

## The Formulation and Physical Stability Test Of Gel Fruit Strawberry Extract (*Fragaria x ananassa* Duch.)

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### Abstract

Strawberry fruit (*Fragaria x ananassa* Duch.) is one of the traditional plants that has various bioactive compounds including phenol compounds, vitamin C, flavonoids and ellagic acid. Strawberry fruit functions as an antioxidant and antibacterial so strawberry extract can be used as gangrene wounds in diabetes mellitus. The purpose of this study was to determine the effect of the gel *gelling agent* formula variation on its physical properties so that it can be known which formula best meets the gel physical standard. The type of research used was experimental research. The research includes extracting strawberry fruit using maceration method. Gel with strawberries in 4 formulas with each formula having a different base concentration of carbopol 940. Formula 1 with a concentration of 0.5%, formula 2 concentration of 1.0%, formula 3 concentration of 1.5% and formula 4 concentration of 2.0%. The gel that has been made is then tested for physical stability which includes organoleptic test, pH test, homogeneity test, adhesion test, dispersion test, viscosity test, and protection power test and gel acceptability. The results of the study showed that in the organoleptic test, pH test, dispersion test, viscosity test, adhesion test, and protection test as well as acceptability the formula had the best spread and stickiness' and the overall standard.

**Keywords:** Carbopol 940; Flavonoid; Gel; Strawberry.

### 1. INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia associated with metabolic abnormalities of carbohydrates, fats and proteins caused by decreased insulin secretion or decreased insulin sensitivity or both of which cause chronic microvascular complications and neuropathy.

The occurrence of injuries in people with diabetes mellitus, especially on the feet must be treated properly. If not handled properly, it can cause dangerous complications in the form of gangrene. Gangrene that is not handled properly will result in amputation. Experts estimate that 50% -70% of the incidence of amputation can be avoided with good wound care (Monalisa, 2002). Diabetic gangrene is a form of tissue death in people with diabetes mellitus due to reduced or interrupted blood flow to the network (Tjokroprawiro, 1997).

In a state of gangrene infection is usually caused by an organism from around the skin which is generally *Staphylococcus aureus* or *Streptococcus*. *Staphylococcus aureus* is one of the causes of infectious diseases that are in the upper respiratory tract, skin, gastrointestinal tract, and vagina in the host under normal circumstances (Shulman et al, 1994).

One of the efforts to treat antibacterial in patients with diabetic gangrene is to use traditional medicines both from animals and plants and there are natural products that have been empirically widely used as traditional medicine to help the wound healing process. One of the traditional medicines that can be used to treat wounds is strawberries (*Fragaria x ananassa* Duch.) (Kurniawan, 2016).

Strawberry fruit (*Fragaria x ananassa* Duch) Is an important source of phytochemicals that has many benefits for human health. Strawberries contain ascorbic acid and phenolic compounds, which consist of phenolic acids, anthocyanins, protosianidin and flavonoids. The effects of these compounds act as protection against cancer cells, prevention of ischemic heart disease, antitumor genic, anti-inflammatory, anti-allergic, anti-mutagenic to have an antimicrobial function (Svarcoca i et al, 1996).

In a study Badjakov i et al, (2008) in Bulgaria showed that strawberries have a strong inhibition against Salmonella, Escherichia coli, and the Staphylococcus group in general. The inhibitory power of this strawberry extract is a complex process between *ellagitannin*, *anthocyanin*, and *proanthocyanidin* (Dzen SM, 2003). Based on research conducted by Anggani (2009) namely through the determination of total flavonoid levels of  $1,9003 \pm 1.5449 \mu\text{g} / \text{ml}$  and has antimicrobial activity against E. Coli bacteria with an effective concentration of 513 ppm extract and against Staphylococcus bacteria at effective concentrations of extracts 980,842 ppm. The results of orientation test of ethanol extract of strawberry fruit with KBM ethanol extract of strawberry fruit were obtained at a concentration of 2% which had no bacterial growth by comparing with control. The concentration of 1% is stated as KBM (Anggani, 2009).

Gel preparations have the advantage of good spreading ability on the skin, the effect of cold which is explained by the slow evaporation of water on the skin, no inhibition of physiological hair function, ease of washing with good water and good drug release (Voigt, 1994).

