

ANALYSIS OF NaOCl CONTENT OF HAND & BODY LOTION AND FACE WASH CREAM BY IODOMETRIC TITRATION METHOD

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ABSTRACT

Cosmetics are needed by the public, such as hand and body lotions and face brightening creams, and there are many misuses of hazardous chemicals in cosmetics, including lotions and face brightening creams. Sodium hypochlorite, a hazardous chemical, can cause skin damage, such as irritation, rash, hypersensitivity, and burns. The purpose of this study was to determine the presence of sodium hypochlorite compounds and sodium hypochlorite in hand and body lotion cosmetics and face brightening cream. The method used in this research was qualitative analysis with color reaction and quantitative analysis with iodometric titration. The results qualitatively showed that color changes occurred in all samples. NaOCl concentration in hand and body lotion at 0.2% concentration showed an average NaOCl concentration of $3.263 \% \pm 0.25$ and face brightening cream concentration at an average concentration of 10 mg showed NaOCl levels of $88.933 \% \pm 7.57$. Based on this, it was concluded that in the samples of hand and body lotion and face brightening cream, sodium hypochlorite compounds with different levels. Therefore, these samples could have side effects and toxicity in their usefulness as cosmetics.

Keywords: Hand & body lotion, face brightening cream, sodium hypochlorite (NaOCl), iodometric titration

INTRODUCTION

The development of cosmetics is very rapid because of the public's need for cosmetics that are used daily. Cosmetics are materials or preparations intended for use outside of the human body (epidermis, hair, nails, lips, and external genital organs), teeth, and oral mucous membranes, especially for cleaning, fragrance, changing appearance, and/or improving body odor or protecting or maintaining the body in good condition (BPOM RI, 2022). Cosmetic preparations that are commonly used by the public to whiten the skin are hand body lotion whitening and face brightening creams (Sari et al., 2017).

Several chemical bleaching agents have been developed. Sodium hypochlorite (NaOCl) is a bleaching agent that functions as the main ingredient of bleaching liquids. Sodium hypochlorite is commonly used in the clothing, paper, and sawdust industries. Sodium Hypochlorite (NaOCl) compounds are generally used as cleaning agents in households because they act as disinfectants that can inhibit microbial growth (Eriksson et al., 2017). In addition, NaOCl has an antibacterial effect on sodium (Sara et al., 2019) and a tissue repair effect (Jacob et al., 2019).

Based on BPOM Regulation No. 17, 2022 for standard materials in cosmetics, NaOCl is not included in the allowed compound in that regulation. This means that NaOCl is not

allowed in cosmetics (BPOM RI, 2022). In cosmetics, basic ingredients from nature, which have high antioxidant activity, are recommended for formulating cosmetics based on safety considerations (Febriani et al., 2023; Marlita & Sujono, 2024). The use of sodium hypochlorite is very impactful on health, both entering the body or being exposed to the skin of the body. Irritation can occur due to the saponification reaction of oil on the skin, which can cause dry skin, tissue damage, irritation of the eyes (red, dry, and itchy eyes), and respiratory problems (Pramujo, 2021). The toxic effects of sodium hypochlorite arise from its corrosive activity when in direct contact with mucous membranes and skin. In addition, it is toxic when ingested and has direct contact with the skin and eyes (Jacob et al., 2019).

Based on the explanation above, it is necessary to conduct further in-depth research on cosmetics. Therefore, this study aimed to determine and analyze cosmetic preparations in the form of hand and body lotion and face brightening creams in the presence of sodium hypochlorite compounds as additional whitening ingredients. Therefore, qualitative analysis of the color reaction and quantitative analysis using the iodometric titration method were performed.

RESEARCH METHODS

Equipment and Materials

The tools used include analytical scales (Ohaus CP 214), stirring rods, electric stoves, and burettes. The materials used included whitening hand and body lotion samples, Face Brightening cream, and potassium iodate p. a. (PT. Merck), chloride acid p.a (PT. Merck), 2 N sulfuric acid p.a (PT. Merck), 1% amylum, 10% potassium iodide p.a (PT. Merck), distilled water, sodium thiosulfate p.a (PT. Merck), and hot water.

Research Procedure

1. Sampling

Samples of hand and body lotion were taken at random (probability sampling) at the Aikmel public market, and 18 samples of different brands and samples of face brightening cream were taken at random (probability sampling) at the Pringabaya public market, with 4 samples of 2 different brands. One sample consisted of morning and night creams.

