

## MERCURY CONTENT ANALYSIS IN COSMETICS SOLD FREELY ON SOCIAL MEDIA IN GORONTALO CITY

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### Abstract:

Cosmetics have become necessary for humans because of their routine and continuous use. Therefore, the research aims to discover mercury content in cosmetics sold freely on social media in Gorontalo City. Besides, the sampling employs total sampling with a complete sample of 10 items. Therefore, this study is descriptive research with an experimental laboratory method. On the other hand, the qualitative analysis using atomic absorption spectrophotometer (SSA) test unveiled that out of the ten samples of whitening cream, there were eight samples containing mercury, namely sample 1, sample 2, sample 3, sample 5, sample 6, sample 8, sample 9, and sample 10. However, it does not exceed the mercury level under the limit requirements set by the National Agency of Drug and Food Control of the Republic of Indonesia. As a recommendation, in choosing cosmetic products, consumers should pay attention to the benefits and adverse effects and the chemical content that can jeopardize their health and use cosmetic ingredients with a POM number.

**Keywords:** Mercury, Cosmetics, AAS

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## INTRODUCTION

Health is generally defined as being physically, mentally, and spiritually well. Meanwhile, healthy skin means skin that does not suffer from any disease, either a disease that affects the skin directly or a disease in the body that indirectly affects the skin's health. The appearance of healthy skin can be seen from the physical structure of the skin in the form of color, flexibility, thickness, and skin texture. Various factors affect the appearance of healthy skin, such as age, race, climate, sunlight, and pregnancy (Holilah, 2016; Jatmiko et al., 2016).

White and bright skin is everyone's dream, especially women. Therefore everyone tries to maintain and improve the health of their skin, so most women always try to look attractive. The development of skincare technology and beauty clinics throughout Indonesia also supports this. For this reason, skincare has become a current trend for modern women and is a necessity for a woman (Tranggono & Latifah, 2014; Dipahayu et al., 2014).

Mercury (Hg) vapor is highly hazardous because it is poisonous when inhaled, enters the brain's blood, and damages brain tissue. Inorganic mercury compound soluble in water and alcohol is poisonous only when in large concentrations. Inorganic mercury compounds such as dimethyl and methyl mercury are the conversion of inorganic mercury with the help of bacteria in the water through the food chain, eventually entering the digestive tract. Furthermore, in the body, mercury can react with thiosulfhydrin in proteins to disrupt enzymes and stop critical chemical reactions, and can interfere with the central nervous system (Walangitan et al., 2018; Wisitaatmadja, 2012).

Polii et al. (2013) conducted the research finding of the analysis of the mercury content in facial whitening cosmetics sold by street vendors in Pasar 45 in Manado City. It was disclosed that the four samples of the sold whitening cream contained mercury. However, only one of the four samples

followed the mercury heavy metal contamination limit under the National Agency of Drug and Food Control regulations, the BPOM (Obat, 2011; Nuradi, 2017).

The result of the interview with three women who frequently use cosmetic products that were sold online via Facebook and Instagram indicated that they prioritized the effects of the whitening cream rather than the dangers that would later be felt. Even within one week, the changes were already seen. The face is already white, clean, and smooth. Also, some respondents have used it for a long time; the more they used it, the more black spots appeared and lodged on their faces. However, the ingredients used in the mixture of whitening face creams have yet to be discovered. Regardless of the dangers that will arise from using this illegal whitening cream, this cosmetic is increasingly loved by most women in Gorontalo City (Mallongi, 2018; Nurfadillah, 2019).

Beauty cosmetics are in demand in Gorontalo City because appearance is always the primary factor. Besides, the results of interviews with several women who bought cosmetics on social media such as Facebook, named Portal Gorontalo and Forum Jual Beli Online, unveil that they did not know that heavy metal mercury can be added to whitening cosmetics and it has harmful effects on consumers who use it (Anwar & Rantetampang, 2017; Irwan, 2019).

**METHODS**

The research design applied the experimental laboratory method. At the same time, the sampling used purposive sampling, where the samples were bought from Facebook, namely portal Gorontalo, five samples, and forum Jual Beli online, five samples. The cosmetic brand chosen was the most widely sold online and had a relatively low price.

The tools used in this research were vapor generation accessory (VGA), Evaporating dishes (porcelain), glass funnel, the separatory funnel 250 mL (pirex®), beaker glass 100 mL and 250 mL (pirex®), volumetric flask 100 mL and 1000 mL (pirex®), analytical balance, volumetric pipette (pirex®), micropipette, tube rack, Atomic absorption spectrometry (AAS) (Varian®), and test tube. Meanwhile, the substances used were distilled water, nitric acid 5 MPa, Ferric chloride, concentrated hydrochloric acid (HCL), mercury standard solution 1000 ppm, petroleum ether p.a, samples of whitening cream, and titanium chloride.

Then, the data collection technique was done by direct observation of the object observed by calculating the amount of mercury. Data were analyzed descriptively to overview the mercury content in cosmetics sold freely on social media in Gorontalo City.

