International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(5): 2383-2385

Received: 09-07-2017
Accepted: 10-08-2017

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Utilization of chitosan as a burn wound healer gel

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Abstract
Utilization of Chitosan As a burn wound healer gel has been done. The objective of this research is to use chitosan as a burn wound healer gel. Gel making is done by dissolving chitosan by using acetic acid then neutralized with NaOH then made gel. The analyzes were organoleptic test, homogeneity, pH and stability test on gel. Based on the results of organoleptic test stated that there is no change of color, odor, and taste, and homogeneity test result does not get the coarse grains, then pH test result also stated that all the s are still within the pH range 5-8 so that the formula meets the requirements.

Keywords: Chitosan, Gel, Burn wound healer

Introduction
Shrimp used as a reliable non-oil commodity exports and is a sea biota of high economic value. Shrimp in Indonesia are generally exported abroad after disposal of head, tail, and shell. This shrimp waste can pollute the environment so it needs to be utilized. Based on various studies that have been done this shrimp waste has considerable potential as a producer of chitin (Synowiecky and Al-Khateeb, 2003) [11].
Chitin is a polysaccharide that can be degraded and non-toxic, so widely used in various fields. Chitin content of shrimp waste consisting of (head, shell and tail) reaches 50% of shrimp weight. Shrimp shell waste contains three main components: protein (25-44%), calcium carbonate (45-50%), and chitin (15-20%) (Sugita, *et al*., 2009) [10]. Chitosan as a polymer composed of 2-amino-2-deoxy-β-D-glucose can be obtained by altering the acetamide group (-$NHCOCH_3$) in chitin into an amine group (-NH_2). Thus the release of acetyl groups on chitin acetamide produces deacetylated amine groups.
Chitosan has been known as an additive in the drug , as a soft and clean moisturizing material and contact lens manufacture. Chitosan can lower cholesterol based on its ability to bind to fat. Chitosan has an active group that can inhibit the growth of microbes (preservatives), accelerate healing burns, wounds/gangrene diabetics. Microbial growth (preservative), accelerate the healing of burns, wounds/gangrene of diabetics (Hargono and Sumantri, 2008) [4].
Burns are a form of injury to the body by fire, hot objects, such as hot iron, and radiation heat. In terms of medicology, other injuries including burns are caused by lightning strikes, electric shock, X-rays, and corrosive materials. Skin with burns will be damaged in the epidermis, dermis and subcutaneous tissue, depending on the factors and duration of contact with the heat source. The depth of the burn will affect the damage or disruption of cell death. Burns will result not only damage to the skin, but also greatly affect the entire system of the patient's body. In patients with large burns (major), the body is no longer able to compensate, resulting in various complications that require special treatment.
Chitosan of shrimp shell to heal burns can be facilitated by making it in gel. Generally a gel is a clear and translucent semisolid containing active substances in a non-sticky solvent and has an aesthetic value (Madan and Singh, 2010) [7]. Hydrogels are commonly used for the treatment of wounds. GAGs-hydrogel coating serves to keep wounds from bacterial infections and controls water evaporation and oxygen permeability and carbon dioxide, while also contributing to accelerate wound healing (Im and Kim, 2009) [6]. Based on the description of the background, the researchers are interested to use chitosan as a burn gel.

Method
Tools and Materials
The tools used in this research are: glass tools, stirrer, stamp and stamfer, spindles, spatula, hot plate, 2 cm diameter metal plate, scissor, razor, syringe, magnetic stirer, thermometer, plastic

pot and pH-meter digital (ATC). The materials used in this study were: Chitosan, glacial acetic acid (Merck), NaOH (Merck), Na-CMC, glycerin, and nipagin.

