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Formulation of Hair Dye from Purple Sweet Potato Extract (*Ipomoea batatas* (L.) Lam.)

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Abstract

The making of purple sweet potato extract *(Ipomoea batatas (L.) Lam.)* namely macerated powder with 96% ethanol extractor 1 night and doing the same way till the solution is colourless. Next, the hair dye is made of formula which consists of purple sweet potato by some concentration. Those are 5, 10, 15. First, at formula 1 pirogalol, sulfate cuprum, xhantangum are 1%. Second, at formula 2 pirogalol, sulfate cuprum, xhantangum are 2%. Third, at formula 3 pirogalol, sulfate cuprum, xhantangum are 3%. Additionally, aquadest is used for a solvent. Then, the colouration is done by submersion during 1-4 hours. The observation is stability on 12 times washing of. Moreover, the result of research shows that the extract substance of purple purple sweet potato can be used for hair dye. The best dye is got from the formula 3 which consists of purple purple sweet potato 15%, pirogalol 3%, cuprum II sulfate 3% and xhantangum 3% which produce dark black.

Keywords

keyword : *Purple sweet potato*, *sulfate cuprum*, *xhantangum*, *hair dye*

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1. INTRODUCTION

Purple sweet potato (*Ipomoea batatas* (L.) Lam.) is one of the most widely cultivated tuber crops in tropical and subtropical regions. It is well known for its high nutritional value and abundant bioactive compounds, particularly anthocyanins, which are responsible for its characteristic purple color (Tang et al., 2023). Purple sweet potato contains carbohydrates, dietary fiber, vitamins (A, B-complex, C, and E), minerals such as calcium, potassium, magnesium, iron, and zinc, as well as phenolic compounds with antioxidant properties (Liu et al., 2022).

Anthocyanins are the major natural pigments found in purple sweet potato. These compounds possess strong antioxidant activity and have attracted considerable attention due to their potential applications in the food, pharmaceutical, and cosmetic industries. In addition to their

biological activities, anthocyanins exhibit good stability and coloring properties, making them promising natural colorants for cosmetic formulations (Fauziah, A., Mulyani, I., & Ramdhini, R. N. 2020).

Hair is a filamentous structure composed mainly of keratin that grows from hair follicles in the skin. It covers most parts of the human body except the palms, soles, and lips. Besides protecting the scalp, hair also plays an important role in personal appearance. Hair dye is a cosmetic product used to change or restore the natural color of hair. Most commercial hair dyes contain synthetic chemicals that may cause allergic reactions, scalp irritation, hair damage, and environmental pollution after prolonged use. Therefore, there is increasing interest in developing hair dyes from natural sources that are safer and more environmentally friendly (Robbins, 2012; Draelos, 2015).

Natural pigments extracted from plants have gained considerable attention as alternative ingredients for cosmetic products because of their coloring ability and biological activities. Anthocyanins, flavonoids, and tannins are among the plant pigments that have been widely investigated as natural colorants due to their antioxidant, non-toxic, and biodegradable properties. These characteristics make plant-based colorants suitable candidates for cosmetic applications, including natural hair dye formulations. (Cui et al., 2022).

Purple sweet potato (*Ipomoea batatas* (L.) Lam.) is considered a promising source of natural hair dye because of its high anthocyanin content. Anthocyanins are natural pigments responsible for the purple color and strong antioxidant activity of purple sweet potato. Their coloring ability and safety profile indicate that purple sweet potato extract has potential to be developed as a natural hair dye that can reduce dependence on synthetic coloring agents while providing added antioxidant benefits. (Li et al., 2023; Cui et al., 2022).

In the formulation of natural hair dye products, several factors influence the quality and effectiveness of the final product, including pigment concentration, pH, viscosity, homogeneity, and stability during storage. A good hair dye formulation should provide adequate coloring ability, be physically stable, easy to apply, and safe for the scalp and hair. Therefore, formulation optimization is essential to produce a high-quality natural hair dye (Kumar et al., 2022).

