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DEVELOPMENT OF TEMULAWAK STARCH (Curcuma xanthorriza Roxb) AS POTENTIAL BASIC MATERIAL IN FACE POWDER

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A B S T R A C T

Temulawak (Curcuma xanthorriza Roxb) or known as Javanese ginger is a type of plants from herbal remedies that have been well known for its health benefits. In this research, Temulawak starch will be developed to be basic material in face powder. Many have tested to be used as processed food ingredient but no one might have tested for cosmetic basic material. The methods used in this test are qualitative test by using thin layer chromatography for determination of curcuminoid Rf, quantitative test to determine curcuminoid level by using UV VIS spectrophotometer, determination of starch characteristics (organoleptic test, pH, and particle size distribution) and determination of physicochemical properties (moisture, LOD, and ash content). Prior to the testing Temulawak samples were taken from Pamulihan, Garut, After sampling, extraction process performed by immersing the samples for 6 days along with removal and replacement of its solvent everyday. We have obtained 17,5% of total samples as extract respectively 6 samples of starch with different colors. The result shows the longer starch immersion process, the lower curcuminoid level becomes. Organoleptically the size of starch particles before grinding is 0.088 mm and 0.0125 mm, after grinding is 0.074 mm, it is physically soft and cool and has a distinctive aroma. The pH is 4. Moisture obtained is 4%, LOD is 5% and ash content is 1%. The result of physicochemical characteristics and properties qualify the starch as powder and to be able to use as basic material in face powder product.

INTRODUCTION

Traditional medicinal plants have been widely used as remedies. It originates from Indonesia and Southeast Asia then extending throughout the world including India, Africa, China, Japan, Korea and Europe (Hutapea and Syamsuhidayat, 1991). Geographically, Indonesia passes through the equator line, thus causing it to bathe in a high intensity of the sunlight. Ultraviolet light and its hot weather here can cause dry and dull skin (Queen Inka *et.al*., 2015).Exposure to excessive sunlight may not be good because sunlight contains ultraviolet (UV) light. UV-A light has λ 320-400 nm, which is able to cause tanning due to melanin release, as well as to stimulate melanogenesis although weaker than UV-

Nearly 50% of UV-A light penetrates skin dermis where skin aging triggered (Lee & Kaplan, 1992).Curcuma xanthorriza Roxb (Curcuma xanthorriza Roxb) is a raw material of traditional medicine which is classified into Zingiberaceae group (Sidik *et.al*., 1992; Prana 2008). Its active component, curcuminoid consists of curcumin, demethoxycurcumin and bisdemethoxycurcumin (Masuda, 1992). Those three components have higher antioxidant activities than others (Jitoe *et al*., 1992) because it contains phenolic compounds (Priyadarsini *et.al*., 2003)
Curcuminoid in temulawak may act as skin lightening / inhibitor of tyrosinase (Sugiarto *et.al*., 2010). Hyperpigmentation occurs when excessive productions of melanin and deposits occur in human skin. This excessive production of melanin in human skin is due to exposure to

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UV light, α-Melanocyte Stimulating Hormone (α-MSH), Agouti Signal Protein (ASP) and increasing metabolism of tyrosinase enzymes (Sulaimon and Kitchell, 2003). Tyrosinase is an enzyme which can catalyze melanin synthesis in melanocytes (Kim and Uyama, 2005; Khan, 2007). People have the same purpose on using skin lightening, it is to improve the quality of skin's physical appearance in order to increase acceptance in social interaction especially women. (Goeswin, 2015). That is what makes Curcuminoid in temulawak starch different from rice starch and yam starch to be developed as the basic material.

Starch is a carbohydrate consisting of amylose and amylopectin. (Jacobs and Delcour, 1998). Utilization of starch in the field of cosmetics is widely used for making face powder. Rice starch and yam starch are often use as skin whitener

(Lukitaningsih, 2009). However Temulawak has not been widely used whereas it contains high level of starch and has higher degrees of whitening compared to rice starch and yam starch. Starch has an opaque characteristic which cannot be penetrated by light but is able to reflect it. Thus it is very beneficial to prevent ultraviolet radiation to human skin (Nursal *et al*., 2006).

METHODS AND MATERIALS

Material Plant

Simplicia of Turmeric rhizome (*Curcuma xanthorriza* Roxb).

