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UTILIZATION OF WATER EXTRACT OF YELLOW POTATO (SOLANUM TUBEROSUM L.) IN HYDROGEL EYE MASK AS ANTI-AGING FORMULATION

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The thinness and sensitivity of the skin in the area under the eyes cause the skin in this area to easily show signs of aging. Hydrogel masks contain quite a lot of water, so during use this mask will moisturize the skin longer. A hydrogel eye mask containing yellow potato tuber water extract is used for the prevention of premature aging, especially under the eyes.

The purpose of this study *was to determine whether hydrogel eye mask preparations containing water extract of yellow potato tubers can provide an anti-aging effect.*

Material and methods. *The yellow potato tuber water extract was screened for phytochemicals, then formulated into a hydrogel eye mask with a concentration of 0.25 %, 0.5 %, and 1 %. Evaluation of the hydrogel eye mask preparation includes organoleptic, weight, thickness, pH test, tensile test, swelling power, shrinkage, stability, cycling test, hedonic test, and anti-aging. Anti-aging parameters measured include moisture, pores, blemishes, and wrinkles. The treatment was carried out for four weeks by applying the mask twice a week.*

Results. *The results showed that all hydrogel eye mask formulas were stable during storage and cycling tests. All formulas meet pH values, shrinkage, elasticity, swellability, and irritation tests. The hedonic test on volunteers shows the most preferred concentration of 1 %. The results of the anti-aging effectiveness test of the best hydrogel eye mask preparation is a concentration of 1 % with an increase in humidity of 27 %, a decrease in pores of 35.8 %, blemishes of 40 %, and wrinkles of 37.6*

Conclusion*. That the different concentrations of each formula showed different anti-aging activities and the best formula was 1 % with moisture values of 27 %, pore values of 35.8 %, blemishes of 40 %, and wrinkles values of 37.6 %, which indicated anti-aging activity*

Keywords *water extract, anti-aging, yellow potato tuber, hydrogel eye mask, solanum tuberosum L., pore, wrinkle, moisture, spot, shrinkage*

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1. Introduction

Aging is a natural process in human life [1]. Along with increasing age, all aspects of our body show the effects of aging. These changes occur naturally. Exposure to UV light results in the formation of free radicals from ROS (Radical Oxygen Species) which trigger chain reactions, resulting in damage to cell components such as fats, proteins and nucleic acids [2].

Aging could be seen from seven main signs such as fine lines and wrinkles, changes in skin colour and texture, dull skin surface, visible pores, blotches, age spots and dryness. Among all these signs, the appearance of fine lines and wrinkles on the skin is the most common sign of aging [3]. The periorbital area is often one of the first areas to show signs of aging [4]. Although this condition is not physically harmful, it has various psychosocial and functional effects. Common impressions related to periorbital aging are looking tired, sad, or angry [5].

One of the natural ingredients that is empirically used by the public as eye compresses is yellow potatoes [6]. Vitamin C and flavonoids are chemical compounds present in potatoes that have antioxidant activity. Vitamin C can function as an oxygen scavenger by transferring hydrogen atoms to oxygen so that oxygen is not available for subsequent reactions [7, 8].

Ginting et al research (2020) found that the use of clay masks with 10 % potato extract for 4 weeks showed changes in skin condition for the better with an increase in water content (45.2 %), smaller pores (8 %), an increase in smoothness (31.9 %), reduction of blemishes (57.37 %) and wrinkles (41.8 %) [9]. Research by Lemba Ariane P. (2010) found that yellow potatoes with water solvent provided higher antioxidant activity than yellow potatoes with methanol solvent [10]. From the description above, researchers are interested in making a hydrogel eye mask formulation from yellow potato water extract as an anti-aging [11].

2. Planning (methodology) of research

Potatoes, which are commonly used as food, have a fairly high-water content and contain compounds that could provide an anti-aging effect. Yellow potatoes were extracted with water and then carried out a phytochemi-

cal screening examination to determine the content of metabolites contained in the extract. It was then formulated in the form of a hydrogel eye mask to help slow premature aging with several formulas designed, namely Formula I (0.25 **%**), Formula 2 (0.5 **%**), and Formula III (1 **%**). including homogeneity, organoleptic, stability, pH, dispersion, and cycling tests. And the effectiveness of anti-aging was tested with the observed parameters, namely moisture, pores, wrinkles, and blemishes, using a skin analyzer.

3. Methodology of the research

Types of research.

