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The International Allied Health Student Conference (IAHSC) 2022
2nd Edition

"Health Innovation for Strengthening Global Health"

Indonesia, 14-15 September 2022

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DETERMINATION OF RETINOIC ACID LEVELS IN FACIAL WHITENING CREAM FOR SALE IN BEKASI CITY USING UV-Visible SPECTROPHOTOMETRY

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Abstract

Introduction: Retinoic acid is a substance used in the treatment of acne by prescription. Its use in cosmetics has been prohibited by the Food and Drug Supervisory Agency of the Republic of Indonesia in regulation Number 23 of 2019 (BPOM RI, 2019). The purpose of this study was to determine the validity of the UV-Visible spectrophotometry method and the levels of retinoic acid in the preparation of facial whitening creams sold in the Bekasi City

Method: This research is a non-experimental type of research and the sample is taken using the purposive sampling method. Qualitative analysis with a thin layer chromatography and quantitative analysis with UV-Visible spectrophotometry.

Results: Retinoic acid has a maximum wavelength of 355 nm. The results of the linearity test were shown by the correlation coefficient (r) = 0.9983, the accuracy-test obtained the retinoic acid recovery value of 100.70%, and the precision test with the RSD value of 1.84%, the LOD value of 0.434 ppm and the LOQ of 1.448 ppm. The results of the analysis showed that of the 12 samples studied, there were 3 positive samples containing retinoic acid with an average level of 2.39% in S9, 2.96% in S10, and 0.86% in S12.

Conclusion: The validity of the UV-Visible spectrophotometric method meets the requirements. There are 3 samples of facial whitening cream containing retinoic acid so it does not meet the requirements set by BPOM.

Key words: Retinoic acid, Face Whitening Cream, UV-Visible Spectrophotometry

INTRODUCTION

Whitening cream is a cosmetic product that has recently been in great demand by the public, especially women. Whitening creams that contain a mixture of chemicals to whiten the skin are sold freely in the *marketplace*. In addition, many irresponsible whitening cream manufacturers include a mix of chemicals and hazardous materials such as metallic mercury, K3 dye, and retinoic acid into their products (Wijaya, 2013).

In 2016, a public warning was issued by the Food and Drug Supervisory Agency of the Republic of Indonesia regarding cosmetics with a mixture of hazardous chemicals and 6% of them contain retinoic acid. In 2017, the use of retinoic acid in cosmetics increased to 10% and increased to 21% in 2018. The use of retinoic acid in cosmetics has been prohibited by the Head of the Food and Drug Supervisory Agency, further stated in regulation No. 23 of 2019 concerning technical requirements for ingredients cosmetics. (BPOM RI, 2019).

The use of retinoic acid can only be obtained with a doctor's prescription. Generally, doctors prescribe retinoic acid as an acne treatment with levels of 0.05% -0.1%. In addition to treating acne, retinoic acid is also often used to treat skin damaged by exposure to the sun and is used as a bleach. However, the use of retinoic acid can also cause dangerous side effects, namely in the first week of use it can cause the skin to become irritated and red, then feel hot and burn and dry and peel (Riyanto, 2014). Excessive use of retinoic acid is teratogenic for pregnant women (Kumar *et al*., 2019). Research on the analysis of retinoic acid in cosmetics in the form of creams have been carried out by Ghina et al. (2015) in the city of Bandung using the TLC-UV-Visible spectrophotometry method. Another study conducted by Wardhani *et al*. 2019 with the analysis of retinoic acid in cosmetics in Klaten City using the UV-Visible spectrophotometric method, Agustina *et al*. thin layer chromatography method to analyze retinoic acid contained in night cream preparations at the Klaten market and Perdina Nursidika *et al*. (2019) using the TLC-UV-Visible Spectrophotometry method.

METHOD

Research

Design The design of this study was a non-experimental study with purposive sampling.

