

# Detection of Mercury Levels in Some Cosmetic Products Marketed In Khartoum, Sudan

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## Abstract:

**Background:** Because of the widespread use of cosmetic products, many studies were reported for the determination of mercury (Hg) metal in these products using different methods and instruments. **Objective:** The purpose of this study is to determine the presence of Hg in a number of the most widely used cosmetic products marketed in Khartoum, Sudan. Additionally, the study also aims at comparing the Hg level detected in some selected samples with the standard limit value set by The United States Food and Drugs Administration (FDA).

**Study design:** Samples of the most common and popular brands of cosmetic products (n=46) were collected from different markets in Khartoum, Sudan. Samples were categorized under eight main groups, viz: facial powder, mascara, eyeliner, eye shadows, lipsticks, eyebrows powders, foundations, and facial soaps.

**Method:** A weight of 100 mg was weighed from the collected samples and was tested using a Direct Mercury Analyzer (DMA) device, using the integrated sequence of thermal decomposition, catalyst conversion, amalgamation.

**Results:** Hg concentrations in the measured 60% of the studied samples were found to have Hg level below the limit stated by The United States Food and Drugs Administration (US FDA), which is less than 1 ppm. Where 40% of the samples were having Hg level above 1 ppm. The most significant trend was for (Yoko) soap which has Hg concentration of 10.56 ppm. The (Anastasia) eyebrows powder Hg concentration was detected to be (0.07 ppm).

**Conclusion:** The results showed that the analyzed cosmetic products had Hg at a detectable level, and some samples showed levels above the allowed limit (1ppm). Such high levels can cause different types of health problems.

**Keywords:** Cosmetic products, mercury levels, heavy metals, Sudan

## 1. Introduction

Cosmetics are generally mixtures of chemical compounds, some being derived from natural sources, many being synthetic. In the U.S., the Food and Drug Administration (FDA) defines cosmetics as “agents intended to be applied to the human body for cleansing, beautifying, promoting attractiveness or altering the appearance without affecting the body’s structure or functions”<sup>(1)</sup>.

These are serious concerns about the effect of heavy metals as there is a variety of toxic ingredients found in skin lightening creams which could cause serious damage, especially after prolonged applications.

Mercury (Hg) is one of the most hazardous heavy metals that can cause serious damage if not handled with caution. It can negatively impact human health, causing disorders in several biological systems such as cardiovascular, immune and reproductive systems<sup>(2-3)</sup>. Heavy metals are used in a large number of cosmetic products for different purposes. However, Hg is particularly used for its effect of lightening the skin, especially in skin-lightening creams, Mercury in cosmetics can destroy the melanin pigment, because it inhibits the production of pigment (melanin) in the skin and can lighten skin<sup>(4)</sup>. However, Hg is harmful to health and to the environment and for this reason, its use is banned in some countries. Nevertheless, phenyl Hg and its salts as well as thimerosal, are permitted as cosmetic preservatives only in eye make-up to a maximum permissible concentration of 0.007% (w/v), whereas as color additives, mercury and its compounds are allowed up to 1 ppm<sup>(5)</sup>.

In addition to the above, more complicated actions of Hg are seen in the central nervous system, kidneys, liver, and even an interruption to the autoimmune processes that can occur after mercury exposure. Moreover, the concentration and chemical form plays a major role in the toxic effect of Hg.

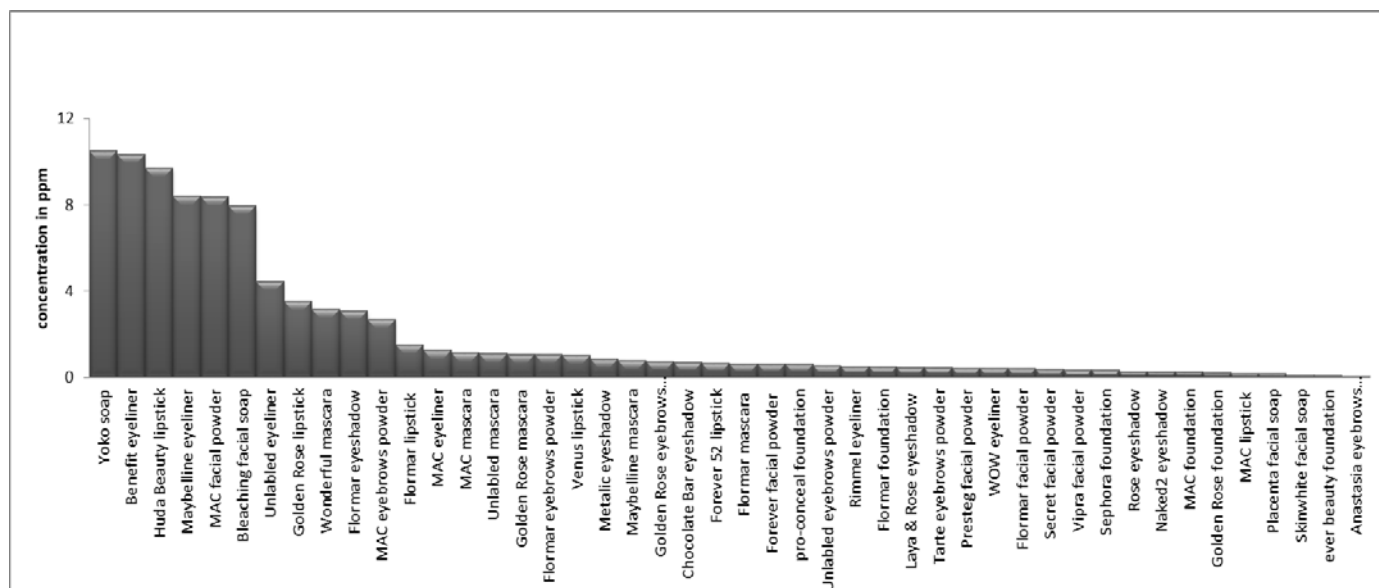
Hg showed a significant impact on the environment because of the wide range of human activities that could facilitate the entrance of this metal into the environment. Several industries, for instance, are making products containing Hg on a relatively large scale<sup>(6)</sup>.