The type of research used in this study is the method:

a) descriptive survey.

This research was conducted on a group of volunteers to make an assessment of the preparations made; in this case a descriptive survey was used in the hedonic test (preferred test) of the hydrogel eye mask preparation of yellow potato tuber water extract;

b) experimental.

Volunteer.

The selection of volunteers based on inclusion criteria included women aged around 20–35 years, examined in a relaxed state using a skin analyzer, had signs of premature aging, had no history of skin allergies and had been conditioned not to use other preparations for 4 weeks for anti-inflammatory therapy. Volunteers are willing to take part in the research to completion and are willing to do an irritation test and test the effectiveness of the hydrogel eye mask preparation as an anti-aging during the research [12].

Yellow Potato Water Condensed Extract Preparation.

The yellow potatoes were cleaned of adhering dirt, then washed with running water until clean, separated from the skin, weighed, and recorded as wet weight. Next, sliced yellow potatoes, blended to smooth condition, and added some distilled water. The mashed potatoes are then squeezed and filtered to obtain potato juice. Potato juice is poured into a baking dish and dried at 40 °C for 2 days to obtain a thick extract of yellow potato tuber water.

Phytochemical Screening.

Alkaloid.

Add 0.5 grams of yellow potato water extract into Erlenmeyer, add 1 ml of 2N HCl and 9 ml of distilled water then shake. Then divided into 3 test tubes:

a) tube I was dripped with Bouchardart's reagent, if a brown precipitate was formed, it was positive for alkaloids;

b) tube II was dripped with Maeyer's reagent, if a yellowish white precipitate was formed, it was positive that it contained alkaloids;

c) tube III is dripped with Dragendorph's reagent, if an orange precipitate is formed, it is positive that it contains alkaloids.

Tannin.

The yellow potato water extract is put in a test tube, then 5 % $FeCl_3$ is added, if a dark black solution is formed, it is positive for tannins.

Saponin.

The yellow potato water extract was put into a test tube, added with distilled water, then shaken for ±10 minutes, observed for the foam formed and then added 2N HCl, shaken again for ±10 minutes. If a solid foam/foam is formed as high as 1–10 cm which is stable and does not disappear within ±10 minutes, it contains saponins.

Flavonoid.

The yellow potato water extract was put into a test tube, added with hot water and then filtered. The filtrate was added 0.1 gram of Mg powder and 1 ml of concentrated HCl and 2 ml of amyl alcohol. Shake and let separate. Formation of pink/orange colour means positive for flavonoids.

Triterpenoid.

Yellow potato water extract was spotted on the TLC plate, then fixed with 1 % $CeSO_4$ then heated on a Hot Plate for ±1 minute, if there is a red or orange colour change, it is positive for terpenoids [8].

Hydrogel Eye Mask Preparation.

The hydrogel eye mask preparation was followed by the Table 1 formula, with the modification formula in Table 2. According to the research of Okwani et al. (2020), formulation of hydrogel eye mask using the composition of Na-Alginate, Xanthan gum, Propylene glycol, Glycerin, Sodium metabisulfite, methyl paraben, propyl paraben, and essence as a basis for hydrogel eye mask, which is used as a reference with slight modifications, the difference in active substances, in previously research used ethanol extract of shrimp heads, this study used water extract from yellow potatoes. The steps of the processing are as follows: 100 ml of distilled water was mixed with sodium alginate in a homogenizer (IKA*RW 20 digital) at 1800 rpm for 60 minutes. The mixture was then left to sit for 72 hours (hydrogel basis). The gel was stirred again with a homogenizer for 30 minutes. Xanthan Gum is dissolved in distilled water, then glycerin is added to it. Incorporated into a gel base preparation. Sodium metabisulfite was dissolved in distilled water, added the active ingredient according to the formula, then put into a gel base preparation. Propyl paraben and methyl paraben were added to the gel base, dissolved in Propylene glycol. Glucono Delta Lactone is dissolved in hot water and made up to 100 grams, then homogenized for 30 minutes, poured into a hydrogel mask mold, dried for 3 days in an oven at 40 °C (Table 1).