Population and Sample

The population in this study is a face whitening cream that is sold in the city of Bekasi with sales through the marketplaces X, Y, and Z. The inclusion criteria, namely whitening cream without notification number, has a price of less than Rp. 50,000, branded and much in demand by the public. The exclusion criteria were whitening cream that did not come after purchase and whitening cream that did not match the product ordered. The research was carried out at the Pharmaceutical Chemistry Laboratory, Mitra Keluarga College of Health, Bekasi in February-March 2022. The research variables included the type of independentvariable, namely retinoic acid levels.

Tools and Materials

The tools used include analytical scales (Ohaus), spatula, watch glass, beaker glass (Iwaki Pyrex), measuring flask (Iwaki Pyrex), funnel (Iwaki Pyrex), volume pipette, capillary tube, dropper pipette, aluminum foil, stirring rod, Whatman No. 41 filter paper, UV lamp$_{245,}$ chromatography vessel, silica gel 60F$_{254,}$ UV-Vis spectrophotometer (Genesys 10S UV-Vis), cuvette, retinoic acid pro-analysis (Acros organics), facial whitening cream obtained online marketplace through) in Bekasi City, methanol pro-analysis (Emsure, ethanol absolute pro-analysis (Smart lab), acetone, n-hexane pro-analysis (Emsure) and phosphomolybdic acid pro-analysis (Emsure).

Qualitative Analysis

Performed by making the mobile phase first. The mobile phase for qualitative analysis of retinoic acid wasa mixture of n-hexane-acetone solvent with a ratio of 6:4 v/v and made in a volume of 30 mL. Then the TLC plate was activated by heating it in the oven at 105^{oC} for 30 minutes. Previously, a lower boundary line of 1 cm and an elution boundary of 1.5 cm from above were drawn on the TLC plate to be activated. The mobile phase is inserted into a 10 x 10 cm chamber. The chamber is saturated using filter paper which is placed into the chamber. Leave until the solvent rises until the filter paper is completely wet. The standard solution and sample solution were smeared using a capillary tube on a heated TLC plate and allowed to dry. After the chamber is saturated, the TLC plate which has been stained with the sample solution is inserted into the chamber phase is allowed to rise until it approaches the elution limit. The TLC plate was removed and allowed to air dry observed under UV$_{254}$ and after being sprayed with a 5% fosmolybdic acid staining solution in ethanol (BPOM, 2019).

Preparation of Standard Standard Solution of 1000 ppm Retinoic Acid

Made by weighing 0.1 g of standard retinoic acid then put into a glass beaker and dissolved with 100 mL ofmethanol (Suhartini *et al*, 2013).

Preparation of 500 ppm Retinoic Acid Standard Standard Solution was

Made by taking 25 mL of 1000 ppm retinoic acid solution, then put into a 50 mL volumetric flask and added methanol to the mark (Suhartini *et al*, 2013).

Preparation of Standard Standard Solution 100 ppm Retinoic Acid

Made by taking as much as 10 mL of 500 ppm retinoic acid solution, then put into a 50 mL volumetric flask and added methanol up to the mark.

Preparation of 50 ppm Retinoic Acid Standard Standard Solution was

Made by taking 25 mL of 100 ppm retinoic acid solution, then put into a 50 mL volumetric flask and added methanol to the mark.

Determination of Maximum Wavelength

Made by pipetting 1 mL of 50 ppm retinoic acid solution and put into a 10 mL volumetric flask (concentration 5 ppm), then add methanol to the mark and homogenize. Measured absorption maximum at a wavelength of 200-400 nm using a blank. The blank used was methanol (Suhartini *et al*, 2013).

Preparation of Standard Curve and Linearity Test

Made by pipetting 0.2 mL, 0.3 mL, 0.4 mL, 0.5, and 0.6 mL (1 ppm concentration, 1.5 ppm, 2 ppm, 2.5 ppm, and 3 ppm) 50 ppm retinoic acid solution and put into a 10 mL volumetric flask, then add methanol tothe mark and homogenize. The maximum absorbance was measured at a wavelength of 200-400 nm using a blank and replicated 3 times. The blank used was methanol (Suhartini *et al*, 2013).

