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Effect of NA-CMC Gelling Agent on Physical Properties of Hand Sanitizer with Basil Essential Oil (Ocimum sanctum L)

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ABSTRACT---*Hand sanitizers were effective and inexpensive product that can reduce of microorganims on the skin. Many hand sanitizer have contents up to 60%-95% ethanol and isopropyl alcohol, but using alcohol in hand sanitizer can cause health risks effect. The leaves of basil oil (Ocimum sanctum L.) can be used as an active ingredient for hand sanitizers because it has an antibacterial activity. The aim of this work was to determine the effects of gelling agent Na-CMC on physical properties of formulation gel hand sanitizer. The concentration that used for the Na-CMC gelling agent are 3%; 3,5%; 4%. The test of physical properties includes organoleptic, homogeneity, pH, viscosity, dispersive ability, and adhesion The results of this research on the physical properties gel hand sanitizer of basil essensial oil, showed that the increasing of gelling agent consentrasion, makes the gel getting faded, more thicker, increase of viscosity, adhesion and decrease of dispersive ability. Based on the physical properties test, (F2) with 3,5% concentration of Na-CMC is the optimal formula it caused by it suitable all the parameters of the physical properties of gel.*

Keywords---*gelling agent, Na-CMC, physical properties, Ocimum sanctum L.*

I. INTRODUCTION

Hand sanitizer is a type of alcohol-based hand sanitizer that is used to kill microorganisms by using water without rinsing (Larasati, D.A & Ety, A., 2016). The main component of basil is essential oil which can function as an antibacterial. Essential oils in basil can be used as a substitute for alcohol in the preparation of hand sanitizer gel. The average hand sanitizer product on the market is in gel form. Gel has better potential as a means to manage topical drugs compared to ointments, because the gel is not sticky, requires less energy for formulation, is stable, and has good aesthetics (Ardana et al., 2015). In addition, the gel can deliver medicinal ingredients well. Other advantages of gel preparations include easily spread evenly when applied to the skin, giving a cold sensation, and does not cause marks on the skin. (Afianti, H.F & Mimiek M., 2015).

In gel formulations, gelling agents are critical factors that affect the physical properties of the formulation result. One of the gelling agents that can be used is Na-CMC. Na-CMC is a semi-synthetic polymer (Maulina & Nining., 2015). The use of Na-CMC as *gel base* has soft, elastic, and high stability properties (Su'aida *et al.,* 2017). Na-CMC has the functional

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properties of thickener, stabilizer, gel maker and in some cases as an emulsifier (Fujiastuti & Nining., 2015). The use of Natrium CMC as a gel base includes giving a stable viscosity to the formulation (Rowe *et al.,* 2009).

II. METHODS

Tools and Material

The tools used are petri dishes, stirring rods, spatulas, mortars and stamper, measuring cups (PYREX), chemical beakers (BONEX), dropper pipettes, spoon horns, analytical scales, watch glass, jam glass bottles, viscometers (Lamy Rheology), dispersion test glass, adhesion and universal pH test instruments (Merck ph stick).

The ingredients used include essential oils of basil leaves (Ocimum sanctum L.), Na-CMC (Honest), Glycerin 84.5% (Merck), TEA 99% (Merck) and Aquadest..

Antiseptic Gel Preparation

In this study, gel hand sanitizer formulated with basil leaves essential oils with 3 variations of concentration are 3%, 3.5% and 4% which can be seen in Table 1

Table 1. Hand Sanitizer Gel Formulation with Basil Leaf Oil

Ingredients	**Total (%)**		
	F1	**F2**	**F3**
Atsiri Basil Leaf Oil	1	1	1
Na-CMC	3	3,5	4
Metil Paraben	0,18	0,18	0,18
Propil Paraben	0,02	0,02	0,02
Gliserin	15	15	15
Aquadest ad (g)	100	100	100

Na-CMC gelling agent was developed in aquadest and stored for 24 hours. Methyl paraben and propyl paraben are dissolved in glycerin. Then, added to the Na-CMC that has been developed and stirred at high speed until the homogeneous gel. Essential oils in the pipette are added to the gel which has formed little by little and stirred until homogeneous.

Formulation Evaluation

1. Organoleptic Test

   Organoleptic test is done visually by looking at the color, texture and smell of the formula.

2. Homogeneity Test

   Homogeneity testing is carried out on a glass plate. The formula is declared homogeneous if there are no coarse grains in the formula

3. pH Test

PH testing is carried out using universal pH paper dipped in the sample, the changes that occur are matched to universal pH standards. Based on the National Standards Agency (BSNI / BSN / SNI) namely SNI 16-4380-1196 for the pH of human skin that is 4.6-6.5.