Table 1

Hydrogel eye mask formula [13]

Ingredients	Formula (%b/b)
Extract	0.10
Sodium alginate	3.00
Xanthan gum	0.50
Propylene glycol	2.50
Glycerin	5.00
Sodium metabisulfite	0.02
Methyl paraben	0.20
Propyl paraben	0.10
Fruit essence	0.06
Distilled water	88.72

Table 2

Modification formula of hydrogel eye mask

Ingredients	Formula I	Formula II	Formula III
Yellow potato water extract	0.25 %	0.5 %	1 %
Sodium alginate	3.00	3.00	3.00
Xanthan gum	0.50	0.50	0.50
Propylene glycol	2.50	2.50	2.50
Glycerin	500	500	500
Sodium metabisulfite	0.02	0.02	0.02
Methyl paraben	0,20	0,20	0,20
Propyl paraben	0.10	0.10	0.10
Fruit essence	0.06	0.06	0.06
Aqua purificata	Ad 100 ml	Ad 100 ml	Ad 100 ml

Hydrogel Eye Mask Packaging

The hydrogel mask sheet was sterilized by autoclaving at 121 °*C* for 30 *min*utes and the mask sheet was left to stand at 30 °*C*. Then the packaging is done in a Laminar Air Cabinet (LAC), masks are packaged in foil bags. Sealed foil bag with sealing device.

Evaluation of Hydrogel Eye Mask.

Organoleptic.

The preparations were observed visually by observing changes in shape, colour and odour of the preparations carried out for 12 weeks.

Hydrogel Eye Mask Weight and Size.

The weight of the preparation was carried out by weighing the preparation using a digital scale and the thickness of the mask was carried out by cutting a sheet with a size of 2.5×2.5 *cm* then measured using a micrometer screw.

pH.

The hydrogel mask was allowed to swell for 2 hours in 100 *ml* of distilled water in the container and the surface pH was measured using a pH meter. Measurements were repeated three times and the average value was obtained. Measurements were carried out every week for 12 weeks.

Elasticity level.

The hydrogel mask preparation was cut to a length of 11×2.5 *cm*, and then the preparation was pulled manually. Strength using a weak pull, the time for the preparation to break/tear is calculated using a stopwatch to see the time for the preparation to break/tear. Tensile strength and elasticity are calculated from the measurement value using the following formula:

$$\text{Elasticity level} = \frac{\text{Lenght after withdraval} - \text{Lenght before withdrava}}{\text{Lenght after withdraval}} \times 100\ \%.$$

Expansion power.

The dry preparation was weighed (dry weight), then immersed in 10 ml 0.9 % NaCl solution for 30 minutes (wet weight). The preparation was dried from an unabsorbed 0.9 % NaCl solution with absorbent paper, then weighed to determine the weight after soaking [14]. The dosage weight is calculated by the following equation:

$$\text{Expansion power} = \frac{\text{Wet Weigth} - \text{Dry Weigth}}{\text{Wet Weigth}} \times 100\ \%.$$

Shrinkage time.

The hydrogel mask was cut into square pieces with an area of 4 cm^2 and weighed. The test was carried out at room temperature for 12 weeks. The shrinkage that occurred in the area (cm^2) and the weight (gr) of the preparation were recorded every week.

Storage stability.

Samples were stored at low temperature (4±2 °C), room temperature (20–25 °C) and high temperature (40±2 °C) in the freezer for 12 weeks, then organoleptic observations (change in colour, odour, shape) [9].

Irritation test.

The irritation test was carried out using a patch test technique, namely a preventive patch which was carried out by attaching the preparation with the highest concentration of the active substance (F3) to the back of the right ear and the back of the left ear for a blank (F0) as a comparison. Safety test was conducted for 24 hours for each volunteer. The volunteers who were used as panels in the irritation test were 12 people, with the following criteria:

1. Healthy women.
2. Age between 20–35 years old.
3. There is no history of disease related to allergies.
4. Willing to volunteer for irritation test.
5. Volunteers are the closest people and are often around the test so it is easier to monitor and observe if there is a reaction that occurs on the skin being tested [12].

Hedonic test.

The hedonic test was carried out by analyzing according to the preference test (parameters of aroma, sensation on the skin and colour of the preparation) using 20 panellists who were given an example of a hydrogel eye mask preparation. To see the level of respondents' preference for cream preparations based on each parameter, a numerical scale is used, namely 1 (dislike very much), 2 (dislikes), 3 (neutral), 4 (likes), 5 (very like) [15].

Anti-aging Effectiveness Test.