Precision Test

Made by pipetting 0.2 mL of retinoic acid standard solution with a concentration of 1 ppm, then the absorbance was measured at the maximum wavelength and replicated six times. The data obtained is then calculated as standard deviation and relative standard deviation using Microsoft excel (Fauziah, 2016).

Accuracy Test

Performed using spiked-placebo recovery method. A number of analytes were added to a pharmaceutical preparation mixture that did not contain analytes (placebo) and then analyzed and compared with the actual analyte levels (added analytes). The absorbance results obtained are then calculated as the value of *% recovery* or recovery**.** A total of 3.0 g of cream samples that did not contain retinoic acid were prepared and then added with standard retinoic acid of 80.0 mg, 160.0 mg, and 240.0 mg so that the concentrations of 1 ppm, 2 ppm, and 3 ppm were obtained. The maximum absorption of the three concentrations of the solutionwas measured at a wavelength of 355 nm using a methanol blank and replicated every 3 times (triple).

Determination of LOD and LOQ

Limit of Detection (LOD) and Limit of Quantitation (LOQ) is calculated statistically by looking at the linear regression equation from the standard a curve that is formed. The absorbance results from the standard solution are then calculated and entered into the obtained linear regression equation (Fauziah, 2016).

Sample Preparation

Made by weighing the cream sample as much as 3.0 g. Then put it in a glass beaker and wrapped in aluminum foil. 10 mL of methanol was added and mixed until homogeneous using *a vortex mixer* for 5 minutes. Next, cool the homogenized cream sample in the refrigerator for 15 minutes and filter it using Whatman No. 41 filter paper in a 50 mL volumetric flask. The filtrate obtained was then added with methanol to the mark and homogenized. A total of 5 mL of the diluted filtrate was then pipetted and put into a 10 mL volumetric flask, then methanol was added to the mark and homogenized. 0.5 mL of thefiltrate was pipetted and put into a 10 mL volumetric flask and then added methanol to the mark and homogeneous. A total of 0.25 mL of the filtrate was pipetted again and then added methanol to the markand was homogeneous and then the absorbance was measured at a wavelength of 200-400 nm (Suhartini *et al*, 2013).

Determination of Retinoic Acid Levels

The determination of retinoic acid levels in the sample is calculated using the following formula:

$$\left(\frac{Au}{As}\right)\left(\frac{Cs}{Cu}\right) x\ 100$$

Description:
Au = Absorbance of the test solution/sample
As = Absorbance of standard solution
Cs = Content of retinoic acid in standard solution (mg/mL)
Cu = Content of retinoic acid in test solution (mg/mL)

RESULTS

Sampling

Facial whitening cream used as a sample was taken as many as 12 products. The sample used came from Bekasi City with online through 3 marketplaces and was selected based on inclusion and exclusion criteria. The cream samples were coded as samples S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11 and S12.

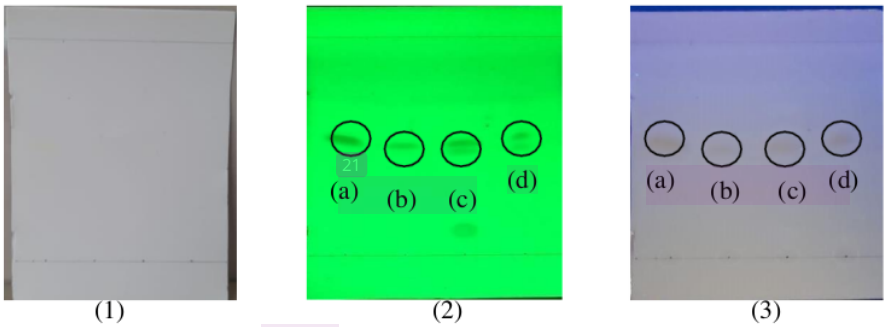
Qualitative Analysis

Performed using thin layer chromatography method by calculating the Rf value. The results of the qualitative analysis can be seen in **Table 1.**

Table 1. Results of qualitative analysis of retinoic acid on facial whitening cream