**RESULT AND DISCUSSION**

**Frequency Distribution of Respondents on Length of Light Exposure.** Concerning the respondents' exposure length to monitor light, the case is divided into risky and non-risky classifications. The results can be seen in the following table:

**Table 1.** The result of Qualitative Analysis of Hg (Mercury) Content in Cosmetics

Sample Name	KE	NOAH	HCL	Result	Conclusion
Ginge	+	+	+	Red precipitate	Positive(+)
Kote	+	+	+	Red precipitate	Positive(+)
Cream blush	+	+	+	Yellow precipitate	Positive(+)
Lipstick	-	-	-	White precipitate	Negative(-)
Hair oil	+	+	+	Yellow precipitate	Positive(+)
Mascara	+	+	+	Yellow precipitate	Positive(+)
Moisturizer	-	-	-	White precipitate	Negative(-)
Deodorant	+	+	+	Yellow precipitate	Positive(+)

Soap	+	+	+	Yellow precipitate	Positive(+)
Parfum	+	+	+	Yellow precipitate	Positive(+)

Sumber: (Testing Center for the Utilization of Quality and Diversification of Fishery Products in Gorontalo Province, 2020).

**Table 2.** The result of Quantitative Analysis of Hg (Mercury) on Cosmetics

Sample Name	Sample Weight (MG)	Dilution Ratio	HCL	Mercury Calculation Results (PPB)	HG Content (PPM)	Conclusion
Ginger	2002,40	10	+	71,40431482	0,0714	Meet standard
Kotex	2002,20	10	+	64,41913845	0,0644	Meet standard
Cream blush	2001,00	10	+	59,96001999	0,0600	Meet standard
Lipstick	2001,00	10	-	64,95752124	0,0650	Meet standard
Hair oil	2001,00	10	+	77,95102449	0,0780	Meet standard
Mascara	2001,00	10	+	60,95952024	0,0610	Meet standard
Moisturizer	2001,00	10	-	65,95702149	0,0660	Meet standard
Deodorant	2001,00	10	+	68,45577211	0,0685	Meet standard
Soap	2001,00	10	+	65,65423121	0,0876	Meet standard
Parfum	2001,00	10	+	70,98767522	0,0968	Meet standard

Source: Primary Data Based on the Criteria for Mercury Standards Set by WHO at one ppm

**Qualitative Analysis.** The result of the qualitative analysis in Table 1 depicts that out of 10 samples, samples of lipstick and moisturizer were tested using one reagent. Namely, the HCL solution gains the white result. It does not contain mercury, so lipsticks and moisturizer samples are safe to use by the public even though they are sold freely. Riswiyanto (2013) declares that adding 1-5 drops of HCL test solution will form a white precipitate. This indicates that the positive test solution does not contain mercury and produces a white chloride salt (Robinson, 2010).

On the other hand, in the cosmetic samples ginger, Kotex (menstrual pants), cream blush, hair oil, mascara, deodorant, soap, and perfume, the color changes to red and yellow precipitate that there is mercury content. Further, the test continued with a quantitative test using atomic absorption spectrophotometry (AAS). As Dahuri (2012) stated, adding 1-5 drops of KI solution is conducted to determine if the identified sample contains mercury, indicated by a change in color and red precipitate (Sastrohamidjojo & Hardjono, 2011; Kusantati et al., 2018).

The appearance of a yellow precipitate in the cosmetic sample is in line with Vogel (2012), in which adding 1-5 drops of NaOH test solution will form a yellow precipitate. This signifies that the test solution is positive and contains mercury because dilute sodium hydroxide when added slowly, will produce a yellow precipitate of mercury oxide. This qualitative analysis aims at determining the presence of a chemical element or compound, both organic and organic (Trisnawati et al., 2017).

**Quantitative Analysis.** The ten samples were analyzed using an Atomic Absorption Spectrophotometer to prove the finding more clearly. The basis for choosing this method was that mercury metal (Hg) was volatile, so the analysis in the SSA machine was carried out with a flameless system with a wavelength of 253.7nm. The wavelength of 253.7 nm was selected since it has the best sensitivity and does not interact with other metals in the sample (Robinson, 2010).

Christiani (2009) asserts that the working principle of flameless atomic absorption spectrophotometer (flameless AAS), namely the suction of the sample liquid containing positively charged mercury, is carried out using a suction tube connected to a peristaltic pump that can suck samples up to 3.2 L / minute. As a reducing agent, Stannum chloride (SnCl 10%) is used to reduce the positive mercury element into neutral (uncharged) mercury in the form of mercury vapor mist. The N22 gas pushes the mist of mercury vapor toward the AAS absorption cell and interacts with

the light from the mercury cathode lamp (Hollow et al.). The interaction is in light absorption, where the magnitude of which can be seen on the AAS monitor screen as absorbance. The amount of light absorption is proportional to the level of mercury present in the sample, which is detected in units of ppb.11 Additionally, the atomic Absorption Spectrophotometer is a spectrophotometer method that utilizes the absorption phenomenon as a basis for measurement. The absorption of light energy occurs by neutral atoms in a gas state, and the absorbed light is usually visible or ultraviolet rays (Weldon, 2013).