Equipments

Equipments used are glass apparatus (Iwaky Pyrex), analytical balance (Mettler Toledo), UV-Vis spectrophotometer, flannel / filter, Knife, Blender, Basin container, Memmert Oven, furnace, Sieve / mesh 16, Grain piston, Desiccator, Krus, Autoclave, Whatman filter paper No.41, Soxhlet, Centrifugators,

Centrifugation Tubes, Memmert waterbaths and Boiling Stones.

Chemical materials

Temulawak rhizome (Curcuma xanthorriza Roxb), raw water, Ethanol p.a and Technical 96%, Ethanol 70%, TLC Flat KLT (F_{254}) *Merck*, Chloroform, Glacial Acetic Acid, Curcuminoid standard solution and Aquadest.

METHODS

Material Collection and Sample's Determinations

Fresh temulawak rhizome which is from Pamulihan, Garut treated as sample for various determinations in Herbarium Jatinangor, Laboratory of Plant Taxonomy of Biology Department FMIPA UNPAD.

Extraction Procedure

The sample peeled thin to remove its skin and impurities. After that, cut small to smooth blending process in order to simplify extraction. Extraction process performed by adding aquadest and extorted over a flannel screen. Suggested extortion should occur several times by reusing post-extortion water and aquadest. 1 kg of the rhizome requires approximately 10 liters of aquadest in this extraction process.

Post-extortion water should be collected in a container (jar) and put steady to let starch precipitation. The process takes 24 hours. After that, decant yellow liquid / filtrat carefully until precipitate remains. The precipitate should be diluted again with fresh aquadest (remaseration) and put steady for 6 days to obtain 6 samples of precipitates (i.e. 1, 2, 3, 4, 5, 6).

Next, the precipitates are dried with oven at 30^oC-50^oC. (Sidik *et.al*., 1986) as well as tested for its qualitative and quantitative characteristics and

physicochemical properties. After obtaining expected starch sample, the starch should be produced more based on the best immersion time. Once tested and standards met, it can be used as basic material in face powder.

Qualitative Test

Thin Layer Chromatography Patterns

Starting from creating standard curcuminoid powders in 5 mg / ml ethanol p.a., Samples are tested with Thin Layer Chromatography. For Silica gel 60 F_{254} stationary phase with Chloroform mobile phase: ethanol: glacial acetic acid (94:5:1) detected under 366 nmUVlamp. Treatment to the sample is the same.

Quantitative Test

UV-Vis Spectrophotometry

Creating Curcuminoid Standard Curve

Standard solution should be prepared before using UV-VIS spectrophotometer by dissolving 10 mg of curcuminoid in 100 ml of ethanol p.a (**Solution 1** 100 ppm). Then dilute it in flask by taking 5 ml of **solution 1** plus ethanol p.a up to 50 ml (**Solution 2** 10 ppm). Retrieve 1,2,3,4,5, ml and add ethanol up to 10 ml (respectively 0,1; 0,2; 0,3; 0,4; 0,5 ppm). Measure its absorbance at λ = 405 and 422 nm.

Sample Measurement (Starch immersion 1 to 5)

Conducted by adding technical ethanol to each starch up to 200 ml, then take its filtrate and measure its absorbency at λ = 405 and 422 nm.

Determination of Starch Characteristics Determination of Physical Properties

Organoleptic

Visual observation of odor, color, physical form and particle size of starch respectively P1, P2, P3, P4, P5 and P6.

Particle Size Distribution

The starch is inserted into gradual sieves no. 40, 80, 100, 120, 170, and 200 at 100 rpm for 1 minute. Weigh each of sieve number after sifting.

pH

The starch dissolved in technical ethanol and measured by using PH indicator.

Determination of Physicalochemical Properties

Ash

200 ml of toluene is saturated with50 of ml aquadest on a separating funnel After removing the water, 200 ml of saturated toluene should be added with 25 gr of sample and put into distillation flask and add boiling stones as well, then boil for 15 minutes and examine the distilled water.

LOD (Lost On Drying)

Weigh 5 gr of sample, then insert into testing instrument and close. Wait for 3 minutes and the result would be shown by the instrument.

Ash content

Put 5 gr of sample into a dry weight-known krus (which is first heated in furnace and cooled down in a desiccator). Put it into a furnace with 100^{o}C temperature for one hour and then raised the temperature up to 300^{o}C for two hours and increase again up to 500^{o}C for two hours until ash formed. Afterwards, cool down the ash-containing krus in a desiccator until its temperature reaches room temperature and weigh the ash. Ash content should be calculated by the following formula.