Sample Code	Color	Rf	Resolution	Conclusion
Standard	Dark green	0,66	Not detected	Positive
S1	Not detected	Not detected	Not detected	Negative
S2	Not detected	Not detected	Not detected	Negative
S3	Not detected	Not detected	Not detected	Negative
S4	Not detected	Not detected	Not detected	Negative
S5	Not detected	Not detected	Not detected	Negative
S6	Not detected	Not detected	Not detected	Negative
S7	Not detected	Not detected	Not detected	Negative
S8	Not detected	Not detected	Not detected	Negative
S9	Dark green	0,50	Not detected	Positive
S10	Dark green	0,51	2	Positive
S11	Not detected	Not detected	Not detected	Negative
S12	Dark green	0,54	2,8	Positive

Here are the results of the qualitative analysis using TLC:



(1) (2) (3)

Figure 1. TLC Results Before Spraying

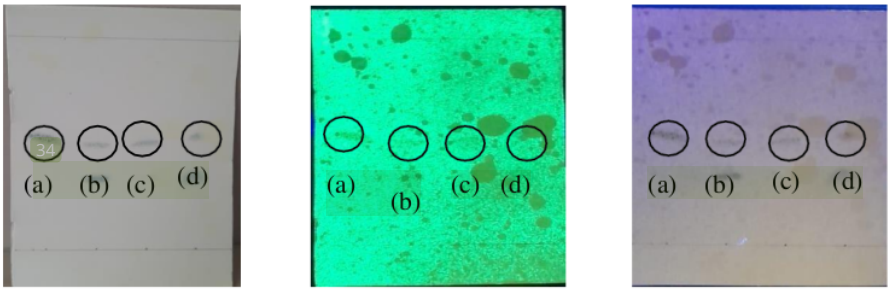


Figure 2. TLC results after spraying

Information:
(1) = TLC result in visible light
(2) = TLC result under UV light 245
(3) = TLC result under UV light 366

(a) = Standard stain of retinoic acid (Rf 0 ,66)
(b) = sample stain S9 (Rf 0,50)
(c) = sample stain S10 (Rf 0,54)
(d) = sample stain S12 (Rf 0,51)

Based on the analysis it is known that 3 out of 12 of the sample tested positive for retinoic acid. The samples are samples with codes S9, S10 and S12. Positive results are indicated by the formation of the same color stain, namely dark green between the reference standard and the sample after spraying and the Rf value of the sample is close to the Rf value of the comparison standard retinoic acid.

Determination of the Maximum Wavelength The maximum

Wavelength of retinoic acid is 355 nm with an absorbance of 0.616. The following are the results of the maximum wavelength spectra obtained:

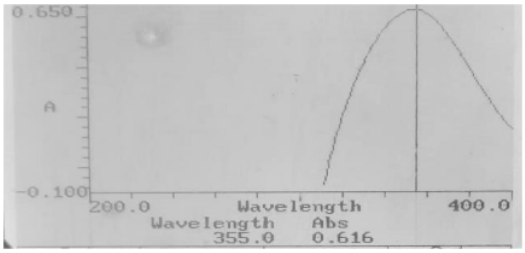


Figure 3. Maximum wavelength spectra of retinoic acid

Determination of the Retinic acid Standard Curve

Determination of the standard curve for retinoic acid using 5 concentration series, namely 1 ppm, 1.5 ppm,2 ppm, 2.5 ppm and 3 ppm. The results of the standard curve of retinoic acid are shown in **Figure 4.**

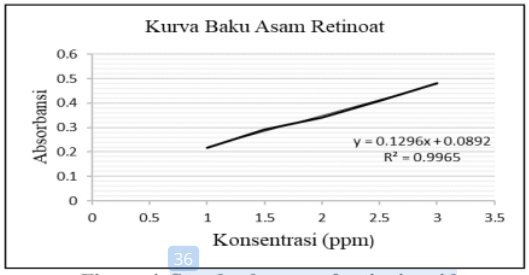


Figure 4. Standard curve of retinoic acid

Linearity Test

In this test, the regression equation obtained from the standard curve is y = 0.1296x + 0.0892 and the correlation coefficient (r) is 0.9983. This value already shows a good linearity relationship because it is close to 1.