4. Viscosity Test

Viscosity test in this study was carried out using a digital viscometer (Lamy Rheology). The viscosity test is carried out by means of 100 mL gel put into a tubular container and then installed a spindle. Then observe the viscosity results on the viscometer screen.

5. Scattering Test

The spread test is done by weighing the gel as much as 1 gram and placed on a glass plate. Then on the glass plate another glass plate is placed without pressure, after which the diameter is measured.

6. Adhesion Test

Adhesion test is carried out by means of 0.25 grams of gel placed on two predetermined glass objects, then pressed with a load of 500g for 5 minutes. After that the glass object is mounted on the test equipment then a load of 65.95 grams is added to the test equipment, then the time of release from the object glass is recorded.

III. RESULT

Organoleptic Test

Table 2. Organoleptic Observation Results

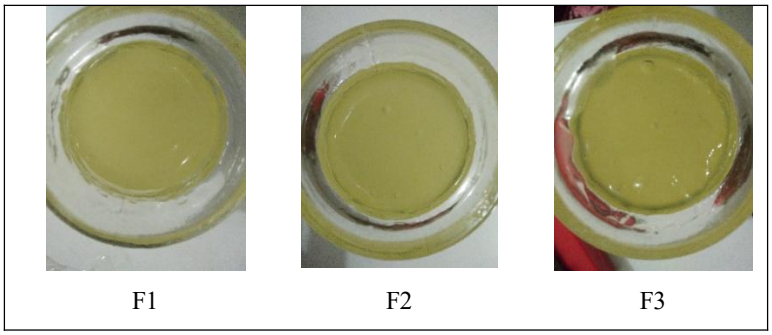
Formula	Concentration	Organoleptic		
		Solid	Color	Smell
F1	3%	Semisolid (+++)	Yellow (+++)	Typical basil
F2	3,5%	Semisolid (++++)	Yellow (++++)	Typical basil
F3	4%	Semisolid (+++++)	Yellow (+++++)	Typical basil

note:

1. (+) – (+++++) shows the higher form of the formula (condensed)

2. (+++++) – (+) show the formula is lower (faded)

Figure 1. Gel *Hand Sanitizer* Basil Leaf Oil



The colors produced with Na-CMC gelling agent produce color changes when adding gelling agent concentration. Concentration of 3% Na-CMC produces slightly faded yellow formula colors, while for concentrations of 3.5% Na-CMC produces brighter colors. At a concentration of 4% the color produced by the preparation is bright yellow. The addition of gelling agent concentration causes the preparation to be brighter, because the Na-CMC gelling agent has a slightly yellowish color so that when adding the essential oil of basil leaves that have a yellow color, the preparation becomes brighter when adding concentration. The odor that is produced from the gel hand sanitizer preparations of basil leaves which is typical basil (Jabarullah, 2019).

Homogeneity Test

Table 3. Result of Observation

Formula	Concentration	Homogeneity
F1	3%	Homogeneous, no coarse grains
F2	3,5%	Homogeneous, no coarse grains
F3	4%	Homogeneous, no coarse grains

Homogeneity test at gel *hand sanitizer* Basil essential oil is (F1), (F2) dan (F3) homogen, no coarse grains

pH Test

PH measurement aims to determine whether the formula can be accepted by the skin or not. This means that the formula must be safe when used on the skin.

Table 4. Result

Formula	Concentration	pH
F1	3%	6
F2	3,5%	6
F3	4%	6

Based on the National Standards Agency (BSNI / BSN / SNI) that range of SNI 16-4380-1196 for human skin pH that is 4.6-6.5. In this study, the pH value in the form of hand sanitizer gel with Na-CMC gelling agent produced a pH value of 6. The pH of Na-CMC was stable because it had a pH of 2-10.

Viscosity Test

The viscosity test aims to measure the magnitude of the viscosity value of the preparation, where the viscosity value is a statement of the resistance of a liquid to flow. If the higher the viscosity, the higher the resistance (Martin et al, 1993). The higher the resistance, the preparation will be thicker and harder to flow. The thickness of the gel must be suitable because it affects the comfort when the preparation is applied.

