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Formulation of Hand Sanitizer Gel Extract of *Citrus sinensis* (*L.*) Osbeck with Combination of Carbopol and HPMC as Gelling Agent

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ABSTRACT

Hand sanitizer gel products that use alcohol as an active ingredient are considered to be less safe for health because alcohol is an organic solvent that can dissolve the layer of fat and sebum on the skin which functions as a protector against infection with microorganisms. If the concentration of gelling agent carbopol is too high, a new gel will be formed at pH sour one. Sweet orange peel contains antibacterial compounds that are used as active substances in hand sanitizer gel preparations to replace alcohol. Carbopol and HPMC were combined with the aim of covering the shortcomings of carbopol to obtain gel preparations with better physical properties. There are 3 formulas with a combination of gelling agent concentrations, namely FI (Carbopol: HPMC 0.75%: 0.25%), FII (Carbopol: HPMC 0.5%: 0.5%), FIII (Carbopol: HPMC 0.25%: 0.75%). The preparations were tested for physical properties including organoleptic, homogeneity, irritation, pH, dispersibility and stability tests and then the data were analyzed using SPSS. The best formulation that meets the criteria for physical properties and physical stability of the gel preparation. The results showed that the combination of Carbopol and HPMC had an effect on the physical properties of the gel preparation, namely pH, dispersibility, and physical stability of freeze thaw and had no effect on organoleptic, homogeneity and irritation. Formula 3 with a combination of Carbopol: HPMC (0.25%: 0.75%) was chosen as the best and most stable formula, it was seen from the dispersion and pH of the preparation that met the criteria for the best and most stable gel in the freeze thaw test.

Keywords: Carbopol, *Citrus sinensis* (*L.*) osbeck, Active ingredient, HPMC.

INTRODUCTION

The hand hygiene is one of the important things for the health of the body, because in activities the hands are often contaminated with microbes. Diseases that are often caused by microorganisms on the hands include diarrhoea, chronic constipation, appendicitis and gastritis (an acute or chronic inflammation). As a practical alternative to replacing soap and water for washing hands before eating and drinking, use hand sanitizer gel preparations as hand antiseptic. Gels are easy to use, practical and active substances can last longer because of the thickening agent, the use of hand sanitizer preparations is also easier and more efficient to use for cleaning hands. The use of hand antiseptics in the form of gel preparations among the middle class upwards has become a way of life. Ethyl alcohol 62% softener and moisturizer. The active ingredient is alcohol which has the highest effectiveness against viruses, bacteria, and fungi and does not cause bacteria resistance. Hand sanitizer gel products that use alcohol as an active ingredient are considered less safe for health because alcohol is an organic solvent that can dissolve the fat and sebum layer on the skin which functions as a protector against microorganism infection [1]. Alcohol can also make hands dry, so hand sanitizers must be equipped with moisturizers and emollients that keep hands soft and not dry. In addition, repeated use of alcohol causes irritation of the skin and skin inflammation where the skin turnover process is too fast characterized by red patches with rough and thick scales. Extracts from *Citrus sinensis (L.) osbeck* are able to inhibit the growth of *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typi* bacteria that cause diseases such as diarrhoea, chronic constipation and appendicitis and gastritis. The results of research conducted by Wijiatuti (2011), 50% ethanol extract of *Citrus sinensis (L.) Osbeck* has antibacterial activity against multi-resistant *Staphylococcus aureus* with a minimum killing rate (KBM) of 6% and multi-antibiotic *Escherichia coli* with KBM is 8%. Hand sanitizer gel in its manufacture requires a gelling agent to get a gel that has good physical properties. Gelling agents that are often used in the manufacture of gels include carbopol and Hydroxy Propyl Methyl Cellulose (HPMC). Advantages carbopol gelling agent is very commonly used in cosmetic production because of its high compatibility and stability, non-toxic when applied to the skin and easier to spread on the skin. Gel with gelling agent carbopol has good properties in the release of active substances. While the advantages of HPMC itself are, it can produce a gel that is neutral, clear, colourless and tasteless, stable at pH 3-11, and has good resistance to microbial attack making it suitable for gel preparations. So that both are suitable to be combined as a gelling agent in gel preparations. The concentration of gelling agent used affects the gel preparation produced. The physical properties possessed by the gelling agent will affect its application as a gelling agent [2].

Goal

- The purpose of this study was to determine the effect of using a combination of carbopol and HPMC on the physical properties of the hand sanitizer gel preparation of sweet orange peel extract (*Citrus sinnensis* (*L.*) *Osbeck*).

- This study aims to determine the effect of the combination of carbopol and HPMC which produces the best formula for hand sanitizer gel preparation of sweet orange peel extract (*Citrus sinnensis (L.) Osbeck*) in terms of physical properties and physical stability.