The formula of strawberry extract gel which is made using a hydrophobic base is carbopol 940. Carbopol is a perfect gel forming material, can form a gel well and also adds viscosity. Carbopol is used as a transparent gel forming with a concentration of 0.5% -2.0% (Lieberman, 2008). Carbopol as a *Gelling agent* has the advantage that it can be mixed with many active substances, high viscosity at low concentrations (Lieberman, 2008). The choice of Carbopol 940 as a gelling agent because according to the results of research by Putri et al. (2012) that Carbopol base gels have organoleptic appearance that is more attractive, viscosity, protective power and dispersal power are better than other base gels.

Therefore researchers are interested in making gels from strawberry extract materials because the products are from deep strawberries gel preparations have not been developed optimally. Gel preparations are intended for topical use. The advantage of using the gel compared to other topical preparations, the gel has a high adhesion, does not interfere with breathing in the pores of the skin, easily washed in water, and good absorption of drugs in the skin (MOH RI, 1995).

The purpose of this study was to determine the physical stability and acceptability of a gel extract of strawberry fruit (*Fragaria x ananassa* Duch.) And determine the concentration of

Carbopol 940 on the physical stability and acceptability test of gel preparations from a strawberry fruit extract (*Fragaria x ananassa* Duch.)

## 2. METHODS

This research is an experimental research. The independent variable in this research is the 940 carbopol base concentration. The dependent variable is the physical quality test results of strawberry extract gel (*Fragaria x ananassa* Duch.) Which includes: organoleptic test results, homogeneity test, viscosity test, scatter test, pH test, protection power test, adhesion test and acceptability test.

### 1. Tools and materials

The tools used are electric scales (ACIS), porcelain cups, bowls, measuring cups, stirring rods, beaker glass, mortars, stamper, millimeter paper blocks, spoons, glass, stopwatch, watch glass, pH meter, Rion Viscometer VT 047.

The ingredients used are strawberries (*Fragaria x ananassa* Duch.) It has taken from Tawang Mangu Karanganyar plantations, Carbopol 940 (bratacho), TEA (bratacho), propylene glycol (bratacho), ethanol 96% (bratacho), methyl paraben (bratacho), TEA (bratacho), propylene glycol (bratacho), ethanol 96% (bratacho), methyl paraben (bratacho) and aquades.

### 2. Ways of working

#### a. Making strawberry fruit extract

Making strawberry fruit extract is done at the Traditional Medicine Laboratory of the Surakarta National School of Health. Extracts are carried out by maceration. The strawberries are washed thoroughly under running water then dried and aerated. And cut it small. After drying the strawberries in a blender until it becomes a powder simplicia, then sifted and weighed as much as 200 grams, put in a glass jar and soaked with 96% ethanol solvent in a ratio of 1: 7.5 for 5 days while in the corner once. then filtered using filter paper and filter funnel. The filtering results were evaporated in a water bath at 60 ° C until a thick extract was obtained (Sorbareyah, 2015).

#### b. Making strawberry fruit extract gel

In making strawberry fruit extract gel, four formulations of strawberry fruit extract gel were made with different concentrations of gel base.

**Table 1. Strawberry gel extract formulas on the basis of carbopol 940**

Material	Formula (% w/ v)			
	I	II	III	IV
Strawberry fruit extract	2	2	2	2
Carbopol 940	0.5	1	1.5	2.0
TEA	2	2	2	2
Propylenglycol	15	15	15	15
Metil paraben	0.075	0.075	0.075	0.075
Aquadest ad	100	100	100	100

Making strawberry fruit extract gel according to Shu (2013), mortar and stampers were prepared. Carbopol 940 weighed 0.5 grams and sprinkled on 20 ml distilled water that has been heated. Carbopol 940 that has been sown is stirred quickly in a mortar until a

gel mass is formed and 2 grams of TEA is added. Methyl paraben weighed as much as 0.075 grams and dissolved in aquadest as much as 5 ml, put in a mortar, stirred until homogeneous. Propylenglycol is added to the mortar, stirred until homogeneous. Strawberry extract was weighed as much as 2 grams and put in a mortar, stirred until homogeneous and add the remaining aquadest stir until homogeneous.

