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Analysis of Hydroquinone Content in Facial Whitening Cream Products Located in the Central Market of Belopa City Using UV-VIS Spectrophotometric Method

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Abstrak

Hydroquinone is an active ingredient that functions to control pigment production and reduce melanin formation in the skin. This is what causes a lot of hydroquinone to be used in whitening cream preparations. This research aims to determine the hydroquinone content in whitening creams available in the Belopa City Central market which do not have a BPOM registration number using the UV-Vis Spectrophotometry method. The samples in this study consisted of 10 samples with codes A, B, C, D, E, F, G, H, I, J. The results of the study showed that these 10 samples contained Hydroquinone with each brand sample level A = 17 %, B = 0.8%, C = 9.4%, D = 9%, E = 5.9%, F = 2.8%, G = 6.6%, H = 4.27%, I = 4.9%, and J = 0.08%. The highest hydroquinone content was obtained in sample A with a hydroquinone content of 17% and overall the hydroquinone content in each sample used exceeded the hydroquinone content limit set by BPOM, namely no more than 0%. Thus, these 10 samples must not be used as cosmetics, and must change the category to therapeutic products (drugs) or remove the Hydroquinone ingredient from the formula if they are still produced in the cosmetics category.

Keywords: Hydroquinone, Whitening Cream, UV-Vis Spectrophotometry.

1. Introduction

Appearance is an important factor in the social environment, especially for women. Most women want clean, white skin because for dull and dark skin, women need a lot of time to take care of their skin [1]. Therefore, various methods ranging from natural cosmetics to skin care are carried out without delay, without regard to whether the chemicals contained have harmful effects on the skin or not. One of the cosmetics used is whitening cream that can enhance the appearance and make the skin look whiter and more confident (Kurnia, 2020).

Cream is a semi-solid preparation in the form of a thick emulsion containing at least 60% water, intended for external use. There are two types of cream, namely oil-water type (A/M) and water-oil type (M/A) (Moh. Anif, 2010). More modern cosmetics known as face whitening creams function as skin lighteners and are popular products for women and men [2]. Meanwhile, ingredients that can be used to brighten facial skin are ingredients that do not contain harmful substances [3].

Whitening creams are easily found in the market at low prices, but there are still many products that do not have an official permit from BPOM [4]. On the other hand, some irresponsible people use the reputation of whitening creams made with a mixture of harmful substances, one of which is hydroquinone [5]. Hydroquinone acts as an antioxidant and depigmenting agent that plays a role in the process of blocking melanogenesis to reduce the dark color of the skin, so the content of hydroquinone is the reason why it is found in many whitening creams [6].

In the regulation of the head of BPOM No. 23 of 2019, the use of hydroquinone as a

whitening ingredient in cosmetics is prohibited. The use of this ingredient without medical examination can cause skin irritation, burning, redness of the skin and kidney abnormalities (nephropathy) [7]. Long-term use of hydroquinone has many harmful effects, including damage from irritant melanocytic dermatitis, contact dermatitis, and ochronosis (Elferjani et al., 2017).

Hydroquinone is a potential carcinogenic ingredient used in skin lightening and hyper-pigmentation treatment [8] Hydroquinone does not actually whiten the skin but is rather a strong inhibitor of melanin production (Yoshimura et al. 2001). Hydroquinone used for topical application is known to cause serious health hazards when used in excess [10]. Hydroquinone toxicity can cause severe side effects such as kidney and liver damage, blood poisoning, nausea, abdominal pain, convulsions and even coma [9].

Based on the above background, it encourages researchers to conduct this study to determine the content of hydroquinone using the UV-Vis spectrophotometric method on whitening cream located in the Central market of Belopa City.

2. Methodology

This research was conducted on October 05, 2023. This research was conducted in the laboratory of Pharmaceutical Chemistry, Faculty of Health Sciences, University of Muhammadiyah Palopo.

Research variables

Independent Variables: Types of whitening cream taken from the Belopa City Central market

The dependent variable: Creams that do not have a BPOM distribution permit

Tools and materials

The tools used in this research are ultraviolet-visible spectrophotometer, analytical balance, dropper pipette, volume pipette, measuring cup, beaker, stirring rod, measuring flask, watch glass, spatulas. The materials used in this research are Research Samples (facial whitening cream), Hydroquinone, Methanol.