2. Preliminary Test

Organoleptic tests were conducted based on the Director General of POM in 1979, and the organoleptic test examination included odor, color, and texture. The test was repeated thrice for each formula (Lumentut et al., 2020).

3. Qualitative Analysis of Hand & Body Lotion Whitening, Face Brightening Cream, and Negative Control Cosmetic Samples

- Negative control of NaOCl was prepared by dissolving 10 mL of NaOCl in distilled water in a 100 mL volumetric flask, adding 3–5 drops of 10% KI solution, 2–3 drops of 1 M HCl, and 3–4 drops of 1% amylum solution, and stirring and shaking until it changed color to purple blue.
- Each sample of hand and body lotion and face brightening cream was weighed to as much as 10 mg, which was dissolved in distilled water to the limit of a 10 mL volumetric flask. The solution (1 mL) was added to 3 mL of 10% KI solution, 2–3 drops of 1 M HCl, and 2 mL of 1% amylum solution, and stirred and shaken until homogeneous. Blue indicates a positive sample containing sodium hypochlorite (Devianti & Yulianti, 2018).

4. Quantitative Analysis of Hand & Body Whitening Lotion, Face Cream and Positive Control Cosmetics Samples

- The positive control NaOCl was taken with variations of 10 mL, 15 mL, and 20 mL dissolved in distilled water in a 100 mL volumetric flask, 1 mL was placed into an Erlenmeyer flask, and 10% KI solution was added to 3 mL and 4 mL HCl. The Erlenmeyer flask was closed and then titrated with 0.01 N sodium thiosulfate to a clear yellow color, 1 mL of 1% amylum indicator was immediately added, and titration was

continued until the dark blue color disappeared. The titration volume was then recorded. Titration replicated 3 times.

- b. Samples with concentrations of 0.1%, 0.15%, and 0.2%, each from hand and body lotion, were taken at 1 mL and 1 g from each face brightening cream sample. Each test sample was placed in an Erlenmeyer flask, and a 10% KI solution was added to 3 mL of 4 mL HCl. The solution was then titrated using a sodium thiosulfate standard solution until the blue color disappeared. The titrant volume was recorded, and the % content of Sodium Hypochlorite (NaOCl) in was calculated (Novitasari et al., 2020).

Data Analysis

Qualitative color changes from colorless to blue; then, the content is calculated by looking at the volume of titrant used and using the % content formula as below (Asmal, 2018).

$$\% \text{ content} = (V.\text{Titran} \times N \text{ Titran} \times BE)/(\text{mg sample}) \times 100$$

RESULTS AND DISCUSSION

1. Organoleptic Test

Preliminary analysis through an organoleptic test is an analysis carried out visually with the aim of determining the initial-to-final characteristics. Organoleptic test examinations include odor, color, and texture (Lumentut et al., 2020). The organoleptic test results of the face brightening cream sample showed that each sample had a different color and a distinctive pungent aroma, and all samples had a solid texture/shape that was in accordance with the proper cream preparation, while the hand body lotion samples showed a fragrant, distinctive odor (not too fragrant and not pungent), and there was a pungent odor (not fragrant), which was adjusted to each formulation of the hand and body lotion. The texture of each sample was soft, and some were oily because the hand and body lotion sample was an emulsion preparation. The texture of the sample fulfills the emulsion preparation requirements, as evidenced by the non-separation of the oil phase and the water phase in the hand and body lotion sample preparation (Rusli & Pandean, 2017).

2. Qualitative Test of NaOCl

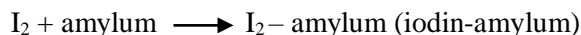
The qualitative test used was the iodine test. The results of the test are listed in Table I.

Table I. Qualitative Test Results Iodometric Titration Method

Sample	Color	Reference (Color NaOCl)	Result
L0	No color change		-
L1	Blue-violet		+
L2	Blue-violet		+
L3	Blue-violet		+
L4	Blue-violet		+
L5	Blue-violet		+
L6	Blue-violet	Blue-violet	+
L7	Blue-violet		+
K0	No color change		-
K1	Blue-violet		+
K2	Blue-violet		+
K3	Blue-violet		+
K4	Blue-violet		+

Description: L0 (negative control loop), L (hand and body lotion), K0 (negative control face brightening cream), K (face brightening cream).

The qualitative test results produced a color change from colorless to blue, which can be adjusted to the reaction below (Ganjar & Rohman, 2018).