### Evaluate gel preparations

Evaluation of gel preparations was carried out by observation and testing day 0,7,14,21 and 28 with replication 3x on each formula, including:

a. Organoleptic Test

Organoleptic observations were made on gel preparations that had been made before and after being given storage conditions. Organoleptic observations were carried out by observing the changes in shape, color, and odor of strawberry extract gel preparations (*Fragaria x ananassa* Duch.)

b. pH

PH measurements are made on gel preparations that have been made before and after storage conditions. The pH measurement is done by using a pH meter by taking 0.5 g of gel preparations that have been diluted into 50 mL of distilled water measured with a pH meter, let stand a few moments and the results are seen in the description of the pH meter. Preparations that meet the skin criteria are in the interval 4.5 - 6.5.

c. Homogeneity Test

Homogeneity measurements were carried out on gel preparations that had been made before and after being given storage conditions. Homogeneity test is carried out by means of the gel preparation applied to a piece of glass or other suitable transparent material, then the homogeneity of the preparation is observed.

d. Viscosity test

Viscosity measurements were carried out on gel preparations that had been made before and after being given storage conditions. Viscosity measurements were made on gel preparations using the Rion VT 047 viscometer. This was done by dipping the spindle into the gel preparation and then observing and calculating the viscosity.

e. Stickiness

Measurement of sticking power is carried out on gel preparations that have been made before and after being given storage conditions. Adhesion test is carried out by placing 0.5 g of the preparation on a glass object that has been determined in the extent of the test equipment. Put another glass object on the preparation, then give a weight of 0.5 kg for 5 minutes. Remove the weight of 80 g so that it pulls the bottom glass object. Record the time needed for the two glass objects to be released.

f. Scatter Test

Scattering measurements were carried out on gel preparations that had been made before and after being given storage conditions. The scatter power test is carried out by means of a sample of 0.5 grams of the sample placed on a square glass of 15 cm in diameter; the other glass is placed on it and left for 1 minute. Then measured the diameter of the gel spread. After that, we add 50 grams, 50 grams and 50 grams respectively. Each load is added and let stand for 1 minute then a constant diameter is measured.

## g. Protection power

Protection measures are measured on gel preparations that have been made before and after being given storage conditions. The protective power test is carried out by means of a piece of filter paper (10 x 10 cm) moistened with phenolphthalein (PP) solution as an indicator until the entire surface is wetted and then dried. Brush the paper with 0.5 g of the preparation on one side of the surface evenly, as is usual for people to use ointments. Make an area (2.5 x 2.5 cm) of 3 places on another filter paper. Apply the melted solid paraffin to the edges of the three ways that have been made. Paste the filter paper size (2.5 x 2.5 cm) on the filter paper (10 x 10 cm), drop the area that has been made on paper (2.5 x 2.5 cm) with 1 drop of dilute Na OH P (4%) or Na OH LP, observe the appearance of reddish stains on paper moistened with phenolphthalein solution. Record the time needed from the paper dripping with dilute Na OH P until the red color appears.

## h. Acceptability Test

The acceptability test is carried out on the first day after the gel preparation is made. The acceptability test for the use of preparations for each formula was carried out on 21 respondents so that each respondent used all the formulas produced by applying gel preparations to the back of the respondent's hand in each formula. Respondents are women or men aged 45 years and over. Assessment by respondents is done by filling out the questionnaire that has been provided. The assessment provisions for each test parameter use a rating scale gauge. In the rating scale the data obtained are qualitative data and then transformed into qualitative data.

### 3. RESULTS AND DISCUSSION

#### 1. Determination Results

Strawberry fruit is obtained from the Tawangmangu plantation, Karanganyar, Central Java. To find out the authenticity and truth of plants, first a determination was made at the Biology Laboratory of the Muhammadiyah University of Surakarta, Central Java. The results of plant determination show that the plants used in this study were true strawberry fruit plants (*Fragaria x ananassa* Duch.). In this study using strawberries with a large base shape and rounded tip that has all the red color.

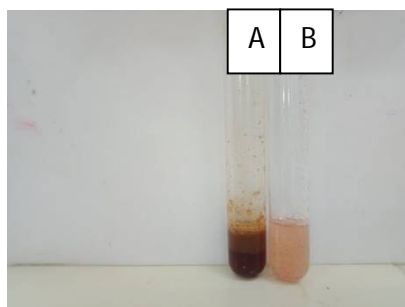
#### 2. Strawberry fruit extract

**Table 2. Results of maceration extraction of strawberries**

Weight of simplicia powder (g)	Yield extract (g)	Yield (%)
200	60	30

The results of strawberry extract were carried out by maceration method for 5 days and produced 60 g extract, with a yield of 30%. Organoleptic extract produces dark brown color, a thick extract form and a distinctive strawberry odor.

