# Formulation And Physical Stability Test Of Celery Leaf Extract Gel (Apium graveolens L.) With Variations Concentration Of Hydroxy Propyl Methyl Cellulose And Carbopol

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## ABSTRACT
*Celery plants can be used as medicine and cosmetic ingredients, but they are still used traditionally, so a pharmaceutical preparation that is effective in its use has been developed. This study aimed to formulate celery leaf extract in a gel preparation using Hydroxy Propyl Methyl Cellulose (HPMC) and carbopol as gelling agents and to test its physical stability. Celery leaf extract gel was made in 6 formulations with different Hydroxy Propyl Methyl Cellulose concentrations, namely 2%, 4%, 6% and carbopol 0.5%, 1%, and 1.5%. The study began with the manufacture of celery leaf extract. In this study, the active substance was extracted using the maceration method and the physical stability of the gel preparation was determined based on observations of changes in color, odor, shape, pH, homogeneity, spreadability, adhesion and viscosity before and after accelerated storage using a climatic chamber at 4°C and 40°C for 12 hours for 10 cycles. Based on the research results obtained, celery leaf extract can be made in gel preparations and gel preparations based on HPMC meet the requirements for physical stability tests, while gel preparations with carbopol base do not meet the requirements for physical stability tests.*
*Keywords: Celery leaf, stability test*

## INTRODUCTION

One of the plants that can be used as medicine and cosmetic ingredients is celery leaf. Currently, public knowledge about the use of celery is only limited as a vegetable commodity or cooking seasoning. Celery (*Apium graveolens* L.) is a plant originating from the Apiaceae family that grows throughout the European continent, tropical and subtropical regions of Africa and Asia (Rusdiana, 2018). Celery contains essential oils (alinine and allicin), flavonoids, protein, vitamin A, vitamin C, vitamin B, iron, calcium, sulfur and phosphorus (Kusumadewi, 2010).

In a study conducted by Agust et al (2018), tested the activity of celery herb ethanol extract cream against cuts in rabbits using 2% and 4% celery herb extract concentrations and at these concentrations had the activity of healing cuts in rabbits. And in a study conducted by Marani et al (2017), tested the effectiveness of celery extract against bacterial inhibition using concentrations of 25%, 12.5%, 6.25%, 3.125% and at a concentration of 3.125% extract had inhibitory power against bacteria.

Gel is a semi-solid system consisting of a suspension made of small inorganic particles or large organic molecules penetrated by a liquid (Dirjen POM RI, 1995). Gels have better potential as a means to process topical drugs compared to ointments, because gels are not sticky, require less energy for formulation, are stable and have good aesthetics (Madan, 2010). In gel formulations, the gelling agent component is a critical factor that can affect the physical properties of the resulting gel (Arikaumala, 2013).

HPMC gel base is a gelling agent that is often used in the production of cosmetics and drugs, because it can produce a clear gel, easily soluble in water, and has low toxicity (Setyaningrum, 2013). HPMC has good resistance to microbial attack and the use of HPMC as a hydrophilic base also has advantages including good dispersion on the skin, cooling effect, does not clog skin pores, is easily washed off with water, and has good drug release (Afianti, 2008). 2015). Carbopol and HPMC compared to other ingredients are easily dispersible by water and with a small concentration of 0.5-2% can provide sufficient viscosity as a gel base, are inert, do not irritate the skin and are not metabolized by the body. (Quinones, 2008)

Optimization of the gel base is very necessary to find a gel base that meets the standards of physical stability or predetermined requirements. Therefore, a study was conducted on the formulation of celery leaf extract gel with variations in the concentration of HPMC and carbopol to find out at what concentration the celery leaf extract gel preparation met the standard of gel physical stability.

## OBJECTIVE

The purpose of this study was to analyze the ability of celery leaf extract (Apium graveolens L.) when made in a gel preparation with variations in the concentration of HPMC and cabopol. Then tested the physical stability of Celery Leaf extract gel (Apium graveolens L.) with various concentrations of HPMC and carbopol.

## MATERIALS AND METHODS

The type of research used in this study is a laboratory experimental study where the resulting extract was hen made in the form of a gel formulation. This study used the extraction method, namely maceration to obtain celery leaf extract. The extract obtained was formulated into a gel preparation with several formulation variables to obtain the stability of the extract gel preparation. The results of the Celery leaf extract gel preparation would tested for stability. The parameters carried out in this physical stability test were carried out before and after being given accelerated storage conditions at 4˚C and 40˚C for 12 hours each for 10 cycles. The types of physical stability testing of the gel are as follows: homogeneity test, pH test, dispersion test, adhesion test and viscosity test.