## 2. Materials and Methods

Samples (n=46) were collected from Khartoum markets in Sudan, in February 2017. Six samples were randomly taken from different brands of facial powder, mascara, eyeliner, eye shadow, lipsticks, eyebrow powders, and foundations. Four samples were also collected from facial soaps.

From each sample, 100 mg was weighed using a sensitive balance. The samples were then introduced directly into the Direct Mercury Analyzer (DMA) device.

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**Fig. 1 - the concentration of Mercury (Hg) in different brands of cosmetic products.**

Controlled heating in an oxygenated decomposition furnace is used to liberate mercury from solid and aqueous samples in the instrument. The sample is dried and then thermally and chemically decomposed within the decomposition furnace. The decomposition products are carried by flowing oxygen to the catalytic section of the furnace. Oxidation is completed and halogens and nitrogen/sulfur oxides are trapped. The remaining decomposition products are then carried to an amalgamator that selectively traps mercury. After the system is flushed with oxygen to remove any remaining gases or decomposition products, the amalgamator is rapidly heated, releasing mercury vapor. Flowing oxygen carries the mercury vapor through absorbance cells positioned in the light path of a single wavelength atomic absorption spectrophotometer. Absorbance (peak height or peak area) is measured at 253.7 nm as a function of mercury concentration.

### 3. Results and Discussion

The results obtained are shown in figures-1

All the 46 samples analyzed were found to have Hg at various levels. From all the samples taken, 28 samples were found to have Hg level below the limit stated by The United States Food and Drugs Administration (US FDA), which is less than 1 ppm. The highest concentration of Hg detected was 10.56 ppm for (Yoko) soap. The eyeliner from (Benefit) contains the second-highest concentration of Hg (10.35 ppm). The least amount of Hg concentration was detected in (Anastasia) eyebrows powder (0.07 ppm).

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Cosmetic products contain a variety of chemical substances, which could be used for different purposes. Some are used as a coloring agent, fragrances, emulsifiers, preservatives or even to enhance the texture. These ingredients could be naturally occurring or synthesized. Undoubtedly, presence of numerous heavy metals such as lead (Pb), zinc (Zn), aluminum (Al), chromium (Cr), manganese (Mn), titanium (Ti), and mercury (Hg) has raised serious concern, as the use of cosmetics, became cosmopolitan. However, the potential

Impact of these cosmetics on the skin depends on the level at which cosmetic products are made of <sup>(7)</sup>.

Our study indicated that Hg detectable in various cosmetic types. The results demonstrate that the concentration of mercury in 39% of products obtained from Sudanese markets did not meet the standards established by the FDA. Facial soaps along with lipsticks show relatively high levels of Hg. Also, several brands of eyebrow powders, eyeliners, foundations, mascara, and facial powders had a significant variation at Hg levels.

The hazardous nature of these products could result from their route of application. For instance; some foundations are available in spray form which can boost the inhalation of dispersed parts of the product. Likewise, lipsticks could be orally ingested. In addition, eyeliner and mascara both have a serious and negative impact on eye-wide. Besides, skin products -especially creamy- may lead to skin absorption of Hg through the trans-epidermal and trans-appendageal routes. Following absorption, inorganic Hg is distributed to all body tissues and could intensify renal damage and other toxicities <sup>(8)</sup>.

We suggest conducting farther studies for measuring Hg in larger samples of cosmetics used in several locations of the middle east to get a better understanding of the extent of the problem. This will help health authorities in the country to better control the use of cosmetics with an unsafe level of Hg.

## 4. Conclusion

It is found that Hg concentrations varied among the cosmetic products tested (46 samples), where samples showed levels below the American FDA permitted trace levels of less than 1, with the exception of 18 samples.

These results may help in providing a groundwork for evaluation and improvement on the quality of Hg-containing cosmetics in the markets of Sudan and other developing countries.

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