

Cadmium Toxicity in Skin Whitening Creams Detection

A. Elphine Prabahar, Professor,
Department of CCSIT, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- elphine.tafhy26@yahoo.co.in

ABSTRACT: Cadmium (Cd) was selected as the heavy metal for this research because it is one of the most commonly found contaminants in a range of cosmetic items, but studies on Cd alone are rare. The acid-digestion technique is used to prepare samples in the majority of examinations. Atomic Absorption Spectrometry (AAS) is the most often used confirmatory technique, with the exception of one research that utilized inductively coupled plasma atomic emission spectrometry (AES). The distinction between AAS and AES is that AAS evaluates electromagnetic radiation absorption while AES examines radiation output. In this research, the World Health Organization (WHO) detection cap or their own country rule is used as a reference. According to research, the usage of certain cosmetic chemicals exposes consumers to small amounts of hazardous heavy metals, which may cause health problems if they stay in biological systems over time. It was also discovered that, while the use of heavy metals in certain brands is below the legal limit, they still pose a significant danger to individuals. Both of these tests are being conducted in order to determine which brands of cosmetics marketed in our industry are in breach of the rules and to bring this to the attention of the authorities.

KEYWORDS: Cadmium, Concentrations, Cosmetics, Heavy Metals, Lightening Creams, Products, Whitening.

1. INTRODUCTION

Poisoning is a disease or process in which a live thing is deliberately injured or affected by a poisonous chemical or animal venom. Acute poisoning occurs when a hazardous chemical is introduced in a single event or over a short period of time. Chronic Poisoning is a recurrent or ongoing exposure to a hazardous chemical in which symptoms do not emerge immediately or after each presentation. Poisoning symptoms may mimic a variety of illnesses, including seizures, inebriation, stroke, and insulin response. Poisoning symptoms and severe consequences may include (Figure 1) [1]:

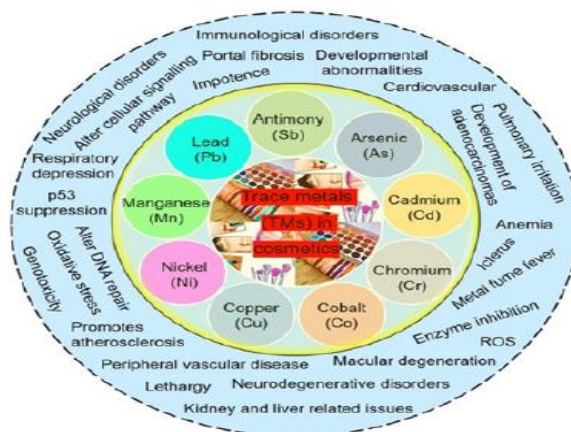


Figure 1: Numerous Unseemly Consequences Exercised by Heavy Metal Intake from Cosmetics.

- Burns or redness around the mouth and lips
- Breath that smells like synthetic chemicals, for example, gas or acetone

- Vomiting
- Difficulty in breathing
- Sleepiness
- Confusion or other altered mental status

The phrase heavy metal refers to any metallic material product with a high thickness that is hazardous or poisonous at low amounts. Heavy metals are ubiquitous on the planet's surface. They can't be polluted or destroyed. They join our bodies in small amounts through eating, drinking water, and breathing. Some heavy metals (such as copper, selenium, and zinc) are required for human digestion to function properly. Nonetheless, in larger amounts, they may cause damage. Mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl), and lead are examples of heavy metals (Pb). Heavy metals are dangerous because they appear to build up in the body. Bioaccumulation refers to the growth of a substance's convergence in a natural living organism over time, as contrast to the compound's fixing in the soil. When living things are taken up and put away quicker than they are isolated (used) or discharged, mixtures form. Cadmium is a silvery white metal buried beneath the crust of the earth. It is isolated during the production of metals such as copper, silver, and zinc, for example. Cadmium is present in certain foods and is spread via the use of petroleum derivatives such as coal and gasoline, smoking tobacco, and eating garbage. Batteries, make coatings, and metal coatings all use it [2].

Cadmium is classified as a human cancer causing agent because of its negative effects on the renal, skeletal, and respiratory systems. It is usually found in the earth's crust in modest amounts. Whatever the scenario may be, human migration has substantially increased such amounts. Cadmium may travel a considerable distance through air from the site of emission. It quickly accumulates in a variety of living species, including mollusks and scavengers. Vegetables, peas, and drab roots have lesser concentrations. Human presentation is primarily caused through the ingestion of contaminated food, the active and passive inhaling of cigarette smoke, and the inhalation of nonferrous metal workers. Long-term exposure to lower levels of Cd has been linked to kidney damage, bone deformity, and the tendency of bones to fracture. Cadmium poisoning has been reported in different regions of the world. It is a worldwide medical problem that affects a variety of organs and may result in a number of deaths each year. Cadmium has an impact on cell growth, separation, and apoptosis. These activities work in conjunction with Deoxyribonucleic Acid (DNA) fixing tools, the age of reactive oxygen species (ROS), and apoptotic recruitment. Cadmium binds to mitochondria and, at low doses, may affect both cell respiration and oxidative phosphorylation [3].