The growing demand for natural cosmetic products has encouraged researchers to explore plant-based materials as safer alternatives to synthetic ingredients. Purple sweet potato extract, with its high anthocyanin content and antioxidant properties, has the potential to be developed as a natural hair dye. Therefore, this study aims to formulate and evaluate a hair dye preparation using purple sweet

potato (*Ipomoea batatas* (L.) Lam.) extract as a natural coloring agent (Purnomo, N. H., Edy, H. J., & Siampa, J. P. 2021).

2. METHODS

The formula research in the hair dye of purple sweet potato is done in laboratory of department of pharmacy stikes Syuhada Padangsidimpuan on 18th to 21th March 2020.

The sample of this research is the purple sweet potato as much as 3 kilograms with additives pirogalol, $CuSO_4$ and xhantangum.This research is experimental research with experimental laboratory research design. Purposive collection of samples without comparing with the Treatment of gray hair Hair Samples.

The collection and processing of sweet potato samples *(Ipomeabatatas L)* is carried out by means of purple sweet potato samples *(Ipomoea batatas (L.) Lam.)* taken as much as 3kg in The Sagumpal Market of Padang Sidimpuan City, then Wet disoration with running water aims to separate the sample from the dirty substance, then Purple Sweet Potato *(Ipomoea batatas (L.) Lam.)* is thinly basketed using a basket, then dried using a dryer cabinet until the Purple Sweet Potato *(Ipomoea batatas (L.) Lam.)* mongering perfectly aimed at making simplisia Then the dry simplisia is smoothed by using a blender until obtained purple sweet potato simplisia powder *(Ipomoea batatas (L.) Lam.)* as much as 1,5grams and after that continue to the stage of making simplisia extract.

The extract of purple sweet potato simplicia *(Ipomoea batatas (L.) Lam.)* was made by: maceration or immersion using 96% ethanol solvent. The maceration process was carried out for five days while stirring occasionally so that it was homogeneous and extracted the anthocyanin. Then the result of the soaking was filtered using a flannel cloth to obtain a liquid extract of 2,5 liters. Then the filtrate is evaporated by heating. The evaporation of the liquid purple sweet potato extract *(Ipomoea batatas (L.) Lam.)* was carried out for the thickening process so that the thick purple sweet potato extract *(Ipomoea batatas (L.) Lam.)* was obtained as much as 56,26 grams.

3. FINDINGS AND DISCUSSION

3.1 Making Hair Dye Formulas

The preparation formula chosen is based on the standard formula found in the 1985 Indonesian Cosmetics Formulary, where in the preparation of hair dye preparations the concentration of prigalol and copper II sulfate is not more than 5% as in table 1 below:

Table 1. Making Hair Dye Formulas

Composition	Blanko	Formula%		
		Formula	Formula	Formula
Sweet potato extract (*Ipomoea batatas (L.) Lam.*)	0	5	10	15
Pirogalol	1	1	2	3
Sulfate Cuprume (II)	1	1	2	3
Xantan gum	1	1	2	3
Aquadest (ml)	50	50	50	50

In this research, the preparation to be made is hair dye with the aim of giving the best color to the hair with the criteria that the resulting hair color is dark black.

From the results of the above orientation, a formula was made with various concentrations of purple sweet potato extract (ipomea limit L) as in the following table 2

Table 2. Formula with various concentrations of Purple Sweet Potato extract *(Ipomoea batatas (L.) Lam.)*

Komposisi	Blanko	Formula%		
		Formula I	Formula II	Formula III
Sweet potato extract (*ipomea)*	0	5	10	15
Pirogalol	1	1	2	3
Sulfate Cuprume (II)	1	1	2	3
Xantan gum	1	1	2	3
Aquadest (ml)	50	50	50	50

The method used in making hair preparations based on the formula above is as follows: Weigh all the ingredients to be used according to the formula in table 3.2 After weighing, enter and mix them into the mortar for prigalol, ground copper II sulfate until smooth and homogeneous, then add crushed xantham gum until homongen, add crushed aquadest to form an emulsion corpus. Furthermore, a hair dye was applied to the gray hair sample.