Anti-aging effectiveness testing was conducted on 20 female volunteers. The test is carried out on the facial skin area. Grouping is divided into:

a) group I: 5 volunteers for the blank formula (without active ingredients);

b) group II: 5 volunteers for the 0.25 % yellow potato tuber water extract formula;

c) group III: 5 volunteers for 0.5 % yellow potato tuber water extract formula;

d) group IV: 5 volunteers for 1 % yellow potato tuber water extract formula.

All volunteers were first measured the initial skin condition/before treatment with a skin analyzer device. The measurement parameters include moisture, fineness, pores, blemishes, and wrinkles. The hydrogel eye mask preparation was placed under the volunteer's eye area which was left for 20 minutes. After that, the hy-

drogel eye mask was removed and allowed to stand for 5 minutes so that the remaining preparations could be absorbed. Re-checked the condition of the facial skin after use. Measurement of facial skin condition is carried out every week for four weeks using a skin analyzer tool by giving masks twice a week on a regular basis.

Bioethics.

All research were approved by the Ethics Committee of Universitas Sumatera Utara No. 1023/KEP/USU/2021

Data analysis.

The research data were analyzed using the SPSS (Statistical Product and Service Solution) v.22. The data were analyzed using one-way ANOVA to determine whether there were differences in anti-aging effectiveness between formulas, then followed by posthoc LSD to determine which formula had a significant effect as anti-aging.

4. Result

Phytochemical Screening.

Phytochemical screening is carried out to identify the content of secondary metabolites of a natural material. Secondary metabolites contained in the water extract of yellow potato tubers include alkaloids, saponins, flavonoids, and triterpenoids. The results of the phytochemical screening test could be seen in Table 3. In this study, the secondary metabolites that are expected to be extracted are flavonoids.

Table 3

Phytochemical Screening Results of Yellow Potato Bulbs Water Extract

No.	Secondary Metabolites	Reagents	Observation	Result
1	Alkaloids	Meyer	White precipitate	+
		Dragendorff	Limpid	–
		Bouchart	Chocolate precipitate	+
2	Tannin	Air panas+$FeCl_3$ 10 %	Chocolate color	–
3	Saponin	Hot water+HCl 2N	Stable foam	+
4	Flavonoids	HCl(p)+Mg Powder	Orange color	+
5	Triterpen/ Steroid	Liberman-burchat	Green color	+

Note: + – Positive result; – – Negative result

Evaluation.

Organoleptic Observation.

Organoleptic observation of the result can be seen in Table 4. That showed the colour, odour, thickness, and weight of various formulas among hydrogel eye masks without extract, formula with 0.25 %, 0.5 %, and 1 % of extract.

Table 4

Organoleptic result

Formula	Time (week)	Colour	Odour	Thickness (mm)	Weight (g)
Hydrogel eye mask without extract	0	Transparent Yellow	Specific	0.10	1.09
	4	Transparent Yellow	Specific	0.10	1.09
	8	Transparent Yellow	Specific	0.10	1.09
	12	Transparent Yellow	Specific	0.10	1.09
Hydrogel eye mask yellow potato tuber extract 0.25 %	0	Transparent Yellow	Specific	0.10	1.09
	4	Transparent Yellow	Specific	0.10	1.09
	8	Transparent Yellow	Specific	0.10	1.09
	12	Transparent Yellow	Specific	0.10	1.09
Hydrogel eye mask yellow potato tuber extract 0.5 %	0	Light Yellow	Specific	0.10	1.09
	4	Light Yellow	Specific	0.10	1.09
	8	Light Yellow	Specific	0.10	1.09
	12	Light Yellow	Specific	0.10	1.09
Hydrogel eye mask yellow potato tuber extract 1 %	0	Brown	Specific	0.10	1.09
	4	Brown	Specific	0.10	1.09
	8	Brown	Specific	0.10	1.09
	12	Brown	Specific	0.10	1.09

pH evaluation.

Evaluation of the pH of various formulas was observed for 12 weeks with observations carried out at week 1, week 4, week 8, and week 12. The results can be seen in Table 5.

Table 5

Hydrogel eye mask pH result

Formula	pH Value				X±SD
	Time (week)				
	1	4	8	12	
Hydrogel eye mask without extract	5.0	5.1	5.1	5.2	5.10±0.08
Hydrogel eye mask yellow potato tuber extract 0.25 %	5.0	5.2	5.4	5.3	5.23±0.17
Hydrogel eye mask yellow potato tuber extract 0.5 %	5.3	5.4	5.5	5.4	5.40±0.08
Hydrogel eye mask yellow potato tuber extract 1 %	5.3	5.3	5.5	5.5	5.40±0.12

Elasticity Level Result.