Procedure

Making of Chitosan Solution

In weigh chitosan as much as 1.5; 2; 2.5 grams and then dissolved with 100 ml glacial acetic acid 1% in 250 ml beaker glass, stirred with sterile magnet until dissolved and neutralized with 3.5% NaOH

Making of gel

The basic gel making formula at Ditjen POM 1979, as follows:

R/	Na-CMC	4 g
Glycerin		15 g
Methyl paraben		0,17 g
Distilled water add		100 ml

The basic gel was done by weighing all the ingredients, then measuring 80 ml of distilled water which had been heated to boiling, and then sprinkled with 4 g of disseminated Na-CMC, then the mortar was closed and kept in the dark for 30 minutes. Methyl parabens of 0.17 g were dissolved in 20 ml of distilled water which had previously been boiled. After 30 minutes, the Na-CMC was crushed to homogeneity and the mass became transparent, and then added a solution of methyl paraben and in homogenous. Then, add glycerin that has been weighed 15 g and crushed to homogeneous gel. After the gel base is formed, the base of the gel and chitosan is weighed according to concentration and the repeat within the homogeneous.

Evaluation of gel

Evaluation of gel included organoleptic test, homogeneity, and Determination of pH for 12 weeks (Herdiana, 2007) [5].

Organoleptic test

Done by observing the gel of the form, smell, and color of the (Anief, 1997) [1]. Done by: certain s applied to transparent glass (glass object), polishing using glass deck. The should show a homogeneous arrangement and do not appear to be coarse grains (Ditjen POM, 1979) [3].

Determination of pH

Determination of pH of the using pH meter. The pH meter is calibrated using buffer solution of pH 7 and pH 4. As much as 1 gram of to be examined is diluted with distilled water up to 10 ml. The pH meter electrode is immersed in the tested solution, the pH meter needle is allowed to move until it shows a fixed position, the indicated pH is recorded (Suardi and Dita, 2008) [9].

Stability Test

Cycling Test

Procedures: The gel sample is stored at 4 °C for 24 hours, then transferred into an oven of 40±2° C for 24 hours (one cycle). The test was performed 6 cycles then the physical condition of the cream compared during the experiments with the previous (Maulina, 2011) [8].

Result and Discussion

Result of Gel evaluation

The active ingredient used in this gel is chitosan, with additional ingredients are Na-CMC, glycerin, methyl paraben, and aquadest. In the of this gel is made of 3 formulas, the first stage is made by 4 formulas by changing the concentration of chitosan or active ingredients and selected an effective and stable formula, after the gel performed physical evaluation with test parameters include organoleptic observation, homogeneity, pH measurement, The physical stability test of the gel was carried out at a temperature of 40° C, room temperature, the observation was done on the 0 until the 3rd week.

The gel formulation of the formula 1-3 was selected an effective formula, then proceeded to formula 4, ie in the absence of chitosan. Each formula is stored in one of the accelerated stability testing conditions. An effective and stable formula is formula 2, after which it is continued to the next formula.

This test is performed to determine the stability of the stock after being stored. This accelerated stability test can be carried out at temperatures of 25, 40, 60, and 70° C, in line with Wardiyah, 2015. In this study gel that available stored at room temperature and temperature of 40° C. The choice of room temperature and 40° C due to temperature above 40° C is feared will affect the stability of the stock, this is because at the temperature of 40° C, the semi-solid base has begun to melt. Therefore, if the supply is stored at a temperature above 40° C., the gel will experience instability from the beginning of storage.

The results of organoleptic test of gel

The results of organoleptic test of gel in this study can be seen in Table 4.1

Table 4. 1: The results of organoleptic test of gel (Room temperature)

Evaluation	Gel	Observation (week)			
		0	1	2	3
Smell	A	S	S	S	S
	B	S	S	S	S
	C	S	S	S	S
	D	-	-	-	-
Shape	A	Sm	Sm	Sm	Sm
	B	Sm	Sm	Sm	Sm
	C	Sm	Sm	Sm	Sm
	D	Sm	Sm	Sm	Sm
Color	A	Y	Y	Y	Y
	B	Y	Y	Y	Y
	C	Y	Y	Y	Y
	D	-	-	-	-
Homogeneity	A	H	H	H	H
	B	H	H	H	H
	C	H	H	H	H
	D	H	H	H	H

Information

A	:	Chitosan 0,225%	H	:	Homogenous
B	:	Chitosan 0,300%	Y	:	Yellowish
C	:	Chitosan 0,375%	S	:	Specific
D	:	Blanco	Sm	:	Semisolid

Table 4.1 shows the results of evaluation of organoleptic gel from shrimp chitosan, odor, shape, and color of gel, obtained good result, no change, smell, shape, and color of cream from week 0 to week the 3rd.