The qualitative analysis applying the atomic absorption spectrophotometer (SSA) test showed that out of the ten samples of whitening cream, there were eight samples containing mercury, namely ginger, Kotex, cream blush, hair oil, mascara, deodorant, soap, and perfume, as shown in Table 2. However, it does not exceed the level of mercury under the limit requirements set by the National Agency of Drug and Food Control of the Republic of Indonesia number 12 of 2019 concerning contamination in cosmetics which discloses that the requirement for heavy metal mercury (Hg) is exact or less than 1 mg/kg or one mg/L (1 ppm) (BPOM, 2019) so that it is still safe to use by the community.

Moreover, Trisnawatu et al., 2017 point out that the whitening creams containing mercury used in the short term can cause toxicity to the body's organs. This happens because the mercury compounds have direct contact with the skin so that it is easily absorbed into the blood and results in an irritant reaction that lasts quickly, including making the skin burn and black, even it can develop into skin cancer. In high dosages, it can cause permanent damage to the brain, lungs, and kidneys, interfere with fetal development, and cause manifestations of poisoning symptoms in the nervous system, such as visual impairment, tremors, insomnia, dementia, and abnormal hand movements (ataxia). Mercury accumulating in the body's organs is a carcinogenic substance that can cause death (Trisnawati et al., 2017).

Putriyanti, 2010 also discloses that mercury in cosmetics used every day and repeatedly will cause harm to health. Even just applied to the skin's surface, mercury easily seeps into the blood and then enters the body's nervous system. Mercury can cause various health problems, ranging from skin changes that can eventually cause black spots on the skin, irritation, permanent damage to the nervous system of the brain, kidneys, and impaired fetal development. In the short term, mercury in high dosage leads to vomiting and diarrhea (Irwan, 2019).

As stated in Holilah (2016), mercury is hazardous because it is easily absorbed. In the long term, mercury stays in the skin layers, enters the body through the skin pores, reaches the bloodstream, and circulates to other organs. As a result, mercury will accumulate in the kidneys and then damage human organs. Consequently, it is necessary to prevent additional mercury exposure, primarily in cosmetic products, and evaluate the cosmetics on the market periodically (Holilah, 2016).

This finding is in line with Nuradi (2017), that indicated that mercury (Hg) content in the amount of 0,1429-1531.5713 ug/g. Based on the decree of BPOM (National Agency for Drug and Food Control) Number. HK. 03. 1.23.08.11.07517 of 2011, mercury is prohibited from being used in cosmetics, so the whitening creams sold and traded online in Makassar City do not meet the predetermined requirements (Nurfadillah, 2019; Polii et al., 2013).

This also follows Trisnawatu et al. (2017), which revealed that two of the 18 samples contain mercury. The quantitative test unveils that the mercury level in the whitening cream product with a BPOM registration number with the A1 variant is  $224.04 \pm 0.35$  mg/kg, and for the A2 variant is  $188.20 \pm 0.28$  mg/kg. So not all whitening cream cosmetics on the market meet the requirements set by the BPOM (Trisnawati et al., 2017).

On the one hand, facial cosmetic products that are good and safe for health make some people still use cosmetics that contain mercury. However, few who have known the dangers of using cosmetics containing mercury instead choose to keep using it to beautify themselves in a short time, without thinking about the side effects and dangers posed to health due to using a mercury product. The accumulation of mercury in the body will lead to the regeneration of nerve cells in the cerebellum, control coordination, and degeneration of the nerve sheath nerve membrane, which ultimately can lead to paralysis and death.

Equally important, mercury poisoning after using skin-lightening products has been reported in several countries, including Africa, Europe, the United States, Mexico, Australia, and China. For instance, a 34-year-old Chinese woman suffers from nephritic syndrome after using a skin-lightening cream. Her blood and urine mercury levels returned normal after chelation therapy with D-penicillamine. In the US (Arizona, California, New Mexico, and Texas), 317 women who used skin whitening creams reported having symptoms associated with mercury poisoning, namely stimulating fatigue (67%), nervousness and irritability (63%), and severe headaches. (61%), insomnia (51%), memory loss (44%), loss of strength in the legs (44%), tingling or burning sensation (39%), tremors or shaking hands (38%), depression (31%), and a metallic taste in the mouth (20%) with high levels of mercury in the urine (Poljšak & Dahmane, 2012).

## CONCLUSION

Further, the test continued with a quantitative test using atomic absorption spectrophotometry (AAS). The result of qualitative analysis depicts that out of 10 samples, samples of lipstick and moisturizer tested using three reagents, namely the KL, NaOH, and HCl solutions, obtain the white result, which means that it does not contain mercury. Whereas, in the cosmetic samples ginger, Kotex, cream blush, hair oil, mascara, deodorant, soap, and perfume, the color changes to red and yellow precipitate, meaning mercury content.

The qualitative analysis using the atomic absorption spectrophotometer (AAS) test unveils that out of the ten samples of whitening cream, eight samples containing mercury, namely ginger, Kotex, cream blush, hair oil, mascara, deodorant, soap, and perfume. However, it does not exceed the mercury level, following the limit requirements set by the National Agency of Drug and Food Control of the Republic of Indonesia.

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