A cosmetic is a substance that is applied to the human body in order to improve, restore, or alter the attractiveness or look of the skin, hair, nails, lips, eyes, or teeth, or to cleanse, colour, condition, or secure the skin, hair, nails, lips, eyes, or teeth. Archaeologists discovered the oldest cosmetics, which were used for eye make-up and the utilization of scented lotions. Cosmetics are the most commonly used product among people today, especially among teenage girls. People's aesthetic awareness has created a demand for cosmetics in today's market. As a result, the cosmetic industry has grown significantly, producing a wide range of cosmetics for the treatment besides prettification of teeth, nails, hair, skin, and the body, such as sindoor, and eye shadows, among other things. People's wellness consciousness, on the other hand, has attracted doctors and academics to discover out what's producing their bad impacts. Heavy metal toxicity was determined to be the heart of the problem. The most frequent contaminants in beauty products are heavy metals such as lead and cadmium [4].

The guideline in India conformed to the EU Cosmetic Directive, as well as the requirements set by the Drugs and Cosmetics Rules 1945, the Drugs and Cosmetics Act 1940, and the

Bureau of Indian Standards (BIS). The Drugs and Cosmetics Act of 1940 is an Act of the Indian Parliament that regulates the import, manufacture, and distribution of pharmaceuticals in India. The demonstration's main goal is to ensure that the prescriptions and cosmetic care products provided in India are safe, efficient, and meet governmental quality requirements. Cosmetics, as defined by the Act, are any article intended to be scoured, poured, sprinkled, or splashed on, or acquainted with, or generally applied to the human body or any part thereof for the purpose of purifying, embellishing, advancing the engaging quality, or modifying the appearance, and includes any article intended for use as a section of restorative but excludes cleanser. Cosmetics are regulated in India by the Central Drug Standard Control Organization (CDSCO), which is governed by the Drug and Cosmetic Act 1940 and Rules 1945 (updated up to Dec. 31st 2016). Norms of value in relation to skin care goods where the restorative commits to such criteria as may be authorized. A cosmetic may be considered misbranded if it produces an improper shade, or if it isn't labelled in an authorized manner, or if the name, holder, or anything else associated with the restorative includes some explanation that is false or misleading in any way [5].

The desire for paler skin tones has been passed on through the ages. This is the cause for the continuously increasing frequency of skin lightening procedures. The prevalence of skin lightening cosmetics in the beauty industry grew as a result of its popularity. Asia has the highest demand for skin whitening solutions. Not all skin lightening cosmetics are illegal, but certain creams from outside the EU contain chemicals that are forbidden by safety laws. Mercury and hydroquinone, for example, have been associated to overdose, skin damage, and liver and kidney failure in long-term use, as well as corticosteroids, which are only available by prescription in the United Kingdom (UK). Misuse of corticosteroid creams has been linked to skin weakening, an increased risk of skin cancer, and, counterintuitively, skin darkening. Skin whitening is used to make your skin lighter than it was when you were born. Skin bleaching is another term for this. Creams, shampoos, tablets, and even injections intended to inhibit the release of melanin are among the skin lightening treatments available. According to a World Health Organization (WHO) research, 40 percent of Chinese women use skin whitening procedures on a monthly basis, compared to 61 percent in India and 77 percent in Nigeria [6].

2. LITERATURE SURVEY

J. E. Onojah et al. stated in the paper that long-term exposure to consumer goods like cosmetics and hygiene may cause heavy metal toxicity in humans. The degree of prevalence of lethal metals in various cosmetics items available in local shops in Anyigba, Kogi State, Nigeria, were evaluated in this study. Five skin lightening creams and five medicated soaps were among the cosmetics examined. After digestion with condensed acids (HNO_3 : H_2SO_4 in a 2:1 ratio), these cosmetics were evaluated for heavy metals (Cd, Pb, Cr, and Hg). Using a Varian Flame AAS, the concentrations of the chosen dangerous heavy metals were measured in triplicate. Chromium was found at detectable amounts in all of the samples tested, with values ranging from 0.0020 to 0.0190 ppm. The concentrations of chromium in samples A (Dettol), B (Fashion fair), C (Septol), D (Tura), and I (Fashion fair) varied from 0.0003 to 0.0027 ppm, whereas the concentrations of chromium in samples F (Fair and White), G (Neurotone), H (Hot Movate), and J (Clear tone) was below the detection threshold. In addition, samples B (Fashion Fair), D (Tura), F (Fair and White), G (Neurotone), and H (Hot movate) contain a measurable volume of lead with concentrations ranging from 0.0063 to 0.0521ppm, while samples A (Detol), C (Septol), E (Crusader), I (Fashion fair), and J (clear tone) have lead concentrations below the detection level. A measurable quantity of mercury was found in all of the samples tested, ranging from 0.0030 to 3.7022ppm. The current research clearly shows that the use of certain cosmetic items exposes consumers to small

quantities of radioactive heavy metals, which may create health concerns if they accumulate up biological processes over time [7].