MATERIALS AND METHODS

The type of research used is experimental research. The procedure for making hand sanitizer gel with sweet orange peel extract was carried out by developing a carbopol and HPMC gel base using hot distilled water at 70°C in a mortar after expanding and then dripping with tea, stirring until homogeneous. Then dissolved methyl paraben using alcohol input into a mortar, sweet orange peel extract dissolved with distilled water then put into a mortar add propylene glycol, stir homogeneously, add distilled water while stirring to form a homogeneous gel mass then each formula from the preparation was tested for physical properties and physical stability. This study was conducted to determine what combination of Carbopol and HPMC produces the best formula for hand sanitizer gel preparations in terms of their physical properties and stability, where 3 types of concentration combinations are used, namely FI (Carbopol: HPMC=0.75%: 0.25%), FII (Carbopol: HPMC=0.5% : 0.5%), FIII (Carbopol: HPMC=0.25% : 0.75%). Evaluation of physical properties was carried out to determine the effect of the combination of carbopol and HPMC as a gelling agent in a gel base seen from the physical properties test of each formulation with each test being replicated 3 times with the aim of reducing errors from the experiments carried out. Physical properties tests include organoleptic test, homogeneity test, irritation test, pH test, dispersion test and physical stability test to determine the best formula of the three formulas [3] (Tables 1-3).

RESULTS AND DISCUSSION

This study used samples of sweet orange peel obtained from Limpung Village, Kec. Limpang, Kab. Trunk. The process of making orange peel extract begins with washing the sweet orange peel with running water, the aim is to separate the impurities or other contaminants attached to the sweet orange peel. Furthermore, the drying process is carried out; the purpose of drying is to reduce the water content of the simplicia. Extraction of sweet orange peel powder was carried out using the maceration method. The results of the sweet orange peel extract obtained were then evaporated using a water bath and obtained a thick extract of 96.13 grams of sweet orange peel (Table 4).

The process of developing carbopol and HPMC using hot distilled water, carbopol and HPMC expands into a clear gel, and then the gel is neutralized with a base, namely TEA. Sweet orange that has been dissolved with distilled water and filtered, put into a mortar, stir until homogeneous, then add propylene glycol and add distilled water until

Formula	Organoleptic results		
	Form	Color	Smell
Formula Ia Formula Ib Formula I c	Slightly liquid Slightly liquid Slightly liquid	Chocolate Chocolate Chocolate	Typical orange peel (Weak) Typical orange peel (Weak) Typical orange peel (Weak)
Formula IIa Formula IIb Formula IIc	Slightly liquid Slightly liquid Slightly liquid	Chocolate Chocolate Chocolate	Typical orange peel (Weak) Typical orange peel (Weak) Typical orange peel (Weak)
Formula IIIa Formula IIIb Formula IIIc	Slightly liquid Slightly liquid Slightly liquid	Chocolate Chocolate Chocolate	Typical orange peel (Weak) Typical orange peel (Weak) Typical orange Peel (Weak)
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)			

Table 1: Organoleptic test results.

Formulation	Homogeneity test results
Formula I	Homogeneous
Formula II	Homogeneous
Formula III	Homogeneous
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)	

Table 2: Result of homogeneity of gel hand sanitizer *Citrus sinnesis (L.) osbeck*.

Formulation	Irritation test results			Information
	Redness	Hot	Itchy	
Formula I	-	-	-	No Irritating
Formula II	-	-	-	No Irritating
Formula III	-	-	-	No Irritating
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)				

Table 3: Irritation test result data.

Formulation	Results mean pH ± SD
Formula I	6.40 ± 0.57
Formula II	5.95 ± 0.07
Formula III	6.05 ± 0.05
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)	

Table 4: pH results gel hand sanitizer *Citrus sinnesis (L.) osbeck.*

a gel is formed, after a homogeneous gel is formed, the gel is stored in a tightly closed container [4].

Organoleptic examination was carried out to determine the physical appearance of the gel based on visual observation. Organoleptically, formulas I, II and III have similarities in terms of shape, colour and aroma. From the table above, it can be concluded that formulas I, II and III have a slightly liquid form. The dosage form is related to the ability to stick together.

The homogeneity test aims to see the uniformity of the particles in the gel preparation so as to provide maximum quality when used. Homogeneity is one of the factors that affect the quality of the gel preparation. The results of homogeneity observations showed that formulas I, II and III showed homogeneous results, meaning that the constituent ingredients such as active substances, gelling agents and other additives were mixed evenly so that the effectiveness of the active substances worked optimally.

The skin irritation test was carried out to determine the side effects of using hand sanitizer gel on the skin of the hands so as to determine the level of safety of the gel preparation before use. The three formulations were not irritating, namely by looking at the results of the tests carried out, where the panellists arms did not show any irritation, either redness, heat and itching within a 10 minutes waiting period. Based on the post hoc test analysis, it can be concluded that the combination of carbopol and HPMC produces significant or influential results. Differences in pH values can be affected by storage environmental conditions such as light and humidity, chemical changes in the active substance or additives in the preparation during storage and carrier factors.