3.2 Result and Discussion

After making the next hair dosage formula, the hair preparation formula is applied to the gray hair sample by: Four hair ties that have been cut and washed with shampoo, are added to the mixture.

Table 3. Formulas for hair dye preparation

No	Formula	Hair Dye Preparation Colors)	Pirogalol	$CuSO_4$	Xanthan gum	Aquadest	Hair Dye Preparation Colors
1.	Blanko	0	0,5 g	0,5 g	0,5 g	50 mL	Black
2.	F1	2,5 g	0,5 g	0,5 g	0,5g	50 mL	Bright dark purple
3.	F2	5 g	1 g	1 g	1 g	50 mL	Dark Purple
4.	F3	7,5 g	1,5 g	1,5 g	1,5g	50 mL	Purple much dark

From the table it can be seen that the blank formula with the amount of purple sweet potato extract *(Ipomoea batatas (L.) Lam.)* 0 grams pyrogallol 0,5 grams $CuSO_4$ 0,5 grams xanthangum 0,5 grams produces a black color. Formula 1 (f1) with the amount of purple sweet potato extract *(Ipomoea batatas (L.) Lam.)* 2,5 grams of pyrogallol 0,5 grams $CuSO_4$ 0,5 grams, xanthangum 0,5 grams produces a bright dark purple color. Formula 2 (f2) with the amount of sweet potato extract Purple *(Ipomoea batatas (L.) Lam.)* 5 grams of pyrogallol 1 gram, $CuSO_4$ 1 gram, xanthangum 1gram produces dark purple color. Formula 3 (f3) with the amount of extract is
bright dark purple. 5 grams of 1gram pyrogallol, 1gram $CuSO_4$, 1gram xanthangum produces dark purple color. Formula 3 (f3) with the amount of Purple Sweet Potato extract *(Ipomoea batatas (L.) Lam.)* 7,5 grams of pyrogallol 1,5 grams $CuSO_4$ 1,5 grams, 1,5 grams of xathangum produces a very dark purple color

Table 4. Hair Color Against immersion

No.	Formula	Gray Hair Sample Color (immersion for 4 hours)			
		Immersion I	Immersion II	Immersion III	Immersion IV
1.	Blanko	White	White	White	White
2.	F1	White	White	White	light brown
3.	F2	White	White mixed with a little brown	Brownish black	Very dark brown
4.	F3	White	brownish white	Dark Black	Black

From the results of soaking gray hair samples, the changes that occur are: Formula blank produces white color, Formula 1 produces light brown color, Formula 2 produces very dark brownish black and Formula 3 produces black.

Formula 2 (f2) with the amount of sweet potato extract Purple *(Ipomoea batatas (L.) Lam.)* 5 grams of pyrogallol 1 gram, $CuSO_4$ 1 gram, xanthangum 1gram produces dark purple color. Formula

3 (f3) with the amount of extract is bright dark purple. 5 grams of 1gram pyrogallol, 1gram $CuSO_4$, 1gram xanthangum produces dark purple color.

Table. 5 Washing Time

Formula	Washing Time (1-2 hours for 2 days)	Washing	
		Before	After
Blanko	12 washes (first day)	White	White
	12 washes (second day)	White	White
Formula I	12 washes (first day)	Light brown	Light brown
	12 washes (second day)	Light brown	Light brown
Formula II	12 washes (first day)	Very dark brown	Very dark brown
	12 washes (second day)	Very dark brown	Very dark brown
Formula III	12 washes (first day)	Black	Black
	12 washes (second day)	Black	Black

From the results of the research on the stability of hair color against washing, the results obtained were blanks with 12 washes on the first and second days, the results were blonde. Formula 1 with 12 washes on the first and second days obtained before and after results, namely light brown. Formula 2 with 12 times. washing on the first and second days obtained the results before and after before and after, namely very dark chocolate. Formula 3 with 12 washes on the first and second days obtained the results before and after, namely black. For hair dyes, soaking for 1-4 hours with one hair tie is taken every hour to be washed, dried and separated and observed for the color formed according to the immersion time.

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