Observations of the results of the elasticity level could be seen in Table 6. Observations include inventory time, length before withdrawal, length after withdrawal, and the level of elasticity in percent.

Table 6

Elasticity level result

Formula	Stock up time (s)	Length before withdrawal (cm)	Length after withdrawal (cm)	Elasticity level (%)
Hydrogel eye mask without extract	18	11	15	26.67
Hydrogel eye mask yellow potato tuber extract 0.25 %	27	11	20	45.00
Hydrogel eye mask yellow potato tuber extract 0.5 %	26	11	19	42.00
Hydrogel eye mask yellow potato tuber extract 1 %	20	11	17	35.30

Expansion Power Result.

The results of the expansion observed three parameters, namely the dry weight of the formula, the wet weight, and presentability. All the formulas for the results of the expansion can be seen in Table 7.

Table 7

Result of expanding power

Formula	Dry weight (g)	Wet weight (g)	Percentage of swellability (%)
Hydrogel eye mask without extract	1.09	6.05	81.99
Hydrogel eye mask yellow potato tuber extract 0.25 %	1.09	5.77	1.10
Hydrogel eye mask yellow potato tuber extract 0.5 %	1.09	4.85	77.52
Hydrogel eye mask yellow potato tuber extract 1 %	1.09	4.77	77.14

Shrinkage Result.

Observations of shrinkage eye mask preparation area were carried out for 12 weeks by observing the area (cm^2) and the weight. Observations were made on the first day of manufacture (week 0), week 4, week 8, and week 12. The shrinkage results in hydrogel eye mask preparation area can be seen in Table 8. For the shrinkage on the weight of the hydrogel eye mask preparation result could be seen in Table 9.

Table 8

Data on Shrinkage result in hydrogel eye mask preparation area

Formula	Area (cm^2); Time (week)			
	0	4	8	12
Hydrogel eye mask without extract	4	4	4	4
Hydrogel eye mask yellow potato tuber extract 0.25 %	4	4	4	4
Hydrogel eye mask yellow potato tuber extract 0.5 %	4	4	4	4
Hydrogel eye mask yellow potato tuber extract 1 %	4	4	4	4

Table 9

Data on the result of shrinkage on the weight of the hydrogel eye mask preparation

Formula	Weight (g); Time (week)			
	0	4	8	12
Hydrogel eye mask without extract	1.09	1.09	1.09	1.09
Hydrogel eye mask yellow potato tuber extract 0.25 %	1.09	1.09	1.09	1.09
Hydrogel eye mask yellow potato tuber extract 0.5 %	1.09	1.09	1.09	1.09
Hydrogel eye mask yellow potato tuber extract 1 %	1.09	1.09	1.09	1.09

Stability Test.

Storage stability result at low temperature.

Based on the results of the study, the hydrogel mask is physically stable (organoleptically) during storage at low temperatures

Storage stability result at room temperature.

Based on the results of the study, the hydrogel mask is physically stable (organoleptically) during storage at room temperature.

Storage stability test result at high temperature.

Based on the results of the study, the hydrogel mask is physically stable (organoleptically) during storage at high temperatures.

Cycling Test.

The results of the cycling test observed the eye mask preparation colour, odour, performance, and phase separation. All results for all testicular formulas can be seen in Table 10.

Table 10

Observation data on hydrogel eye mask cycling test

Formula	Cycling test result			
	Colour	Smell	Performance	Phase separation
Hydrogel eye mask without extract	Transparent Yellow	Specific	Good	Do not separate
Hydrogel eye mask with yellow potato tuber extract 0.25 %	Transparent Yellow	Specific	Good	Do not separate
Hydrogel eye mask with yellow potato tuber extract 0.5 %	Yellow	Specific	Good	Do not separate
Hydrogel eye mask with yellow potato tuber extract 1 %	Brown	Specific	Good	Do not separate

Irritation Test.

An irritation test was performed on 12 volunteers with inclusion criteria. All volunteers did not show irritation reactions as shown in Table 11.

Table 11

Data on irritation test result for hydrogel eye mask preparation

Observation	Volunteer											
	1	2	3	4	5	6	7	8	9	10	11	12
Redness	–	–	–	–	–	–	–	–	–	–	–	–
Itchy	–	–	–	–	–	–	–	–	–	–	–	–
Skin roughening	–	–	–	–	–	–	–	–	–	–	–	–

Note: – (no irritation)

Hedonic Test.