Results of the Homogeneity Test

The Results of the homogeneity test from gel showed that no coarse granules were obtained, it is indicating that the resulting gel was homogeneous physically and showed the gel

materials used in the solvated and completely mixed formulations.

Results of pH Measurement

The pH of the gel is determined by using pH meter. From the research conducted the results of pH measurement of gel can be seen in Table 4.2.

Tabel 4.2: The results of pH measurement of gel (on storage 0-3 weeks)

No	Formula Gel	Average of pH	
		0 week	3 week
1	A	5.80	5.90
2	B	5.83	5.90
3	C	5.83	5.95
4	D	5.95	6.06

Table 4.2 showed that the results of the pH of gel at 0 and 3 weeks on average in terms of the pH range in the gel formula, in line with the previous research Wulandari, 2016. According to Balsam and Sagarin (1972) [2], pH for gel and body is 5-8, so the formula at Table 4.2 qualifies pH for the gel and does not irritate the skin.

The Result of Temperature Stability Test

The result of temperature stability test, observed organoleptis test, phase separation and observation of pH change on 0 and 3 week at room temperature and temperature 40 ° C. The result of gel temperature stability test in this research can be seen in Table 4.3 and 4.4.

Table 4.3: Results of observation Stability Temperature on 0 week

Gel	Observation				
	Color		pH		Homogeneity
	25°C	40°C	25°C	40°C	25 and 40°C
A	Yellowish	Yellowish	5.6	5.7	Homogenous
B	Yellowish	Yellowish	5.7	5.7	Homogenous
C	Yellowish	Yellowish	5.8	5.9	Homogenous
D	Colorless	Colorless	5.7	5.9	-

Table 4.4: Results of observation Stability Temperature on 3 weeks

Gel	Observation				
	Color		pH		Homogeneity
	25°C	40°C	25°C	40°C	25 and 40°C
A	Yellowish	Yellowish	5.6	5.7	Homogenous
B	Yellowish	Yellowish	5.7	5.7	Homogenous
C	Yellowish	Yellowish	5.8	5.9	Homogenous
D	Colorless	Colorless	5.7	5.9	-

Tables 4.3 and 4.4 show the results of initial organoleptic examination did not show any color difference in all gel s. The four s have a clear yellowish color (except blanco). The gel formula (A-C) produced does not cause odor, has a soft texture and forms a semi-solid consistency.

Stability test results at different storage temperatures at room temperature and 40 ° C indicated that the A-C gel did not cause a rancid odor. Changes in odor or rancidity can be caused by oxygen from the air that oxidizes fats or oils, besides light is one of the catalysts that can also cause oxidation reactions, so it can be concluded that the oil phase contained in the gel does not experience oxidation.

The results of the stability test on 3 weeks storage showed that all gel s at room temperature did not cause discoloration, this indicated the stability of the gel. The color change occurs in the gel s of Formula A, B, C, and also shows changes in texture at storage at 40 ° C which shows the color change to yellowish, it can be concluded that the temperature factor affects the stability of the gel, because it is caused at every temperature increase of 10 ° C can increase the reaction rate to two times.

The pH values of all s indicate that they are within the pH range for hand and body gel s 5-8, so the above formula satisfies the pH requirement for the gel and does not irritate the skin. All of the gel s showed no phase change and were still in the pH range of skin so that they were still safe to use on the skin, indicating that all gel s were stable in storage.

Conclusion

Based on the research that has been done, it can be concluded that the gel obtained good. This can be seen from the results of the gel homogeneity test showed the formulation of dissolved and mixed perfectly. The measurement results of pH gel that has been qualified in the making of the gel so that the gel can be applied for burn wound healer.

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