RESULTS

Determinations

The results of determinations of temulawak is true to the temulawak sample that would be used in this research. It is Curcuma xanthorrhiza Roxb. Family: Zingiberaceae, Genus: Curcuma, Species: Curcuma xanthorriza Roxb.

Extraction

Starch from Extraction Results

6times immersion through the process of solvent remaseration performed once every 24 hours and results to Different colors of starch as follows

P1 (first immersion) dark yellow

P2 (second immersion) yellow

P3 (third immersion) faded yellow

P4 (fourth immersion) white yellow

P5 (fifth immersion) white slightly yellow

P6 (sixth immersion) white

The starch results in changes of color caused by the replacement of the solvent every 24 hours in addition to remove the bitter taste of Temulawak. It also diminished the yellow color produced by curcuminoid. Prior to the use as the basic material in face powder, the starch should be tested. 2 kg of Temulawak is able to produce 350 gr of starch or respectively 17.5%.

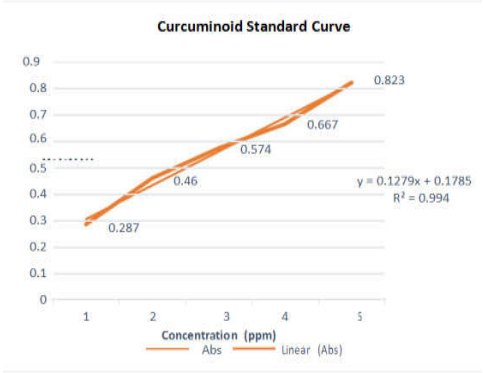
Qualitative Test

Thin Layer Chromatography Result

Sample	Rf Curcumin	Rf demethoxy curcumin	Rf bisdemethoxy curcumin
Curcuminoid	0,78	0,6	0,5
P1	0,78	0,6	-
P2	0,78	0,6	-
P3	0,81	0,62	-
P4	0,81	0,62	-
P5	0,78	0,56	-
P6	0,78	-	-

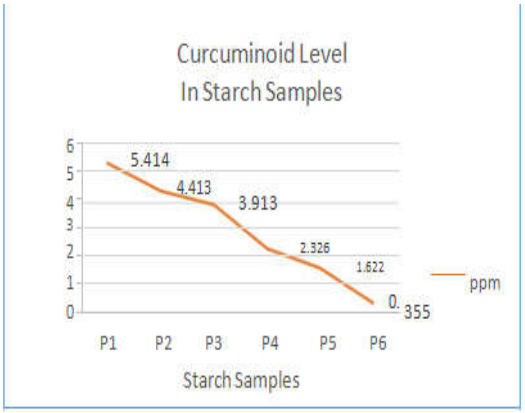
Determination of ppm Level (Spektrofotometri UV-Vis) Curcuminoid Standard Curve

C (ppm)	Abs
1	0,287
2	0,460
3	0,574
4	0,667
5	0,823



Concentrations of Starch Samples

Sample	Abs	Concentration (ppm)
P1	0.871	5.414
P2	0.743	4.413
P3	0.679	3.913
P4	0.476	2.326
P5	0.386	1.622
P6	0.224	0.355



Organoleptic

Particle Size Distribution

Mesh	Sample					
	P1	P2	P3	P4	P5	P6
40	0	0	0	0	0	0
80	0	0	0	0	0	0
100	4 grams	5 grams	5 grams	7 grams	7 grams	8 grams
120	8 grams	9 grams	9 grams	10 grams	10 grams	12 grams
170	12 grams	10 grams	10 grams	7 grams	7 grams	6 grams
200	6 grams	6 grams	6 grams	6 grams	6 grams	4 grams

pH

Each sample is respectively 4 (P1 to P6).