The hedonic test is the most widely used test to measure the level of consumer preference for the sample being tested [16].

Anti-Aging Test.

Testing the effectiveness of anti-aging using the Aramo skin analyzer with parameters including measuring moisture, pores, blemishes, and wrinkles.

Moisture.

The moisture content has been checked and for all volunteers who use the hydrogel eye mask preparation, the results of this air content can be seen in Fig. 1.

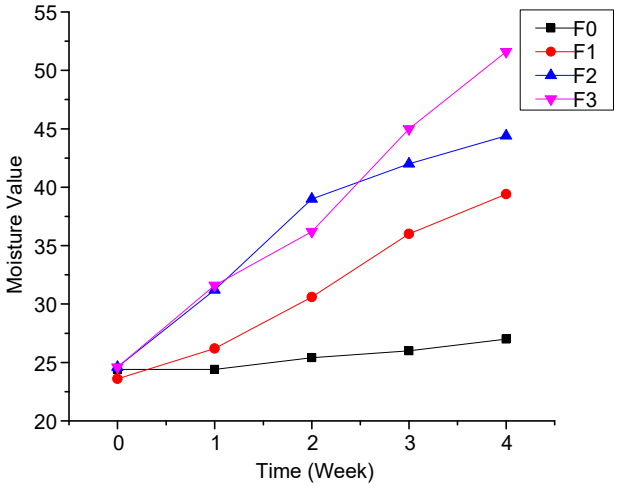

Fig. 1. Graph of the effect of the yellow potato hydrogel eye mask preparation on moisture values

Based on the measurement results showed that after using the anti-aging hydrogel eye mask preparation for 4 weeks, all anti-aging hydrogel eye mask preparations with yellow potato water extract experienced an increase in water content from dehydration to normal (30–50), while the moisture content of the blank preparations increased, stay dehydrated. Volunteers who used an anti-aging hydrogel eye mask preparation with 1 % yellow potato tuber water extract had a higher water content than volunteers who used an anti-aging hydrogel eye mask preparation with other formulas.

Pore.

A pore examination on volunteers was performed. The results of the pore examination on volunteers after using the hydrogel eye mask can be seen in Fig. 2.

Volunteers who used an anti-aging hydrogel eye mask preparation of 1 % yellow potato tuber water extract had a higher pore reduction compared to volunteers who used an anti-aging hydrogel eye mask preparation with other formulas.

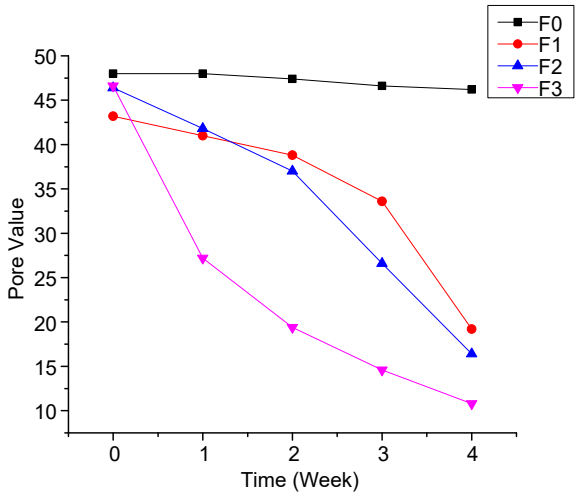

Fig. 2. Graph of the effect of hydrogel preparations for eye mask water extract of yellow potato tubers on skin pore values

Spot.

Spot checks are also performed. A spot examination was performed on all volunteers who had used a hydrogel eye mask. The results of the inspection can be seen in Fig. 3.

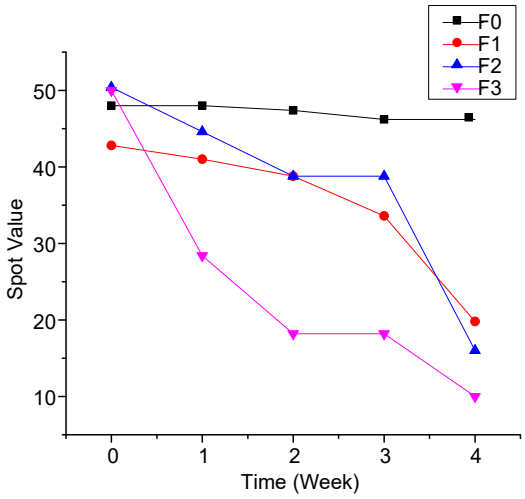

Fig. 3. Graph of the effect of hydrogel eye mask preparation of yellow potato tuber water extract on spot values

Volunteers who used anti-aging hydrogel eye mask preparations with 1 % yellow potato tuber water extract had a higher stain reduction compared to volunteers who used anti-aging hydrogel eye mask preparations with other formulas.