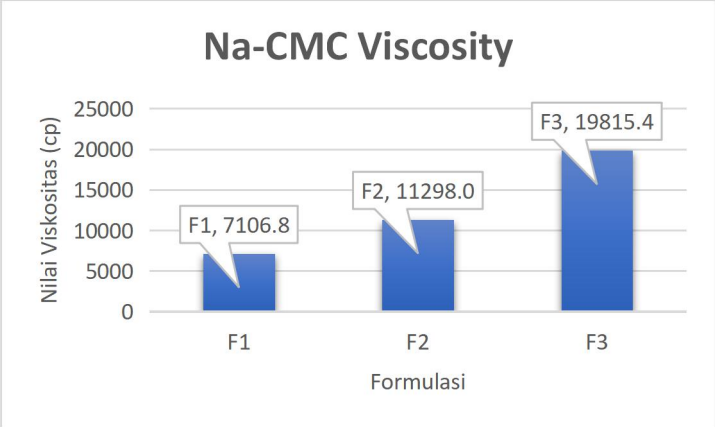


Figure 2. Result of Viscosity

The addition of Na-CMC gelling agent concentration in the formula causes the viscosity value to be even greater. If the higher the concentration of Na-CMC, the higher the value of viscosity because more and more polymers bind. In this study, a hand sanitizer gel formulation of basil leaf essential oil with a Na-CMC gelling agent produced a viscosity value that met the gel formula requirements. This is in accordance with the parameters of the viscosity value for gel preparations based on SNI 16-4380-1996 is 3,000 - 50,000 cps.

Dispersive Ability (spreadability)

Gelling agents greatly affect the physical properties of formulas, one of which is the spread ability. Spreadability is a factor that influences the efficacy of topical therapy in pharmaceutical preparations (Baktiman, 2014) and the extent of spread of the formula when applied to the skin.

Tabel 5. Result of Test

Result (cm)			
Gelling Agent	**Formula**	**Concentration**	**Mean±SD**
NA-CMC	F1	3%	6,72±0,11
	F2	3,5%	6,34±0,14
	F3	4%	5,33±0,16

Testing of spreadability with gelling agents with variations in concentration results in different values of spreadability. The value of the spreadability greatly influences the physical properties of the gel hand sanitizer formula because the spreadability influences the diffusion rate of the active substance through the membrane. If the wider membrane where the formula spreads, the greater the diffusion coefficient that results in drug diffusion is increasing. If the greater the spread of a formula, the better (Hasyim, 2012). In this study, the addition of concentration is very influential on the value of the scattered power produced, the higher the concentration the smaller the spread of power, this is because the addition of concentration causes the matrix formed in the gel preparation will be more dense. In the spread test with Na-CMC (F1), (F2) and (F3) gelling agents are included in the good dispersion category. This is in accordance with the requirements of the dispersion test where the spreadability that is comfortable in use for semisolid preparations ranges from 5-7 cm (Garg, 2002).

Adhesive Test

Test for adhesiveness to determine the ability of the gel when attached to the skin. If the gel is more attached to the skin, the active substances that diffuse in the skin more so that the gel that is used more effectively (Voigt, 1984).

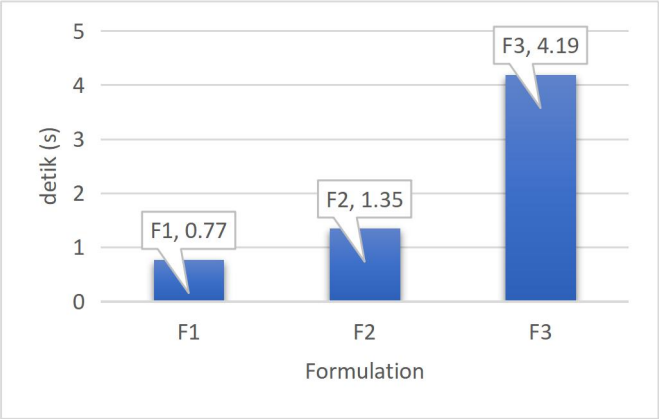


Figure 5. Result of NA-CMC Adesive Test

The value of adhesion is influenced by the concentration of the gelling agent used in the formula. The increase of Na-CMC concentration in the formula causes the value of adhesion to increase. If the greater the concentration of Na-CMC in the formula, the more polymers are bound so that the value of adhesion produced is greater. Adherence requirements on semisolid preparations should be more than 1 second (Zats & Gregory, 1996). In this study, (F2) and (F3) have good adhesion values that are more than 1 second

IV. CONLUSIONS

Based on the analysis that has been done on the formula of the gel hand sanitizer basil essential oil (Ocimum sanctum L.), it can be concluded that the most optimal formulation and meets the physical properties requirements of the Na-CMC gelling agent is (F2) with a concentration of 3.5%. While for (F1) exceeding the standard range of dispersion and (F3) it has a more sticky texture compared to (F1) and (F2) so that for comfortable use (F2) that meets the requirements.