Research Procedures

Sample Collection: The samples used in this study were cosmetic preparations of face whitening cream with 10 different brands taken from the Belopa City area, where 10 samples did not have BPOM registration numbers. Samples taken from the Belopa City area came from the central market of Belopa City. Samples were taken by random sampling method.

Sample Preparations: Sample preparation was carried out through weighing each whitening cream sample as much as 25 mg and suspended in 50 mL methanol, then shaken until homogeneous.

Preparation of Hydroquinone Standard Solution: Weighed standard Hydroquinone as much as 5 mg dissolved with methanol, then put in a 100 mL volumetric flask and added methanol until exactly 100 mL, then the solution was shaken until homogeneous. So as to obtain a standard concentration of 50 ppm Hydroquinone in methanol. Piped 10 mL of 50 ppm standard solution was included in a 50 mL volumetric flask, added with methanol solution until exactly 50 mL and then shaken until homogeneous. Obtained a solution with a concentration of 10 ppm. Pipetted 0.1; 0.2; 0.3; 0.4; 0.5; 1; 1.5 mL of 10 ppm standard solution

put each into a 50 mL volumetric flask add methanol to the mark. Obtained a solution with a concentration of 0.02; 0.04; 0.06; 0.08; 0.10; 0.20; 0.30 ppm.

Determination of Maximum Wavelengths: Piped 0.4 mL of 10 ppm standard solution into a 50 mL volumetric flask, diluted with methanol solution until the mark and then shaken until homogeneous and the resulting hydroquinone solution with a concentration of 0.08 ppm. The 0.08 ppm solution was measured at a wavelength of 200-400 nm (resulting in a wavelength maximum of 294 nm).

Measurement of Hydroquinone Content of Sample: Hydroquinone levels in the sample were analyzed by UV-Vis spectrophotometry. Measure the absorbance of the sample by ultraviolet spectrophotometry at a wavelength of 294 nm. Meanwhile, to calculate the level of hydroquinone in the sample, it was calculated using the linear regression equation: $y = bx \pm a$ obtained through the standard curve of hydroquinone.

$y = a + bx$

Description: y = Expressed absorbance
x = Concentration
b = Regression coefficient (states the slope)
a = Regression constant (states the intercept)

3. Result and Discussion

3.1. Result

There were 10 samples of face whitening cream taken from the central market of Belopa City. Each was coded A, B, C, D E, F, G, H, I, and J. Samples were pretreated with methanol for subsequent quantitative analysis with a UV-Vis Spectrophotometer.

Hydroquinone standard solution was prepared before measuring the samples. Hydroquinone standard solution was prepared for use in determining the maximum wavelength of Hydroquinone and establishing the standard curve of Hydroquinone. A series of standard solutions of Hydroquinone with concentrations of 0.02; 0.04; 0.06; 0.08; 0.10; 0.20; 0.40 ppm were prepared, the standard solution with a concentration of 0.08 ppm was selected as the solution in determining the maximum wavelength. Scanning to determine the wavelength was carried out in the range of 200-400 nm and obtained the maximum wavelength of hydroquinone in this study of 294 nm. This result is in accordance with the research conducted (Utama et al., 2023) which obtained 294 and 290 nm as the maximum wavelength for Hydroquinone.

The following Hydroquinone standard curve was generated by measuring the absorbance of hydroquinone standard solution at the maximum wavelength obtained. The absorbance (y) obtained was then plotted against the concentration of the standard solution (x). The standard curve of concentration against absorbance forms a straight line (linear) and produces a linear regression equation y-0.0192+0.0368 with a correlation coefficient (R) of 0.6171. Determination of sample levels using the linear regression method is a parametric method with independent variables (sample concentration) and dependent variables (sample absorbance) using the calibration curve equation. Repharase Sample concentration can be calculated based on the standard curve equation obtained.