Precision

Test The precision test that has been carried out gives the result of the %RSD value of 1.84%. The precision results have met the criteria for acceptable value requirements according to Gonzales and Herrador, namely the precision requirement for an analyte content of 1 ppm is less than 16% (Gonzales and Herrador, 2007). Other requirements according to the AOAC, precision can be accepted if it gives results in the form of coefficient of variation (KV) or relative standard deviation (RSD) <2%. Precision test results are shown in **Table 2.**

Tables 2. Precision test results

Replication	Actual concentration (ppm)	Absorbance	Level obtained (ppm)
1	1	0,225	1,048
2	1	0,224	1,040
3	1	0,226	1,056
4	1	0,223	1,032
5	1	0,227	1,063
6	1	0,220	1,009
Average			**1,041**
SD			**0,019**
%RSD			**1,84**

Accuracy Test

In the accuracy test carried out, the average value of % *Recovery* or recovery is 100.70%. These results have met the requirements for reacquisition. In theory, the accuracy requirement is if the recovery received is 80-110%. The results of the accuracy test are shown in **Table 3.**

Table 3. The results of determining accuracy

Standard addition concentration	Rep.	Absorbance	(%) Recovery	(%) Recovery average
1	1	0,221	102%	101,18%
	2	0,222	102%	
	3	0,218	99%	
2	1	0,358	103,70%	103,06%
	2	0,359	104,09%	
	3	0,352	101,39%	
3	1	0,478	100%	97,86%
	2	0,460	95,37%	
	3	0,471	98,20%	
Recovery average				**100,70**

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Determination of LOD and LOQ The

Determination of LOD and LOQ gives the results of the LOD value of 0.434 ppm and the LOQ value of 1.448 ppm**.** These results can be seen in **Table 4.**

Table 4. Results of determining accuracy

Parameter	Result
SE of Intercept:	0,009
SD of Intercept:	0,019
LOD:	0,434
LOQ:	1,448

Determination of Retinoic Acid Levels

Determination of retinoic acid levels in face whitening cream preparations in samples S9, S10 and S12 the average grade value is 2.39% for sample S9, 2.96% for sample S10 and 0.86% for sample S12. The three samples did not meet the requirements set by the Regulation of the Food and Drug Supervisory Agency of the Republic of Indonesia regarding the content of retinoic acid in cosmetics. The following is a table of the results of the determination of retinoic acid levels:

Table 5. Retinoic acid levels in samples of facial whitening cream

Sample code	Rep.	Abs.	Sample weight (mg)	Retinoic acid level (%)	Average % b/b	SD	Desc.
S9	1	0,695	3000,0	2,493%	2,39%	0,172	Not eligible
	2	0,661	3000,0	2,353%			
	3	0,652	3000,0	2,316%			
S10	1	0,775	3000.0	2,822%	2,96%	0,221	Not eligible
	2	0,822	3000,0	3,016%			
	3	0,827	3000,0	3,036%			
S12	1	0,292	3000,0	0,835%	0,86%	0,035	Not eligible
	2	0,298	3000,0	0,859%			
	3	0,301	3000,0	0,872%			

DISCUSSION

Research on the determination of retinoic acid levels in facial whitening cream preparations circulating in the city of Bekasi with sales through the marketplace by TLC-UV-Vis spectrophotometry, which aims to determine the presence or absence of retinoic acid in the face whitening cream sample. This refers to the Regulation of the Head of the Food and Drug Supervisory Agency Number 23 of 2019 concerning the technical requirements of cosmetic ingredients. The regulations do not allow the presence of retinoic acid in cosmetics. In this study, the sample used is facial whitening cream which is sold in the city of Bekasi with sales through the marketplace. A total of 12 samples were obtained from 3 marketplaces after previously determining the sampling. A total of 4 samples were obtained from marketplace X, 5 samples were obtained from marketplace Y and 3 samples were obtained from marketplace Z.