The research was carried out in the Pharmacy Laboratory, Department of Pharmacy, Faculty of Mathematics and Science, Pancasakti University. The population of this research is celery plant and the research sample is celery leaves which will be extracted using the maceration extraction method

The data processing and analysis techniques in this study describe the results of the stability test with 5 stability test parameters shown in the table of research results.

## RESULTS

**Table 1**. Celery Leaf Extract (Apium graveolens L.) gel preparation formula

| Ingredients | Formulation Concentration (F) (%) | | | | | | Utility |
|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | |
| Celery Leaf Extract | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | Active substance |
| HPMC | 2 | 4 | 6 | - | - | - | Gel base |
| Carbopol | - | - | - | 0,5 | 1 | 1.5 | Gel base |
| Propylene glycol | 15 | 15 | 15 | 15 | 15 | 15 | Humectants |
| Methyl paraben | 0.075 | 0.075 | 0.075 | 0.075 | 0.075 | 0.075 | Preservative |
| Propyl paraben | 0.025 | 0.025 | 0.025 | 0,025 | 0.025 | 0.025 | Preservative |
| TEA | - | - | - | 2 | 2 | 2 | Stabilizer |
| Aquades ad | 100 | 100 | 100 | 100 | 100 | 100 | Solvent |

**Table 2**. Test for homogeneity of gel preparations from celery leaf extract with variations in HPMC concentrations

| Replications | Homogeneity Observation | | | | | |
|---|---|---|---|---|---|---|
| | Before accelerated storage | | | After accelerated storage temperature 4˚C and 40˚C | | |
| | F1 | F2 | F3 | F1 | F2 | F3 |
| 1 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |
| 2 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |
| 3 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |

**Table 3.** Test for homogeneity of gel preparations from celery leaf extract with variations in Carbopol concentrations

| Replications | Homogeneity Observation | | | | | |
|---|---|---|---|---|---|---|
| | Before accelerated storage | | | After accelerated storage temperature 4˚C and 40˚C | | |
| | F4 | F5 | F6 | F4 | F5 | F6 |
| 1 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |
| 2 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |
| 3 | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous | Homogeneous |

**Table 4**. pH test of gel preparations from celery leaf extract with variations in HPMC concentrations

| Replications | pH observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage | | | After accelerated storage temperature 4˚C and 40˚C | | | |
| | F1 | F2 | F3 | F1 | F2 | F3 | |
| 1 | 6.10 | 6.22 | 6,35 | 5.33 | 5.96 | 6.11 | 4.5-6.5 |
| 2 | 6.12 | 6.32 | 6.41 | 5.69 | 6.05 | 6.14 | |
| 3 | 6.15 | 6.35 | 6.45 | 6.05 | 6.02 | 6.16 | |
| Average | 6.123 | 6,297 | 6.403 | 5.69 | 6.01 | 6.137 | |

**Table 5.** pH test of gel preparations from celery leaf extract with various in Carbopol concentrations

| Replications | pH observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage | | | After accelerated storage temperature 4˚C and 40˚C | | | |
| | F4 | F5 | F6 | F4 | F5 | F6 | |
| 1 | 8.73 | 8.78 | 8.73 | 8.25 | 8.36 | 8.77 | 4.5-6.5 |
| 2 | 8.78 | 8.79 | 8.74 | 8.31 | 8.36 | 8.77 | |
| 3 | 8.77 | 8.73 | 8.74 | 8.31 | 8.35 | 8.77 | |
| Average | 8.76 | 8.76 | 8.736 | 8.29 | 8.36 | 8.77 | |

**Table 6.** Test of dispersion of gel preparations from celery leaf extract with variations in HPMC concentrations

| Replications | Spread Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (cm) | | | After accelerated storage temperature 4˚C and 40˚C (cm) | | | |
| | F1 | F2 | F3 | F1 | F2 | F3 | |
| 1 | 6,.60 | 6 | 5.3 | 6.35 | 5.9 | 5.35 | 5-7 cm |
| 2 | 6.65 | 5.85 | 5.75 | 6.55 | 6.2 | 5.2 | |
| 3 | 6 | 5.9 | 5.75 | 6.35 | 6,.25 | 5.5 | |
| Average | 6.417 | 5.917 | 5.6 | 6.416 | 6.117 | 5.35 | |