The pH test is a test carried out to determine the preparation that has been made does not irritate the skin. The pH range in a good gel preparation according to skin pH ranges from 5-7. If the pH is too acidic then the gel preparation can irritate the skin, whereas if the pH is too alkaline it can dry out the skin. Formula I has a higher pH value than formulas II and III. To determine the effect of the combination of carbopol and HPMC on viscosity, one way analysis was carried out using one way annova analysis in SPSS software. The first step is the kolmogorov normality test. Based on the post hoc test analysis, it can be concluded that the combination of carbopol and HPMC produces significant or influential results. Differences in pH values can be affected by storage environmental conditions such as light and humidity [5].

The results of the gel dispersion test carried out that the gel preparation of sweet orange peel extract in formula I had a lower dispersion than formula II and formula III. Based on the post hoc test analysis, it can be concluded that the combination of carbopol and HPMC resulted in significant dispersion results, namely the effect; the significance itself was different and proved that the research was real. This is influenced by the amount of HPMC used in each different formula. In formula III HPMC has a higher concentration of 0.75% compared to formula I and formula II (Tables 5-8).

Stability tests are carried out to determine the physical condition to survive within the specified limits applied throughout the period of storage and use to ensure the identity, strength, quality, and purity of the product. In the stability test, it is necessary to make observations including organoleptic and homogeneity. Based on the results of physical properties testing that have been carried out on hand sanitizer gel preparations sweet orange peel extract (*Citrus sinensis (L.) Osbeck*) it can be seen that in the organoleptic physical properties test the 3 formulations have the same physical appearance but in formula III the consistency of the preparation is more watery compared to formula II and III, in the 3rd homogeneity test, there were no coarse particles, in the 3rd irritation test, the preparation did not irritate the skin, in the 3rd pH test the formulation passed the pH test, which was susceptible to skin pH 5-7, in the 3rd dispersion test the formulation passed the dispersion test, namely where a good dispersion of 5-7 cm in formula

Gel formula comparison	Significance	Information
FII with FIII	0.00	Significant
FI with FIII	0.00	Significant
FI with FII	0.00	Significant
Note: FI Carbopol: HPMC (0.75%:0.5%)**,** FII Carbopol: HPMC (0.5%:0.5%)**,** FIII Carbopol: HPMC (0.25%:0.75%)		

Table 5: Results of SPSS data analysis of pH test.

Formulation	Average result ± SD
Formula I	5.61 ± 0.01
Formula II	5.70 ± 0.02
Formula III	6.23 ± 0.04
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)	

Table 6: Spreadability of gel hand sanitizer extract *Citrus sinnesis (L.) osbeck.*

Comparison of gel formula	Significance	Information
FII with FIII	0.00	Significant
FI with FIII	0.00	Significant
FI with FII	0.00	Significant
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)		

Table 7: Data analysis of post hoc spreading power test.

Formulation	Organoleptic			Syneresis
	Form	Color	Aroma	
Formula I	Slightly liquid	Chocolate	Sweet orange	No syneresis
Formula II	Slightly liquid	Chocolate	Sweet orange	No syneresis
Formula III	Slightly liquid	Chocolate	Sweet orange	No syneresis
Note: FI (Carbopol 0.75% and HPMC 0.25%)**,** FII (Carbopol 0.5% and HPMC 0.5%)**,** FIII (Carbopol 0.25% and HPMC 0.75%)				

Table 8: Stability test results.

III had the highest dispersion, higher than formulas II and III [6]. Of all the physical properties tests that have been carried out, the 3 formulations passed the physical properties test, the best formula seen from the dispersion test where a good hand sanitizer gel preparation is one that is not too thick and has a high spreadability so it is easy to use, namely formula III which has the highest spreadability compared to formulas II and III.

CONCLUSION

The combination of carbopol san HPMC as a gelling agent in hand sanitizer gel preparations affects the physical properties of the hand sanitizer gel preparation of extract *citrus sinnesis (L.) Osbeck*, namely dispersion and pH, and has no effect on organoleptic, homogeneity and irritation tests. Based on the physical properties and stability of the hand sanitizer gel, the best formula for hand sanitizer gel preparation of extract *citrus sinnesis (L.) Osbeckis* formula III with a combination of carbopol: HPMC (0.25% : 0.75).y.

REFERENCES

1. Das AK, Rajkumar V, Dwivedi DK. *J. Int. Food. Res*. **2011**; 7(18): 563-569.
2. Dewi AR. *Curr. Res. Food. Sci*. **2019**; 4: 326-335.
3. Madan J, Singh R, *Int. J. Pharm. Sci*. **2010**; 9(2): 551-515.
4. Retnosari. *Indo. Pharm. Mag*. **2006**; 17(4): 163-169.
5. Saryanti D. *Nat. Fac. Pharm. Stikes*. **2019**.
6. Yuniarsih N. *J. Pharma*. **2016**