3.2. Discussion

More modern cosmetics known as facial whitening creams function as skin lighteners and are popular products for women and men [2]. Meanwhile, ingredients that can be used to brighten facial skin are ingredients that do not contain harmful substances [3] Whitening creams are easily found in the market at low prices, but there are still many products that do not have an official permit from BPOM [4]. On the other hand, some irresponsible people use the reputation of whitening creams made with a mixture of harmful substances, one of which is hydroquinone [5]. Hydroquinone acts as an antioxidant and depigmenting agent that plays a role in the process of blocking melanogenesis to reduce the dark color of the skin, so the content of hydroquinone is the reason many are found in whitening creams [6].

Hydroquinone is a chemical compound that inhibits melanocyte function and has long been known to have skin whitening effects. According to previous studies, the activity inhibitory effect and specific cell toxicity of melanocytes are known as the mechanism of depigmentation, however, the details of the underlying mechanism are unknown. Arbutin which is a glycoside of Hydroquinone, is also known for its activity inhibitory effect and is commonly used as a skin whitening agent. Hydroquinone if more than 0% is a class of hard drugs that must be used by prescription. Hydroquinone concentrations of more than 5% may cause skin redness. If this aggressive drug is used without medical supervision, it can cause skin irritation, including: skin redness, burning, kidney abnormalities, blood cancer and even liver cancer. Based on complaints from BPOM, the maximum amount of hydroquinone in creams in circulation should not be more than 0% above the amount used as medicine (BPOM RI, 2019).

Based on the results of quantitative analysis using UV-Vis spectrophotometry shown in table 2, the resulting levels of hydroquinone in 10 whitening cream samples with codes A, B, C, D, E, F, G, H, I, and J, have exceeded the levels of hydroquinone that have been determined. This is in accordance with BPOM regulation No.23 of 2019, concerning the prohibition of the use of hydroquinone as a skin whitener and brightener in cosmetics, The use of hydroquinone can only be used for nails with 0.02% hair, as well as hair dye oxidizers with a maximum level of 0.3%.

Determination of Hydroquinone concentration in face whitening cream samples was carried out in the same way as measuring the standard solution, where the sample solution that had been prepared was measured for absorbance using a UV-Vis spectrophotometer at a maximum wavelength of 294 nm. The measurement results are shown in Table 2 and Figure 2, obtained absorbance values for samples with codes A, B, C, D, E, F, G, H, I, and J respectively of 1.731; 0.697; 0.944; 0.908; 0.609; 0.309; 0.673; 0.447; 0.516; and 0.516. This absorption value is then used to calculate the concentration, which is then converted into a percentage (%) so that it can be compared with the Hydroquinone pollution limit set by BPOM RI Number 23 of 2019, which is the level of Hydroquinone contained in whitening cream of 0%. Percentage of Hydroquinone content of each sample obtained were 17%; 6.8%; 9.4%; 9%; 5.9%; 2.8%; 6.6%; 4.27%; 4.9%; and 0.08%. Thus, the quantitative analysis of Hydroquinone levels in all samples used in this study gave results of Hydroquinone levels in the range of 0.08-17%. The highest hydroquinone level was detected in the sample with code A, which was 17%. The

results of this study indicate that overall the samples that do not have BPOM registration numbers have Hydroquinone levels in cream samples with codes A, B, C, D, E, F, G, H, I and J still within high limits because Hydroquinone levels were detected at more than 0%. It can be concluded that 10 samples that do not have a BPOM distribution permit contain Hydroquinone levels which do not meet the requirements of BPOM RI Number 23 of 2019, which is the level of Hydroquinone contained in whitening cream of 0%.

4. Conclusion

Based on research conducted on October 5, 2023, on the Analysis of Hydroquinone Content in Face Whitening Cream in the Central market of Belopa City using UV-Vis Spectrophotometry, it can be concluded that of the 10 samples there were no samples that had levels of Hydroquinone range according to predetermined rules, namely 0%. Where from the research that has been done obtained the results of Hydroquinone levels in samples with code A = 17%, B = 6.8%, C = 9.4%, D = 9%, E = 5.9%, F = 2.8%, G = 6.6%, H = 4.27%, I = 4.9%, and J = 0.08%. Of the 10 samples tested, it was found that the range of Hydroquinone was 0.08%-17%, which certainly did not meet the requirements for Hydroquinone levels determined by the BPOM RI Number 23 of 2019, namely the level of Hydroquinone contained in whitening cream which is 0%.

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