Moisture

No.	Sample	Sample number(g)	distilled water(ml)	moisture(%)
1	P1	25	1	4
2	P2	25	1	4
3	P3	25	1	4
4	P4	25	1	4
5	P5	25	1	4
6	P6	25	1	4

LOD (Lost On Drying)

No.	Sample	Sample number (g)	LOD (%)
1.	P1	5	5,221
2.	P2	5	5,223
3.	P3	5	5,214
4.	P4	5	5,242
5.	P5	5	5,216
6.	P6	5	5,228

Ash Content

No.	Sample	Krus	Krus + Sample	Krus + Ash	Ash in%
1.	P1	29,001	30,524	28,975	1,6785
2.	P2	28,892	30,475	28,915	1,4529
3.	P3	25,742	26,775	25,756	1,3553
4.	P4	25,742	26,775	25,756	1,3553
5.	P5	25,243	26,486	25,259	1,2872
6.	P6	25,243	26,486	25,259	1,2872

DISCUSSION

The biggest chemical content in temulawak is starch and its yellow color caused by the presence of curcumin. (Koswara, 2012). In this research, 350 gr of starch resulted from 2 kg of fresh temulawak or respectively 17.5%.

The obtained starch would be developed as the basic material in face powder. Previously there have been researches on temulawak starch as foodstuffs (Agustina, 2014, Sidik *et al*, 1986). However, there might be no one who has developed it as basic material in cosmetics. Commonly used basic materials in face powder are rice starch and yam starch (Queen Inka, *et al*., 2015). In this research, we found that Temulawak starch is different from other kinds of starch in general because of its yellow color and it does not rot quickly compared to rice starch and yam starch in its immersion process.

The immersion consumed 6 days with 6 times replacement of the solvent for 24 hours in order to identify the color change and the level of curcuminoid. The qualitative test by TLC shows that the longer the immersion time, the curcuminoid spots become less visible and no RF value found in it.

The highest level of curuminoid found in sample P1 respectively 5.414. But it is still considered low. Despite the facts, the characteristics and physicochemical properties are suitable for face powder's basic material.

The organoleptic test shows that P1 to P4 still have its original distinctive aroma but acceptable and appropriate to be traditional face powder's material. The yellow color of temulawak starch should also become natural color of face powder. The softness and the coolness of the starch might be good values to cold face powder product in the future. The particle size tested by using granulometry; P1 to P3 have each value respectively 0.088 mm (88µm) and P4 to P6 have each value respectively 0.125 mm (125µm) which passes through mesh 120 and 170. After going through grinding process, the granules become smaller respectively 0.074 mm (74µm) at mesh 200; so it is acceptable to use as face powder's basic material. Because the smaller the particle size, the level of irritation become smoother and lower to human skin. Thus it is safe to use in face powder production.

The PH value of each starch is respectively 4 and this corresponds to human facial skin PH value (4.5-6). The moisture is 4% for each tested starch and it meets the standard (<10%), LOD (Lost On Drying) is 5% and the value meets the standard for making face powder. The granules are respectively 2-5% (Lachman, 1994), and the ash content is 1% of which the value meets the standard (<17%) as well.

Organoleptic	Sample					
	P1	P2	P3	P4	P5	P6
Odor	Temulawak distinctive aroma (++)	Temulawak distinctive aroma (++)	Temulawak distinctive aroma (++)	Temulawak distinctive aroma (++)	No distinctive aroma	No distinctive aroma
Color	dark yellow	yellow	faded yellow	white yellow	white yellow slightly	white
Physical form	soft and cool	soft and cool	soft and cool	soft and cool	soft and cool	soft and cool
Particle size	0.088 mm(88µm) /mesh 170	0.088 mm(88µm) /mesh 170	0.088 mm(88µm) /mesh 170	0.125 mm(125µm) /mesh 170	0.125 mm(125 µm) /mesh 170	0.125 mm(125µm) /mesh 170

*) particle size after grinding for each sample: 0,074 mm(74 µm).

CONCLUSION

This research shows that Temulawak starch is acceptable as basic material in making face powder cosmetic. Based on the qualitative and quantitative test

results, its low curcuminoid level may not be effective as skin lightening and antioxidant but it should be effective to protect human skin from of UV light exposure. Because the starch itself has an opaque characteristic which is able to reflect UV light. Standards met in determination of the physicochemical characteristics and properties; thus it is able to be used as the basic material of face powder. To underline, the sizes of starch particles before grinding (0.088 mm and 0.125 mm) and after grinding (0.074mm) meet the standards for making face powder as it passes mesh 200. Besides, Temulawak starch has potential in color. Its curcuminoid content and odor stability during immersion lasts more compared to rice starch or yam starch (both have been widely used as basic material in face powder). In addition, its soft and cool sensation may allow the starch to become basic material of traditional face powder such as cool face powder.

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