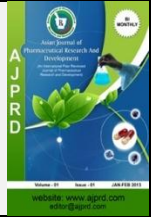


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Research Article

# Hydrogel Activity Test from Kirinyu Leaf Ethanol Extract (*Chromolaena odorata* (L.) R. King & H. Rob) and Combination of Kirinyu Leaf Ethanol Extract with Collagen as a Healing Wound Excision.

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### ABSTRACT

**Objective:** The purpose of this study was to determine the activity of the kirinyu leaf ethanol extract hydrogel preparation and the combination of the kirinyu leaf ethanol extract with collagen as a healing wound excision.

**Method:** This research is experimental, where the ethanol extracts of Kirinyu leaves and collagen are formulated in the form of hydrogel preparations and tested on the healing of excision wounds in rats. Testing wound healing activities were divided into 6 groups. The Group 1 (negative control) were given hydrogel base without Kirinyu leaf ethanol extract in combination with collagen, group 2 (positive control) were given Octenilin®gel, groups 3 and 4, were given hydrogel of Kirinyu leaf ethanol extract while groups 5 and 6 were given hydrogel extract of kirinyu leaves combined with collagen.

**Result:** The results of percent reduction in wound diameter showed that groups 3 and 4 gave significant differences compared to group 1 which began to be seen on the 10th day ( $p < 0.05$ ). While groups 5 and 6 gave significant differences that began to be seen on the 8th day ( $p < 0.05$ ).

**Conclusion:** Hydrogel preparation in group 6 has the most potential in healing excision wounds.

**Keywords:** Kirinyu leaf, collagen, hydrogel, excision wound.

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### INTRODUCTION

Injury is a disorder or damage from the integrity of the skin. One type of wound is an excision wound, which is the loss of skin as a whole and is widespread, causing a large amount of tissue to be lost<sup>1</sup>. Kirinyu leaves contain several main compounds such as tannins, phenols, flavonoids, saponins and steroids. Tannins and flavonoids are one of the compounds contained in the leaves of Kirinyu which can accelerate the process of wound healing due to its efficacy as an astringent, which has a role in shrinking wounds and increasing the rate of epithelialization. Flavonoids and saponins also have the ability as a cleanser and antiseptic that functions to kill or prevent the growth of microorganisms that commonly occur in wounds so that the wound does not experience severe infections<sup>2-3</sup>. Collagen is a fibrous protein that gives strength and flexibility to tissues and bones and

plays an important role for other tissues, including the skin and tendons. This compound is the main protein that makes up the extracellular matrix component<sup>4</sup>.

Hydrogels are semisolid preparations formed by hydrophilic tissue. Hydrogel is ideally used as a wound cover material because it can help remove dead tissue. Hydrogels are able to absorb water or biological fluids so that the wound area becomes dry and is able to provide a cold feeling to the skin caused by the slow evaporation of water so as to reduce swelling around the wound so that it will speed up the wound healing process<sup>5-6</sup>.

### MATERIALS AND METHODS

#### Plant and Chemical Material

Kirinyu leaves were obtained from Aceh (Indonesia), Collagen, Ethanol, Carbopol 940, Na-CMC, Propylen glycol, Triethanolamine, Glycerin, Distilled Water.

### Preparation of Extracts

Making extracts is done by maceration. 500 g of simplicia powder soaked with 70% alcohol for 6 hours while stirring occasionally. Then let stand for 18 hours. Separate maserat by filtering. Repeat the search process twice with the same type and amount of solvent. Furthermore, all maserates are collected, then evaporated with a rotary evaporator at  $\pm 50^{\circ}\text{C}$  until a thick extract is obtained.

### Formulation of Hydrogel

The process of making hydrogel begins with the development of carbopol and Na-CMC in 20 ml distilled

water. then stir until homogeneous. Add glycerin and propylenglycol and complete triethanolamine while stirring constantly and add distilled water. Then add thick extract with various concentrations that have been dissolved into 2 ml of distilled water to produce hydrogel ethanolic extract of kirinyu leaf and add ethanol extract of kirinyu leaf and collagen powder which has been dissolved into 1 ml of 0.5 M acetic acid to produce hydrogel ethanol extract Kirinyu leaf combination with collagen. The percentage of the ingredients of hydrogel formula (Table 1) was modified from the hydrogel formula which was carried out in the previous study by Edy, et al<sup>6</sup>.

**Table 1:** Hydrogel formulation of kirinyu leaf ethanol extract and combination of kirinyu leaf ethanol extract with collagen.

Composition of Hydrogel	Formulation (%)				
	F0	F1	F2	F1K	F2K
Extract	-	3	5	3	5
Collagen	-	-	-	1	1
Carbopol 940	1	1	1	1	1
Na-CMC	1	1	1	1	1
Propylen glycol	2	2	2	2	2
Triethanolamine	1	1	1	1	1
Glycerin	12,5	12,5	12,5	12,5	12,5
Distilled Water ad	100	100	100	100	100

### Physical Evaluation of Hydrogel

Physical evaluation of the preparation includes organoleptic, homogeneity, pH measurement and viscosity of the preparation. Stability test is carried out for 90 days.

### Experimental Animal

The experimental animals used in this study were male Wistar strain rats (*Rattus Norvegicus*) weighing 200-250 g. The experimental protocol was approved by the Institutional Animal Ethics Committee.

