarsih S and Achmad A 2018 Uji Aktivitas Sediaan Gel dan Ekstrak Lengkuas (Alpinia galanga) terhadap Bakteri Staphylococcus epidermidis secara In Vitro Method Validation of Ultra High Performance Chromatography-Double Mass Spectrometry (UHPLC-MS / MS ) for Analysis of Curcumin i Pharm. J. Indonesia 4 1 pp. 23–28
[10] Nakhil U, Kalsum U, Purwojati N and Latifah E 2018 Test of Stability and Determination of Optimum Formula on Gel Madam "Gel Adam Hawa Leaf Extracts ( Rhus Discolor ) as Antiinflammation Gel" for Advanced Research Uji Stabilitas dan Penentuan Formula Optimum pada Gel Madam “Gel Ekstrak Daun Adam Hawa R,” Pharm. Conf. 3 pp. 14–24
[11] Moore R J 1982 Harry’s Cosmeticology
[12] Dewi M L, Rusdiana T, and Putriana N A 2018 Manfaat Kefir Untuk Kesehatan Kulit J. farmaka vol. 16 pp. 80–86