REFERENCE

[1] Afianti, H. P., dan M. Murrukmihadi, 2015, Pengaruh Variasi Kadar Gelling Agent NA-CMC terhadap Sifat Fisik Sediaan gel Ekstrak Etanolik Daun Kemangi (Ocimum basilicum L. Forma citratum Back.), Majalah Farmaseutik, Volume 11 Nomor 2, pg 307-315.

[2] Ande, Baktiman, 2014, Skripsi : Pengaruh Penambahan Konsentrasi Carbopol 940 pada Sediaan Sunscreen Gel Ekstrak Temu Giring (Curcuma heyneana Val.) Terhadap Sifat Fisik dan Stabilitas Sediaan dengan Sorbitol sebagai Humectant, Univeritas Sanata Dharma, Yogyakarta.

[3] Ardana, M., Vebry Aeyni., dan Arsyik, I, 2015, Formulasi dan Optimasi Basis Gel NA-CMC (Hidroxy Propyl Methyl Cellulose) dengan Berbagai Variasi Konsentrasi, J.Top. Pharm. Chem, Volume 3 Nomor 2, pg 102-108.

[4] Damayanti, A.T.R, 2016, Skripsi: Pengaruh Konsentrasi NA-CMC dan Propilen Glikol Terhadap Sifat dan Stabilitas Fisik Sediaan Gel Ekstrak Pegagan (Centella asiatica (L.) Urban), Universitas Sanata Dharma, Yogyakarta.

[5] Fujiastuti, T., dan Nining, S., 2015, Sifat Fisik dan Daya Iritasi Ekstrak Etanol Herba Pegagan (Centella asiatica L.) dengan Variasi Jenis Gelling Agent, Pharmacy Volume 12 Nomor 1, ISSN 1693-3591, pg 11-20.

[6] Garg, A., Aggarwal, D., Garg, S., dan Singla, A.K, 2002, Spreading of Semisolid Formulation, Pharmaceutical Technology, USA, pg 84-104.

[7] Hasyim, N., K.L.Pare., I. Junaid, A. Kurniati, 2012, Formulasi dan uji Efektivitas Gel Luka Bakar Ekstrak Daun Cocor Bebek (Kalanchoe pinnata L.) pada Kelinci (Oryctolagus cuniculus), Majalah Farmasi dan Farmakologi, Volume 16 Nomor 2, pg 89-94.

[8] Jabarullah, N.H. (2019) Production of olefins from syngas over Al_2O_3 supported Ni and Cu nano-catalysts, Petroleum Science and Technology, 37 (4), 382 – 385.

[9] Larasati, D. A., dan Ety, A., 2016, Efek Potensial Daun Kemangi (Ocimum basilicum L.) sebagai Pemanfaatan Hand Sanitizer, Majority (Medical Journal of Lampung University), Volume 5 Nomor 5, pg 124-128.

[10] Martin, A., Swrbrick, J., Cammarata, A, 1993, Physical Pharmacy, Physical Chemical Principles in The Pharmaceutical Science 2 ed 3, diterjemahkan oleh Yoshita, Universitas Indonesia Press, Jakarta.

[11] Maulina, L., dan Nining, S., 2015, Formulasi Gel Ekstrak Etanol Kulit Buah Manggis (Garcinia mangostana L.) dengan Variasi Gelling Agent sebagai Sediaan Luka Bakar, Pharmaçiana, Volume Nomor, pg 43-52.

[12] Rowe, R.C., Sheskey P.J., Quinn M.E, 2009, Handbook of Pharmaceutical Excipients, 6th Ed, The Pharmaceutical Press, London.

[13] Su'aida, N., Destria, I. S., Mia, F., 2017, Optimasi Sediaan Gel Fraksi Etil Asetat Buah Kasturi (Mangifera casturi Kosterm) dengan Kombinasi Basis CMC-Na dan Carbopol Menggunakan Metode Simplex Lattice Design, JCPS (Journal of Current Pharmaceutical Sciences), Volume 1 Nomor 1, ISSN 2598-2095, pg 19-24.

[14] Voigt, R, 1984, Buku Pelajaran Teknologi Farmasi edisi 5, Universitas Gadjah Mada Press, Yogyakarta, pg 560-561.

[15] Zats, J. L., dan G. P. Kushia, 1996, Gel, in Lieberman, H.A., Rieger, M.M., Banker, G.S., Pharmaceutical Dosage Forms: Disperse system Volume 2, pg 400-415, Marcel Dekker Inc, New York.