Qualitative analysis using thin-layer chromatography (TLC) was carried out to identify retinoic acid contentor separating retinoic acid from other compounds contained in the face whitening cream sample. The mobile phase is determined by looking at the polarity of the analyte to be analyzed. In this study, the mobile phase used was a mixture of n-hexane-acetone (6:4) v/v which was made in a volume of 30 mL. The choice of the solvent mixture in the mobile phase is determined based on its polarity. Based on the calculations, the mobile phase in this study has a polarity index of 2.1 which indicates the mobile phase is a semi-polar solvent. The polarity index is an empirical quantity that is used to measure the attraction between molecules in a solute and the solvent molecules on the solubility parameters of the solvent in question in its pure state (Rubiyanto, 2016). The higher the polarity index, the more polar the solvent. While the stationary phase of silica gel GF_{254} has more polar properties. Meanwhile, the analyte in this case retinoic acid has a low polarity. In the separation, the non-polar mobile phase will hold polar compounds in the polar stationary phase and bring non-polar compounds up to the top.

TLC plate activation was performed before cream sample analysis. This activation is carried out to activate the silanol and siloxane groups contained in silica and play a role in adsorption (Harmita, 2004). The surface of the silica gel is a siloxane group (Si-O-Si) and a silanol group (Si-OH) and is slightly acidic and polar so it can interact with solutes that are slightly polar to very polar. The -OH group in silanols will form hydrogen bonds with the -OH groups of retinoic acid ($C_{20}H_{28}O_2$) as shown in the figure below:

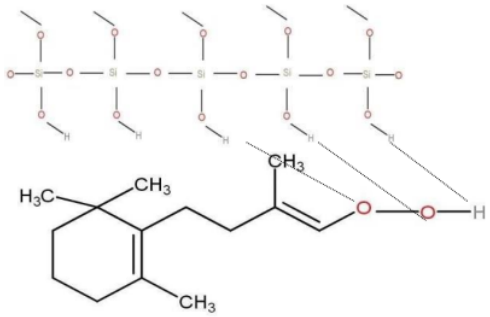

Figure 5. Interaction between silanol groups and retinoic acid

Activation in this study was carried out by drying the TLC plate in an oven at 105℃ for 30 minutes. In addition, it is necessary to saturate the chamber. This is because the interaction between the TLC plate sorbent and the solvent vapor molecules depends on the saturation of the chamber (Wulandari, 2011). Saturation is done by placing the filter paper vertically into the chamber containing the eluent. And let the eluent rise to move along the filter paper and wet the entire filter paper. The eluent used in this analysis is a mixture of n-hexane-acetone (6:4).

Retinoic acid will give blue to dark green spots by spraying phosphomolybdic acid when analyzed using TLC (Ministry of Health RI, 2020) Of the 12 samples of whitening cream analyzed in this study, 3 of themgave results in the form of dark green spots. The three samples are samples with codes S9, S10, and S12. The calculation of the Rf value was then carried out to determine the possibility that the sample with dark green spots was the analyte. The result of the Rf value obtained in the S9 sample is 0.50. The sample S10 gave three spots, namely spot A with an Rf of 0.12, spot B with an Rf value of 0.46, and spot C with an Rf value of 0.51. Meanwhile, the S12 sample gave two spots, namely spot A with an Rf of 0.47 and spot B of 0.54. Resolution calculations were carried out on sample spots S10 and S12. This is because samples S10 and S12 formed two stains so the resolution calculation was used to ensure that the spots formed were well separated. In the S10 sample between node A to node B, the resolution value is 2, while in the S12 sample, between node A and node B, the resolution value is 2.8. The separation of substances in samples S10 and S12 has given good results. This is to the requirements for the separation or resolution of the analyte with other substances, it will be said to be good if the value is > 1.5 (Harmita, 2004). A sample is declared positive if in the qualitative analysis it gives an Rf value equal to or close to the comparison Rf and the difference is less than 0.2 (Ministry of Health RI, 2020). In this study, it has met the requirements because the result of the difference in the Rf value of the sample with the comparison is less than 0.2, namely, the S9 sample has a different value of 0.16, the S10 sample has a different value of 0.12 and the S12 sample has a 0.15 difference value. From these results, samples S9, S10 and S12 were positive samples containing retinoic acid. In addition, positive results were also indicated by the color formed in the three samples afterbeing given a phosphomolybdic acid spot viewer. Samples S9, S10, and S12 showed the same color as the standard retinoic acid, which was dark green.