Wrinkle.

Wrinkles in anti-aging testing are also important to observe. The results of the measurement of wrinkles in volunteers can be seen in Fig. 4.

Volunteers who used anti-aging hydrogel eye mask preparations 1 % yellow potato tuber water extract had a

higher reduction in wrinkles than volunteers who used anti-aging hydrogel eye mask preparations with other formulas.

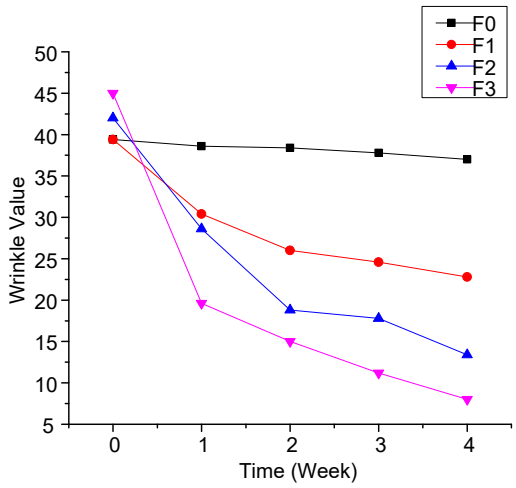

Fig. 4. Graph of the effect of hydrogel eye mask preparation of yellow potato tuber water extract on the wrinkles values

5. Discussion

Phytochemical screening.

Phytochemical screening was carried out to identify the content of secondary metabolites of natural ingredients. Secondary metabolites contained in the water extract of yellow potato tubers include alkaloid, saponins, flavonoids and triterpenoids. Phytochemical screening is a preliminary stage that can provide an overview of the content of certain compounds in natural materials. The results of phytochemical screening showed that the aqueous extract of yellow potato tubers gave positive results on flavonoids. Flavonoids act as antioxidants by donating hydrogen atoms or through their ability to chelate metals, in the form of glucosides (containing glucose side chains) or in free forms called aglycones [17]. The positive flavonoid content is the part that contains high antioxidants equivalent to vitamin C, so the presence of these metabolite compounds encourages anti-aging effects [18]. Flavonoids have been proven to have benefits for skin health, including the potential to protect the skin from sunburn, and provide a moisturizing and brightening effect on the skin so that the skin is not only kept moist but looks more radiant [19].

Evaluation.

Organoleptic observation.

Based on the table above, the results of the organoleptic test for hydrogel eye mask preparations that were observed for 12 weeks showed no physical changes occurred.

pH evaluation.

Based on the table above, the results of measuring the pH of the hydrogel eye mask preparation from the first week to the 12th week there was an increase pH.

Elasticity Level.

Based on the table above, the results of the attractiveness of hirogel mask preparations in the 0.25 % yellow potato water extract formula have the longest damage time of 27 seconds with an elasticity level of 45 % compared to other formulas.

Expansion Power.

Based on the table above, the results showed that the hydrogel eye mask preparations of all formulas had a swelling percentage that was not much different, but with the addition of yellow potato water extract concentration, the swelling ability of the preparation decreased.

Shrinkage.

Based on the table above, the results showed that all hydrogel eye mask formulas did not experience shrinkage both in terms of weight and area at the beginning of making the mask preparation until the twelfth week.

Stability.

The stability test measured in this study consisted of three, namely stability at low temperature, room temperature and high temperature. The preparations were stored at room temperature for 12 weeks with visual observation intervals at weeks 1, 4, 8 and 12. The results of the evaluation of the stability of the preparations obtained that the anti-aging hydrogel mask water extract of yellow potato tubers was physically stable (organoleptically) during storage at low temperatures, room temperature and high temperature. Colour, odour and dosage form did not change from the beginning of observation until storage [20].

Cycling test.

Based on the table above, the results showed that in the cycling test, the hydrogel eye mask did not change colour, odour and shape.

Irritation test.