A change in color to mauve blue indicates the presence of sodium hypochlorite compounds because the amount of iodine released in this reaction is equivalent to that of sodium hypochlorite during the addition of excess KI. The addition of amylum indicators aims to clarify the color change at the endpoint of the titrant to obtain the titrant volume (Saputra et al., 2014).

3. NaOCl Concentration in Face Lightening Cream and Hand & Body Lotion

The results of the calculation of sodium hypochlorite levels in the samples of hand and body lotion and facial brightening cream are shown in (Table II and Table III). The concentration of the hand % body lotion sample used was 2% and that of the face brightening cream sample was 10 mg.

Table II. NaOCl Levels of Hand & Body Lotion (n=3)

Sample	Concentration (%)	Mean ± SD
L1	3.24	
L2	3.06	
L3	2.94	
L4	3.25	3.263 ± 0.25
L5	3.50	
L6	3.19	
L7	3.66	

Description: L (hand & body lotion)

Table III. NaOCl Levels of Face Brightening Cream (n=3)

Sample	Concentration (%)	Mean ± SD
K1	79.05	
K2	94.86	88.933 ± 7.57
K3	86.96	
K4	94.86	

Description: K (face brightening cream)

Iodometric titration is an indirect titration, which means that the titration analysis is carried out on the analyte solution (solution of unknown concentration) with a sodium thiosulfate solution ($\text{Na}_2\text{S}_2\text{O}_3$) as a standard solution (titrant) by adding amylum, which is an indicator (Rohmah & Rini, 2020). Sodium thiosulfate solution was first standardized with a primary standard solution because sodium thiosulfate solution is a secondary solution. Sodium thiosulfate solution was standardized using a primary standard solution, one of which was potassium iodate (KIO_3).

Determination of Sodium Hypochlorite (NaOCl) levels was carried out using the iodometric titration method. The results of the calculation of the levels in Table II and Table III show that all samples contain different levels of sodium hypochlorite. At a percentage level of 0.01–0.08 %, Sodium Hypochlorite showed antibacterial effects on planktonic cells. With this anti-bacterial effect, apart from being a bleaching agent, atrium hypochlorite (NaOCl) functions as a disinfectant because of its antibacterial properties (Eriksson et al., 2017). The percentage of NaOCl content of samples that is more than 2.5% can be used as a bleaching agent in hand and body

lotion preparations. In cosmetic preparations, one of which is hand and body lotion or in the form of a face-lightening cream, it is not possible to use ingredients that are harmful to skin health. NaOCl as a bleach in the preparation of hand & body lotion can have a dangerous impact on skin health, because NaOCl in addition to whitening clothes, NaOCl can be used as a disinfectant. The use of disinfectants is not allowed on living tissue; therefore, the use of sodium hypochlorite in the body can cause damage to body tissues, one of which, if applied to the skin, damages the skin tissue. Skin exposed to disinfectants can cause irritation, itching, dryness, and peeling (Sagala et al., 2020). Therefore, NaOCl is not safe for use as an ingredient in cosmetic preparations.

Exposure to direct skin contact may result in hypersensitivity IV allergic contact dermatitis. The degree of damage depended on the duration of the exposure. Short exposure only causes temporary damage to the skin tissue, but prolonged exposure can cause irritation, damage, and skin irritability. Exposure to high concentrations can cause burning pain, redness, edema, watering, and necrosis of skin cells. This is due to the irritant nature of NaOCl (Chung et al., 2022). Inhalation of hypochlorite can cause irritation, nausea, vomiting, noise, headache, and cough. Long-term use of this compound raises neutrophil levels and causes lower respiratory tract disorders (White & Martin, 2010). Chlorine gas derived from the chemical reaction between sodium hypochlorite and other substances produces compounds that can cause upper respiratory distress, serious hypoxemia, pneumonia, bronchitis, pulmonary edema, and acute respiratory distress syndrome (Matulonga et al., 2016). In another case, the symptoms caused when exposed to the eye area are conjunctival edema, conjunctivitis, visual disturbances, lacrimation, and corneal abrasions. In addition, exposure to sodium hypochlorite at a concentration of 3.5% causes a burn sensation in the eye (Regalado et al., 2014).

CONCLUSION

Samples of hand & body lotion whitening circulating in the Aikmel market and face brightening cream samples taken from the Pringgabaya public market contain sodium hypochlorite compounds marked by a change in color to mauve blue (qualitative test) and have different percentage levels of quantitative test. Therefore, awareness of consumer in choosing, buying, and utilizing the variously of cosmetics absolutely needed. Also, the collaboration of government and public must be increase.

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