Before validating the method, the maximum wavelength of retinoic acid was first measured. Determination of wavelength aims to determine the maximum absorbance of retinoic acid that can be read by a UV-Vis spectrophotometer. The maximum wavelength obtained is 355 nm. According to the Indonesian Pharmacopoeia VI edition, retinoic acid has a wavelength of 352 nm with a standard deviation of 3% or 10.65 nm so in the analysis of retinoic acid it will conform to the standard if the resulting wavelength ranges from 341.35 nm to 362.65 nm (Ministry of Health). RI, 2020). The maximum wavelength results in this study are in accordance with the theory where the shift that occurs is less than 3% (10.65 nm) or ranges from 341.35 nm to 362.65 nm. The shift in wavelength can be caused by differences in the analysis tools and the condition of the equipment and the differences that can occur during sample preparation.

Linearity is expressed as the ability of the analytical method to provide comparable results to the analyte concentration contained in the sample (Riyanto, 2014). Linearity can be expressed in the correlation coefficient obtained from the measurement results of several analyte concentrations. According to AOAC, the linearity parameter is good and acceptable if the value obtained is > 0.99 (AOAC, 2016). In this study, 5 concentration standard curves were used to determine linearity, namely the standard curve concentrationsof retinoic acid 1 ppm, 1.5 ppm, 2 ppm, 2.5 ppm, and 3 ppm. The results obtained for linear regression are y= 0.1296 + 0.0892 with a correlation coefficient (r) of 0.9982 and a coefficient of determination (r^2) of 0.9962. Based on this value, linearity shows a linear result between concentration and absorbance results.

Precision is defined as a measure that expresses the closeness of the test results to a homogeneous samplein a series of measurements that are repeated. According to Riyanto (2014), the precision test was carried out on a homogeneous mixture of at least six replications. Precision can be done as repeatability and reproducibility (Riyanto, 2014). Precision is expressed in the form of standard deviation which is then calculated the coefficient of variation of the standard deviation.

The precision carried out in this study is repeatability, where precision is carried out under the same conditions and repeated at short time intervals. In the precision test in this study, the standard deviation (SD) was 0.019 and the coefficient of variation (CV) or %RSD was 1.84%. This value has met the criteria for a good precision value, which is less than 2%. An acceptable precision criterion is if a method can give results in the form of coefficient of variation (CV) or relative standard deviation (RSD) <2%. Meanwhile, according to Gonzalez and Herrador, the precision required for the analyte content of 1 ppm is less than 16%. The precision results of this study have met the requirements of RSD Horwitz, namely 1.84% or less than 16% (Gustavo González & Angeles Herrador, 2007).

Accuracy is one of the parameters in method validation in the form of a value that shows the closeness between the test results and the actual levels and is expressed in percent recovery (%recovery) (Riyanto, 2014). In the accuracy results, the closer the measurement value to the actual level, the more accurate the method used. Based on the results of the recovery measurements at three concentrations of 1, 2, and 3 ppm after measurement with three replications, the average percent recovery was obtained at 100.70%. At a concentration of 1 ppm, the average yield of recovery is 101.11%, the concentration of 2 ppm is 103.06% and the concentration of 3 ppm is 97.86%. According to Harmita (2004), the error range in each analyte concentration is still acceptable if the analyte contained in the sample is < 1 ppm, which is 80%-110% (Harmita, 2004). The 80%-110% accuracy range is also an accuracy range that is declared good if the analyte concentration in the sample is 1 ppm based on the AOAC (Association of Official Analytical Chemists) (2016). The accuracy results in this study have met the acceptable accuracy requirements because they are in the 80%-110% range.