Skin irritation test was carried out to prevent side effects on the skin [11]. The results of the skin irritation test showed that all volunteers gave negative results on the irritation reaction parameters. Skin irritation test was carried out to determine the side effects that occur on the skin when this preparation was applied to the skin surface of volunteers. The results showed that the test volunteers did not experience and feel the irritation effect caused by the hydrogel eye mask preparation of yellow potato tuber water extract. From these results it can be concluded that this preparation is good and safe to use as an eye mask [21].

Hedonic test.

Based on the research, it was shown that the 0.25 % yellow potato tuber hydrogel water extract eye mask was the most preferred formula compared to other formulas. Ningrum (2017) reveals that the hedonic test is “a test designed to measure the level of desire for a product. The category scale starts from very different, because they don’t like or don’t like, really don’t like it, with a varying number of categories. Panelists indicate their level of love for each sample by choosing the appropriate category [22]. The hedonic test is the most widely used test to measure the level of preference for production [23]. From the results of this study, it was found that the 0.25 % yellow potato tuber hydrogel eye mask was the most preferred formula compared to other formulas.

Anti-Aging Test.

Moisture.

According to its physiological function, the skin needs fat and water. The fat layer on the surface of the skin and the material in the stratum corneum is hygroscopic, can absorb water and is in a functional relationship called the Natural Moisturizing Factor. The ability of the stratum corneum to bind water is very important for the flexibility and elasticity of the skin [11]. The highest percentage of increase in water content was shown by the group of volunteers who were treated using an anti-aging hydrogel eye mask preparation of 1 % yellow potato tuber water extract. This shows that the more extract content in the anti-aging hydrogel eye mask preparation, the greater its role in increasing moisture on the skin.

Pore.

According to Sulastomo, one of the parameters to determine healthy facial skin is having small pores. Pores can enlarge when exposed to the sun that is too hot, an increase in temperature causes the opening of the pores on the skin. Large pores can cause dirt to easily enter and clog them, causing acne to occur more easily [19]. The highest percentage of pore reduction was shown by the group of volunteers treated with an anti-aging hydrogel eye mask preparation of 1 % yellow potato tuber water extract. This shows that the more extract content in the anti-aging hydrogel eye mask preparation, the greater the role in reducing the number of pores on the skin.

Spot.

The second main cell of the epidermis (after keratinocytes) is the melanocytes which are found in the basal layer. Melanocytes are cells that produce tyrosinase and melanosomes. Melanocytes secrete melanosomes into keratinocytes through cytocrine activity. Melanosomes present in melanocytes interact with tyronase to form melanin. The amount of melanin in the keratinocytes in the skin determines the colour of a person's skin. Excessive sunlight can also increase the formation of melanosomes and melanin. The more sunlight that hits the skin, the more active the formation of melanin and the formation of brown spots on the skin [24, 25]. The percentage of reduction in skin blemishes under the eye area was greater shown by a group of volunteers treated with an anti-aging hydrogel eye mask preparation of 1 % yellow potato tuber water extract. This shows that the more extract content in the anti-aging hydrogel eye mask preparation, the greater its role in reducing blemishes on the skin.

Wrinkle.

The aging process whose symptoms are clearly visible on the skin such as the appearance of wrinkles, reduced skin softness, decreased skin elasticity, rough skin texture, hyperpigmentation, and dark skin. Wrinkles that arise can be interpreted simply as the cause of a decrease in the amount of dermal collagen [26]. The percentage of reduction in skin wrinkles under the eye area was the same as shown by the group of volunteers treated with an anti-aging hydrogel eye mask with 1 % yellow potato tuber extract. This shows that the more extract content in the anti-aging hydrogel eye mask preparation, the greater its role in reducing wrinkles on the skin.

Research limitations. During the research, the limitations that existed during the homogenization of eye mask hydrogels often failed when poured into the mold due to the unstable homogenization process, hydrogel masks could form pores which made the hydrogel mask results not aesthetic.

Prospects for further research. For further research, it is expected to examine the use of hydrogel eye mask preparations for the side effects and therapeutic effects of anti-aging so that they can be marketed.

6. Conclusion

Different concentrations of yellow potato extract formulated in hydrogel masks provide different anti-aging effectiveness. The higher the concentration of potato extract, the greater the anti-aging effectiveness. In this case, the highest formulation, namely the 1 % formula, gave the best results on humidity (27 %), pores (35.8 %), blemishes (40 %), and wrinkles (37.6 %). The results of the evaluation of all hydrogel eye masks showed results that met the requirements.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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