#### 3. Flavonoid Test



**Figure 1. Flavonoid Results**

The results obtained are formed orange so that it can be concluded that the extract of strawberries contains flavonoids.

Information:

A: The strawberry extracts sample results

B: results of strawberry extract gel samples

4. The results of the physical testing of gel preparations

The following are the results of the physical stability and acceptability tests on the respondents, namely:

**Tabel 3. The results of the physical stability and acceptability tests on the respondents**

No.	Evaluate gel preparations	Concentration			
		F1	FII	FIII	FIV
1	Organoleptic:				
	Form	Gel	Gel	Gel	Gel
	Color	Clear brown	Clear brown	Clear dark brown	Clear dark brown
	Smell	Typical strawberries	Typical strawberries	Typical strawberries	Typical strawberries
	Taste	cold	cold	cold	cold
2	Homogeneity	Homogeneous	Homogeneous	Homogeneous	Homogeneous
3	pH	6,3	6,1	6,3	6,3
4	Viscosity	130 dpas	150 dpas	175dpas	280dpas
5	Stickiness	00:46 seconds	00:47seconds	00:50 seconds	00:51 seconds
6	Scattering	15,3887 cm	10, 7749 cm	10, 139 cm	8,003 cm
7	Protection powder	00:45 seconds	00:43 seconds	00:40 seconds	00:42 seconds

- a. **Organoleptic**  
Based on organoleptic test results it is known that strawberry extract gel (*Fragaria x ananassa* Duch.) With replication three times where the results between formulas I, II, III and IV differ in color, this is due to the greater concentration of carbopol 940, the resulting gel gets thicker.
- b. **Homogeneity**  
Based on the results of observational tests during storage showed that no change. The results obtained during storage are homogeneous, indicating that the active substance from the preparation and its constituent ingredients can be mixed evenly so that it can be expected that the gel has the same effect in each use.
- c. **pH**  
Based on the data above, it is obtained that the preparation of strawberry extract gel (*Fragaria x ananassa* Duch.) has a pH value that can be said to fluctuate and the pH is still in line with the susceptibility of the gel gel which does not irritate the skin, namely 4.0 - 7.0 (Maria, 2016 ).
- d. **Viscosity**  
In this study from the IV formula it is known that formula 1 has the smallest viscosity value. This is because formula I has the smallest viscosity value. This is because formula I has a low level of Carbopol content so that it automatically gives a low viscosity to the gel. In formula IV, it is known to have a high viscosity value because it has a higher Carbopol content. This is consistent with the theory and orientation where the Carbopol gelling agent exerts an influence on increasing viscosity.
- e. **Stickiness**  
Formulas I, II, III and IV experience values of sticking up and down, which means the formula is unstable during storage, the result of sticking up and down may be due to the reduced stability of the gel preparation during storage.
- f. **Scattering**  
Based on the results of the scatter power test obtained, it show that all formulas fall within the desired range of 5-7 cm.
- g. **Protection power**  
Protection test aims to determine the ability of gel preparations in protecting the skin in external influences. In this test using a NAOH solution which is alkaline which will react with phenolphthalein which will form a pink color. The longer the pink color is formed; the gel is able to provide protection to the skin from external influences.
- h. **Acceptability Test**  
Based on the results of the acceptability test of respondents can be obtained on average in formula I shows the results of 4, formula II is 3, formula III is 3 and formula IV is 2. Then it can be concluded that the formula I of strawberry extract gel

is better than formula II, III and IV based on the results of the assumption and physical stability test of gel

#### 4. CONCLUSION

- a. The formula for the preparation of strawberry extract gel meets the requirements of physical stability based on the results of organoleptic, pH, homogeneity, viscosity test, stickiness test, spread ability test, protection power and acceptability test from day 0 to day 28.
- b. Gel formula with 0.5% carbopol concentration produces a good gel preparation based on organoleptic parameters, pH, homogeneity, viscosity test, adhesion test, dispersion test, protection and acceptability test.

#### 5. SUGGESTION

- a. Further research needs to be done using other gelling agent optimizations.
- b. Further research needs to be done to determine the antibacterial activity of strawberry extract gel preparations.

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