J. G. Ayenimo et al. stated in the paper that many found different there are few or no reports in personal care products, which have biotic effects. Using atomic absorption spectrophotometry, the quantities evaluated five different chemicals widely used in Nigeria. Many of the medications included significant amounts of Cd, Cr, Cu, and Zn. Hair care includes quantities of Cd and Cu, while mainly responsible for Cr and Zn. It's impossible to determine whether the metal sample are since no cap for cosmetic products exists; however, Cd and Cr are banned in cosmetics in any quantity. The use of these components in soaps and creams for a long length of time may be harmful to human health and the environment [8].

A. A. Alqadami et al. explained in the paper, dangerous heavy metals such as metalloid arsenic (As), lead (Pb), titanium (Ti), mercury (Hg), bismuth (Bi), and cadmium (Cd) were detected in utilizing AES. A combination of hydrofluoric acid, hydrogen peroxide, and nitric acid was used to fully digest cosmetic samples. The target compounds were measured using a standard addition method. Excellent consistency parameters were obtained, such as detection limits, Ti (4.3 ppb), Pb (3.8 ppb), Hg (3.3 ppb), Cd (0.45 ppb), Bi (7.9 ppb), As (4.6 ppb) linearity ($r > 0.999$), as well as the run-to-run besides day-to-day precisions of relative standard deviations of <3 percent [9].

T. Ahmadi-Jouibari et al. articulated in the article that for the detection of cadmium in cosmetic samples, Continuous sample drop flow-based micro-extraction (CSDF-ME) in conjunction with graphite furnace atomic absorption spectrometry (GFAAS) has been developed as a high-performance pre-concentration method. A few microliters of an organic solvent are transferred to the bottommost of a conical sample cup in this process. As it passes through the organic solvent, given by a syringe needle is converted into droplets. As a consequence, extracts matrix. The conical sample cup is transported to the GFAAS instrument after using an auto sampler, 20 μ L of the extraction solvent is placed into the graphite furnace under optimal conditions, The method's intra-day as well as inter-day repeatability and reproducibility is 3.2 percent and 4.5 percent, respectively, based upon 7 repetitions. As a consequence, the newly created technique was effectively used to extract and measure cadmium ions in lipsticks, eye shadows, and hair colors, providing acceptable results [10].

3. DISCUSSION

This study is based on a survey of numerous studies on heavy metal contamination in skin-whitening/lightening creams conducted around the world. Cadmium (Cd) was chosen as the heavy metal for my study because it is one of the most commonly detected toxins in a variety of cosmetic products, and there are few studies on Cd alone. The bulk of research use the acid-digestion method to prepare materials. With the exception of one study that used inductively coupled plasma atomic emission spectrometry, atomic absorption spectrometry is the most often used confirmatory method. The difference between AAS and AES is that AAS measures the absorption of electromagnetic radiation while AES measures the production of radiation. The WHO detection limit or their own country law was used as a reference in this study. According to study, using such cosmetics creates exposing consumers to tiny quantities of dangerous heavy metals, which may cause healthiness issues if they remain in biological systems for long periods of time. It was also found that, while some brands' use of heavy metals is below the legal limit, they nevertheless pose a significant risk to individuals. Both of these tests are being carried out in order to determine which cosmetics goods sold in our industry are in breach of the rules and to bring this to the government's attention.

As a consequence, establishing metals in cosmetic products regulatory limits is important. Low-quality materials should be avoided, particularly for long-term continuous use, since heavy metals are easily absorbed through the skin. Following the findings, highly advised creams be tested for metal being sold. Certain materials, both local and non-local, violated the regulations by using excessive amounts of heavy metal impurities, causing degradation. The study investigated the concentrations of several metals as well as a metal's concentration in different brands. Cadmium poisoning may have a number of deleterious consequences, including cell death and increased cell proliferation, all of which may lead to cancer. It also has an effect on the blood flow, skeletal muscle, brain, lungs, and kidneys, resulting in heart attacks, liver disease, hypertension, immune system suppression. People who use skin-lightening procedures may be more vulnerable to higher levels of heavy metals, according to the study. The two studies looked at were both done in Nigeria and revealed greater levels of heavy metal toxicity.