**Table 7.** Test of dispersion of gel preparations from celery leaf extract with various in Carbopol concentrations

| Replications | Spread Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (cm) | | | After accelerated storage temperature 4˚C and 40˚C (cm) | | | |
| | F4 | F5 | F6 | F4 | F5 | F6 | |
| 1 | 6.45 | 6.40 | 6.30 | 5.70 | 5.30 | 5.10 | 5-7 cm |
| 2 | 6.50 | 6.30 | 6.20 | 5.75 | 5.40 | 5.20 | |
| 3 | 6.60 | 6.30 | 6.20 | 5.80 | 5.50 | 5.30 | |
| Average | 6.517 | 6.333 | 6.233 | 5.750 | 5.400 | 5.200 | |

**Table 8.** Tests for the adhesion of gel preparations from Celery Leaf extract with variations in HPMC concentrations

| Replications | Adhesive Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (seconds) | | | After accelerated storage temperature 4˚C and 40˚C (seconds) | | | |
| | F1 | F2 | F3 | F1 | F2 | F3 | |
| 1 | 2,73 | 2,15 | 2.19 | 3.65 | 3.32 | 3.40 | More than 1 second |
| 2 | 2.80 | 2.35 | 2.44 | 3.75 | 3.55 | 3.45 | |
| 3 | 3,10 | 2.56 | 2.84 | 3.84 | 3.62 | 3.47 | |
| Average | 2.877 | 2.353 | 2.490 | 3.747 | 3.497 | 3.440 | |

**Table 9.** Test the adhesion of gel preparations from celery leaf extract with variations in Carbopol concentrations

| Replications | Adhesive Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (seconds) | | | After accelerated storage temperature 4˚C and 40˚C (seconds) | | | |
| | F4 | F5 | F6 | F4 | F5 | F6 | |
| 1 | 4.97 | 4.22 | 3.23 | 4.75 | 3.41 | 2.03 | More than 1 second |
| 2 | 4.00 | 3.78 | 3.32 | 3.06 | 2.25 | 2.57 | |
| 3 | 4.53 | 3.49 | 3.42 | 2.34 | 2.25 | 2.30 | |
| Average | 4.500 | 3.83 | 3.323 | 3.383 | 2.637 | 2.300 | |

**Table 10.** Viscosity test of gel preparations from Celery Leaf extract with variations in HPMC concentrations

| Replications | Viscosity Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (cPs) | | | After accelerated storage temperature 4˚C and 40˚C (cPs) | | | |
| | F1 | F2 | F3 | F1 | F2 | F3 | |
| 1 | 12.196 | 19.696 | 36.529 | 10.029 | 19.196 | 37.696 | 3000-50.000 cPs |
| 2 | 13.168 | 20,666 | 37.500 | 11.000 | 20.166 | 38.666 | |
| 3 | 14.137 | 21.637 | 38.471 | 11.971 | 21.137 | 39.637 | |
| Average | 13.167 | 20.667 | 37.500 | 11.000 | 20.167 | 38.667 | |

**Table 11.** Viscosity test of gel preparations from celery leaf extract with various in carbopol concentrations

| Replications | Viscosity Observation | | | | | | Condition |
|---|---|---|---|---|---|---|---|
| | Before accelerated storage (cPs) | | | After accelerated storage temperature 4˚C and 40˚C (cPs) | | | |
| | F4 | F5 | F6 | F4 | F5 | F6 | |
| 1 | 11.100 | 15.000 | 15.100 | 10.000 | 14.000 | 14.100 | 3000-50.000 cPs |
| 2 | 16.000 | 16.000 | 16.000 | 14.000 | 15.000 | 15.000 | |
| 3 | 16.000 | 18.000 | 18.000 | 16.000 | 17.000 | 18.100 | |
| Average | 14.366 | 16.333 | 16.366 | 13.333 | 15.333 | 15.733 | |

F1: Gel with HPMC base 2 %
F2: Gel with HPMC base 4 %
F3: Gel with HPMC base 6 %
F4: Gel with carbopol base 0,5%
F5: Gel with carbopol base 1%
F6: Gel with carbopol base 1,5%

## DISCUSSION

This study used celery leaf extract in the formulation of gel preparations. Celery leaves were extracted by maceration method using 96% ethanol as solvent because it is a solvent that has the extraction ability to attract compounds in celery leaves. Each formula in this study was tested for stability to ensure that each preparation still meets the specified requirements. Stability testing was carried out to prove that no changes occurred in the formulation which could have an adverse effect on the stability of the preparation. In this study, the physical stability of the preparation was tested by storing the preparation in a climatic chamber at a temperature of 4˚C and 40˚C for 12 hours. This treatment is counted as one cycle. This work was carried out for 10 cycles. Through accelerated storage treatment, it will be seen whether the gel preparation

made remains stable or undergoes decomposition. Physical stability tests including homogeneity, pH, spreadability, adhesion and viscosity were carried out three times each.