### Wound Making for Test Animals

The rats were acclimatized for 7 days, then anesthetized using ketamine HCl, then the hair was shaved on the back of the rat to be made wound then cleaned with cotton that was given 70% alcohol. The wound pattern is made in a circle with a 20 mm diameter. Then made a wound with the size of a sign that has been made in the form of a circle on the back by lifting the skin of test animals with tweezers then cut with surgical scissors<sup>7</sup>. Mice will be divided into 6 groups, namely group 1 treated with a hydrogel base, group 2 treated with Octenilin<sup>®</sup>gel, group 3 treated with Kirinyu leaf ethanol extract hydrogel 3%, group 4 treated with Kirinyu leaf ethanol extract hydrogel, group 5 treated with Kirinyu leaf ethanol extract hydrogel

3% combination of 1% collagen combination and group 6 treated with Kirinyu leaf ethanol extract hydrogel 5% combination of 1% collagen.

## RESULTS AND DISCUSSION

### Organoleptic test

Organoleptic examination results of hydrogel preparations are form and consistency which is updated for 90 days. Hydrogel preparations of Kirinyu leaf ethanol extract combined with collagen produce a brown color and a characteristic smell of Kirinyu leaves.

### Homogeneity test

Homogeneity examination showed that all preparations were homogeneous.

### pH measurement

The pH determination of the hydrogel preparation is carried out using a pH meter for 90 days. The differences in the pH of the preparations are caused by differences in the concentration of the Kirinyu leaf extract contained in the formula. The pH criteria for skin preparations are at a pH interval of 4.5 - 6.5<sup>8</sup>. Table 2 shows the results of the pH values from the four formulas for 90 days at room temperature.

**Table 2:** The results of pH measurements of hydrogel

Formulation	pH					
	0 Days	7 Days	14 Days	21 Days	28 Days	90 Days
F0	6,3	6,3	6,3	6,3	6,3	6,3
F1	6,3	6,3	6,3	6,3	6,2	5,9
F2	6,1	6,1	6,1	6,1	6,0	5,4
F1K	5,8	5,8	5,8	5,8	5,7	5,3
F2K	5,7	5,7	5,7	5,7	5,5	4,8

## Viscosity test

The results of determining the hydrogel viscosity were carried out using a NDJ-8S viscometer on all preparations. Viscosity testing aims to determine the viscosity value of

a substance. Good viscosity of hydrogel preparation is 50-150 dPa.s<sup>9</sup>. Table 3 shows the results of the viscosity values of the four formulas for 90 days at room temperature.

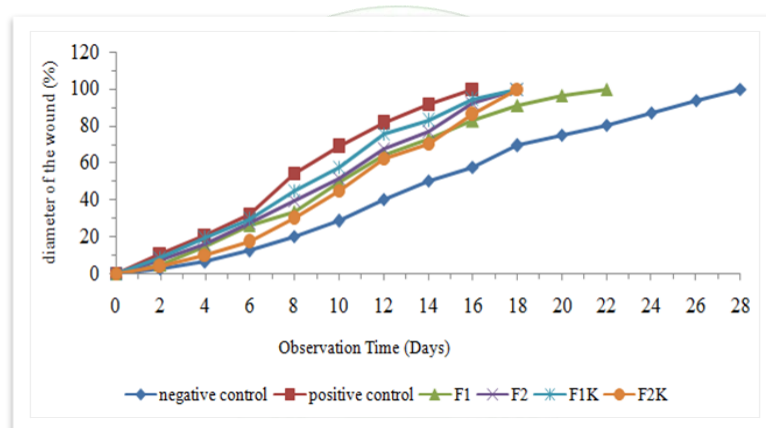
**Table 3:** The results of viscosity measurements of hydrogel

Formulation	Viscosity (dPa.s)					
	0 Days	7 Days	14 Days	21 Days	28 Days	90 Days
F0	99,9	99,9	99,9	99,9	99,9	99,9
F1	99,9	99,9	99,9	99,9	99,9	99,9
F2	99,9	99,9	99,9	99,9	95,1	70,8
F1K	99,9	99,9	99,9	99,9	99,9	70,2
F2K	99,9	99,9	99,9	96,4	85,3	63,4

## Percentage of wound diameter reduction

Test results on excision wound testing were analyzed using the SPSS program 25, One Way ANOVA method. Group 1 shows the percentage of wound diameter shrinkage of 100% on the 28<sup>th</sup> day. Group 2 shows the

percentage of wound diameter shrinkage of 100% on the 16<sup>th</sup> day. Groups 4, 5 and 6 show the percentage of wound diameter shrinkage of 100% on the 18<sup>th</sup> day. In group 3 the percentage diameter of 100% shrinkage on the 21st day on the new graph is seen on the 22nd day.



**Figure 1:** Graph of percentage reduction in wound diameter in each group observed on the day of observation

The results of statistical analysis showed that the group given hydrogel ethanol extract of kirinyu leaf gave a significant difference compared to the group given hydrogel without ethanol extract of kirinyu leaf which began to be seen on the 10th day ( $p < 0.05$ ). The group that was given hydrogel ethanol extract of kirinyu leaf with collagen also gave a significant difference with the group that was given hydrogel without ethanol extract of kirinyu leaf which began to be seen on the 8th day ( $p < 0.05$ ).

## CONCLUSION

Hydrogel preparation of 5% kirinyu leaf ethanol extract with the addition of 1% collagen has the greatest potential in wound healing.

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