Doctors warn that using a whitening cream containing topical steroids for a long time will cause hypertension, high blood pressure, and suppression of the body's natural hormones. Any unfavorable consequences, such as stretch marks, may last a lifetime. Hydroquinone has been recognized by several doctors as the culprit in cases of misuse. A blue-black darkening of the skin is an unusual side consequence of misusing hydroquinone. Since toxic heavy metals are recognized to survive in organic environments, using these cosmetic items exposes customers to tiny amounts of lethal heavy metals, which is competent to provide a health concern.

Each touch departs as stated by Lockard's trading strategy. As a result, residues of cosmetic items are often discovered at a law-breaking scene. The evidential value of such follow evidence will be determined by the type of test method used. The ideal competence should be non-ruinous, repeatable, and capable of assessing a small number of trials with little to no example preparation. In practice, the system's ability to break down perplexing. About five-thousand distinct materials have been identified as having been used in cosmetics. As a result, different methods are needed for the effective separation of restorative displays acquired in criminal instances. For example, chromatographic procedures are frequently used to separate shade specialists in skin care items, while spectroscopic techniques are employed to dissect other natural and inorganic mixes.

4. CONCLUSION

The findings of a study of all research on heavy metal toxicity in skin whitening or skin lightening cosmetics show that harmful heavy metal content (Cd) was present in different concentrations in the cosmetics, with certain products beyond the WHO's permissible limits, potentially causing lethal effects on human health. People maintain the idea that if there is poisoning, it can only be discovered in local products and not in branded ones. However, after analyzing various testing, it is discovered that non local cosmetic items have higher levels of heavy metal toxicity than locally marketed products in some cases. Cadmium poisoning may result in a variety of outcomes, all of which may lead to cancer. It also affects the blood vessels, cardiac muscle, kidney, lungs, and brain, causing heart attack, hypertension, liver damage, immune system suppression, and other symptoms. According to the findings, people susceptible to higher levels of heavy metals. The two studies that were examined were conducted and revealed a high degree of heavy metal toxicity.

REFERENCES

- [1] F. B. Odokudu, J. G. Ayenimo, A. S. Adekunle, A. M. Yusuff, and B. B. Mamba, "Safety evaluation of heavy metals exposure from consumer products," *Int. J. Consum. Stud.*, 2014, doi: 10.1111/ijcs.12061.
- [2] C. M. A. Iwegbue, F. I. Bassey, G. O. Tesi, S. O. Onyeloni, G. Obi, and B. S. Martincigh, "Safety evaluation of

- metal exposure from commonly used moisturizing and skin-lightening creams in Nigeria,” *Regul. Toxicol. Pharmacol.*, 2015, doi: 10.1016/j.yrtph.2015.01.015.
- [3] “Spectrophotometric determination of heavy metals in cosmetics sourced from Kaduna Metropolis, Nigeria,” *Sci. World J.*, 2015.
- [4] O. E. Orisakwe and J. O. Otaraku, “Metal concentrations in cosmetics commonly used in Nigeria,” *Sci. World J.*, 2013, doi: 10.1155/2013/959637.
- [5] S. S. Omenka and A. A. Adeyi, “Heavy metal content of selected personal care products (PCPs) available in Ibadan, Nigeria and their toxic effects,” *Toxicol. Reports*, 2016, doi: 10.1016/j.toxrep.2016.07.006.
- [6] M. D. Faruruwa and S. P. Bartholomew, “Study of heavy metals content in facial cosmetics obtained from open markets and superstores within Kaduna metropolis, Nigeria Citation,” *Am. J. Chem. Am. J. Chem. Am. J. Chem. Am. J. Chem. Appl. Appl. Appl. Appl. Am. J. Chem. Appl.*, 2014.
- [7] J. E. Onojah, P.K. and Emurotu, “Heavy Metals in Selected Skin Lighting Creams and Medicated Soaps,” *Int. J. Innov. Sci. Math.*, 2017.
- [8] J. G. Ayenimo, A. M. Yusuf, A. S. Adekunle, and O. W. Makinde, “Heavy metal exposure from personal care products,” *Bull. Environ. Contam. Toxicol.*, 2010, doi: 10.1007/s00128-009-9867-5.
- [9] A. A. Alqadami *et al.*, “Determination of heavy metals in skin-whitening cosmetics using microwave digestion and inductively coupled plasma atomic emission spectrometry,” *IET Nanobiotechnology*, 2017, doi: 10.1049/iet-nbt.2016.0212.
- [10] T. Ahmadi-Jouibari, N. Fattahi, N. Mirzaei, K. Sharafi, and H. Reza Ghafari, “Determination of cadmium in cosmetics from Kermanshah, Iran by graphite furnace atomic absorption spectrometry,” *New J. Chem.*, 2017, doi: 10.1039/c7nj00406k.