The results of the observation of homogeneity in all preparations were said to be stable in the homogeneity parameter both before and after accelerated storage. From the results obtained there was no solid particles or lumps contained in the gel. On day 0 of inspection before accelerated storage, all gel preparations did not show syneresis, that was, no water came out of the gel structure. Likewise, after accelerated storage, the gel preparation did not show syneresis.

The pH test aims to determine the pH of the preparation that is in accordance with the pH of the skin so as not to irritate the skin when used. The pH test was carried out using a pH meter. From the test results of each gel formulation formula, the pH value tends to become more alkaline both before and after accelerated storage which indicates that the higher the concentration of the base used, the more alkaline the pH value of the preparation. After accelerated storage there is a decrease in pH (more acidic) The decrease in pH from 3 formulas based on HPMC still meets the skin pH parameters according to the Indonesian National Standard Agency (SNI), namely SNI 16-4380-1996 for human skin pH, namely pH 4.5-6.5. Meanwhile, the 3 formulas that used carbopol did not meet the skin pH parameters. The pH of the preparation must be in accordance with the pH of the skin so as not to cause irritation and preparations with a pH that is too acidic can cause the loss of the acid mantle on the skin, making it easier for microorganisms to enter (Tranggono et al., 2007). Changes in pH are caused by environmental conditions such as temperature and humidity.

The dispersion test aims to determine the area of the gel can be spread and evenly when used on the skin. Spreadability is a useful characteristic to take into account the ease of use of the preparation. From the test results, the results of the dispersion test of each gel formulation tended to decrease before storage and after accelerated storage, which indicated that the higher the concentration of the base used, the lower the dispersion value of the preparation. This is because the more bases of HPMC and carbopol, the dispersion will decrease because the preparation is getting thicker. The decrease in the spreadability of preparations based on HPMC and carbopol occurs due to the influence of the decreasing viscosity of the preparations in storage causing the spreadability of the preparations to increase. This shows that variations in the concentration of HPMC and carbopol have an effect on the spreadability of the gel preparations in each formula in storage.

Adhesion test aims to determine how long the preparation can stick or stick to the skin, good adhesion is more than 1.02 seconds. From the test results, the results of the adhesion test on each gel formulation tended to decrease both before and after accelerated storage which showed that the higher the concentration of the base used, the lower the value of the adhesive power of the preparation. After accelerated storage there was an increase in adhesion to the preparation. gel based on HPMC, while the gel preparation with a carbopol base experienced a decrease in the value of adhesion.

Viscosity test is a measurement that states the thickness of a preparation. Viscosity testing aims to determine the value of the viscosity of a preparation. The higher the viscosity value, the higher the viscosity level of the preparation. The test results indicate that each gel formulation formula shows an increased viscosity value both before and after accelerated storage which indicates that the higher the concentration of the base used, the higher the viscosity value of the preparation.

After accelerated storage, each of the gel preparations experienced a decrease in viscosity value, except for gel preparations with a concentration of 6% HPMC. In this case, it still meets the standards according to the Indonesian National Standards Agency (SNI), namely SNI 16-4380-1996, the standard value of viscosity for gel preparations is 3000-50,000 cPs. Based on previous research, a decrease/shift in the viscosity value of the preparation could be caused by the pH factor and water molecules trapped in the gel matrix leaving/released from the matrix so that 2 phases were formed which resulted in a decrease in the viscosity value during storage.

## CONCLUSION

1. Celery Leaf Extract (Apium graveolens L.) can be made in gel preparations based on HPMC and carbopol.
2. Gel preparations with variations in HPMC concentrations met the requirements for the physical stability test parameters of the gel, such as homogeneity, pH, dispersibility, adhesion and viscosity. Meanwhile, gel preparations with variations in carbopol concentrations did not meet the requirements for the physical stability test parameters of the gel.

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