The limit of detection (LOD) is the lowest concentration of an analyte in a sample that still gives a value or is detected by an analytical method. While Limit of Quantitation (LOQ) or is the the lowest concentrationof an analyte in a sample that can still be quantified. In this study, LOD and LOQ were determined by statistically calculating the linear regression line from the previously obtained calibration curve (Riyanto, 2014). From this measurement, it is known that the LOD or the smallest retinoic acid concentration that canstill be measured by a UV-Vis spectrophotometer is 0.434 ppm while the LOQ or retinoic acid concentration that can still be measured and quantified using a UV-Vis spectrophotometer is 1.448 ppm.

Quantitative analysis was carried out to determine the level of concentration of retinoic acid contained in samples of facial whitening cream. In this study, quantitative analysis was carried out using the UV-Vis spectrophotometric method. Retinoic acid is a compound that has ring aromatics, conjugated double bonds, and auxochrome anions -O so that they can be detected through a UV detector (Nastiti, 2016). Retinoic acid has a chromophore group which is part of the molecule with the function of absorbing light in the UV-Vis region and has an auxochrome group that plays a role in the intensity of UV light absorption on the chromophore. The following is a picture of the chromophore and auxochrome groups present in retinoic acid:

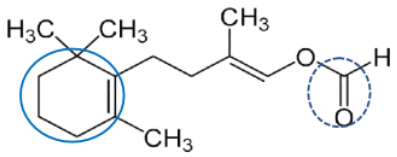

Figure 6. Chromophores and Auxochrome Groups of Retinoic Acid

Remarks:

=Chromophores
= Auxochromes

In the UV-Vis spectrophotometric analysis method, the molar excision value (ε) is important. The value ofa sample can be analyzed using UV-Vis spectrophotometry, one of which is if it has a value > 1,000 (Tati, 2017). This is because the absorbance obtained will be greater at a small analyte concentration. Analysis of retinoic acid has an excision value (ε) of 36,288.32, which means that retinoic acid can be analyzed using spectrophotometry. Determination of retinoic acid levels in the preparation of facial whitening cream is determined by processing the absorbance measurement data from the prepared sample solution. The resulting data is calculated using the linear regression equation that has been obtained previously, namely y= 0.1296 + 0.0892. In determining the levels, replication or repetition of each sample was carried out 3 times. Replication aims to determine repeatability. The prepared face cream samples were measured for absorbance using a UV-Vis spectrophotometer with a maximum wavelength of 355 nm. Of the 12 facial whitening creams that were sampled, 3 of them were samples that were graded. The samples of the facial whitening cream are samples that have codes S9, S10, and S12. This is because samples S9, S10, and S12 are samples that give positive results in the qualitative test using Thin Layer Chromatography (TLC). Basedon the analysis, it shows that samples of facial whitening cream circulating in the city of Bekasi with sales through the marketplace analyzed in this study contain retinoic acid with an average level of 2.39%. These levels are 2.39% in the S9 sample, 2.96% in the S10 sample, and 0.86% in the S12 sample. The results of these levels indicate that the three samples of facial whitening cream analyzed using a UV-Vis spectrophotometer did not meet the requirements set by the Food and Drug Supervisory Agency of the Republic of Indonesia where in Regulation Number 23 of 2019 concerning technical requirements for cosmetic ingredients it is not allowed to contain retinoic acid in cosmetics.

CONCLUSION

Based on the research conducted, it was concluded that 3 of the 12 samples of facial whitening creams soldin Bekasi City online on the X, Y, and Z marketplaces were positive for retinoic acid with levels ranging from 0.86% - 2.96% and did not meet the requirements outlined in this article determined by BPOM. The analytical method used fulfills the validation requirements as indicated by the correlation coefficient (r) of 0.9983, %RSD of 1.84%, accuracy obtained with an average recovery of 100.70%, LOD value of 0.44 ppm, and the LOQ result is 1.45 ppm.

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