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Identification of Lead from Sindur Samples

Dr. Durgesh Wadhwa[1], and Dr. Gopal Arora[2]

[1,2]Assistant Professor, Department of Chemistry, Sanskriti University, Mathura, Uttar Pradesh, India

Correspondence should be addressed to Dr. Durgesh Wadhwa; hodchem@sanskriti.edu.in

ABSTRACT- Sindur powder is often colored with red lead to produce a deep red hue. While many people think that cosmetics are clean, numerous studies have shown that the majority of cosmetics contain heavy metals and other pollutants. The adverse health effects of lead poisoning have been extensively established. A rapid inspection or "search" technique for provisional detection of particles was tried using an X-ray Fluorescence (XRF) lead paint commercially provided testing kit for use by state health authorities. Field sampling techniques, besides prediction values aimed at samples containing 3×10^5 µg/g lead have all been substantially changed. The above-mentioned measures were 100 percent in the samples containing 3×10^5 µg/g lead, but the Confidence Intervals (CIs) exhibited a considerable variance. Also, concentration of 5,110 µg/g was not to be clearly detected using any field inspection technique. Colorimetric and semi-quantitative XRF tests successfully detected lead in samples with higher Pb levels ($>3\times10^5$ µg/g lead), but not in those with lower Pb levels. According to the findings, health department inspectors cannot use screening kit as a quick field test for sindur. In a nutshell, these findings highlight the importance of sindur danger monitoring.

KEYWORDS- Cosmetics, Health, Lead Levels, Lead Poisoning, Paint, Powders, Sindur, XRF.

I. INTRODUCTION

According to the main effects that it causes when it comes into contact with the body, lead poison is categorized as an irritating metallic poison. Lead has been proven to be one of the most extensively researched neurotoxic in recent decades. Lead is a common toxin that builds up over time. Its negative consequences or side effects are widely known, and the reduction in Blood Lead Levels (BLLs) over the past few decades is usually regarded as one of the greatest public health accomplishments of the twentieth century [1].

Figure 1: Married Bengali Hindu Ladies Smear and Play with Vermilion at Sindur Khela Traditional Ritual on the Last Day of Durga Puja Festival

Lead is a steel-grey alloy with a high melting point. In fact, metallic lead and all of its salts are toxic:

- Lead acetate (lead sugar): white crystals are the primary ions that cause poisoning
- Safeda (lead carbonate): a white crystalline powder
- Lead chromate is a light yellow powder that may be used in a variety of applications
- Litharge (lead monoxide): light brick-red or pale orange masses
- Scarlet crystalline powder of lead tetroxide (red lead, vermilion, sindur)
- In nature, lead sulphide is the least toxic.

Storage batteries, solders, paints, hair colors, electric wire insulations, pottery and ceramics, and gas are all made of lead. Lead is the most common heavy metal used in chronic poisoning, although acute lead poisoning is rare. Lead is a naturally occurring element of the earth's crust and may be used in trace quantities of soil, water, and plants. Lead is virtually immobile, but when mined and used by humans, it becomes extremely hazardous. Pollution in the air, fish, and water may all be sources of lead in the environment. The primary causes of lead poisoning and pollution in the atmosphere is believed to be

lead-containing gasoline and paints. Lead-based paint was prohibited in 1978, and by the mid-1990s, lead was phased out of fuel in the United States (US), in order to remove lead from these ubiquitous goods such as gasoline and paints [2]. Analysis showing a connection between decreased BLLs in the US population and the phase out of lead from gasoline has shown the advantage of eliminating lead from gasoline in the US for public health (see Figure 1) [3].

Occupational exposure and exposure from dust and chipping of old lead-based paint are the most common causes of elevated BLLs in adults and children today [4]. Staff in sectors such as smelting, battery production, and mining have higher BLLs than employees in any other industry. Workers from these occupations are categorized as "take-home exposures", meaning they will bring lead dust home with them on their clothing, boots, and other things. At home, which may then be accumulated on carpets, chairs, mattresses, and other surfaces. They are not just a source of exposure for these professions at home, but they may also be a source of exposure for their family members. The bulk of today's lead poisoning in children comes from decaying old lead-based paint and the lead dust that may accumulate on window sills, windows, and other surfaces as the paint deteriorates [2]. In addition to lead-based paint or industrial contamination, immigrant communities may be exposed to lead via cultural items imported from their home countries. Culture-specific tools, foods like Mexican tamarind candies, cosmetics like kohl, kajal, tiro, and henna (used in Middle Eastern and South Asian cultures), and treatments like Ayurveda medicines (used by South Asians) and Mexican digestive cures are examples of these alternate outlets. Heavy metals end up in these materials whether they are either intentionally or accidentally added to improve cleanliness, to raise pricing for products sold by weight, or because to contamination during the manufacturing process. Lead from the packaging of Mexican sweets may leach into the candy [5]. Glazed pots or ceramics, which may leach into meals (these pots/ceramics may use lead glaze to give the pottery a smooth finish and bright colors); plastics and vinyl mini-blinds; and manufactured candles with leaded wicks are examples of non-culture related products that may be sources of lead [6].

Elemental lead is a shiny, solid, silvery metal with a cubic crystal structure that tarnishes to a blue color when exposed to air. It is usually extremely delicate and flexible. Several of its salts (mentioned above) are available as a variety of colored powders or liquids and are extensively used in business and at home, resulting in cumulative toxicity following clinical exposure. Lead's low melting point and malleability made it one of the first metals smelted and used for lead, including pipes, cooking utensils, and ceramic glazes, a grape syrup boiled down in lead pots, was a popular activity used as a sweetener and preservative. Lead usage grew significantly since the industrial revolution, and it is now the most commonly used non-ferrous metal, with global demand on the order of 9 million tons a year [7].

Lead production in the US is 1.1 million tons a year, with about 0.5 million tons coming from new mines and 0.6 million tons coming from scrap metal recycling. Lead is extensively used in industry because of its water resistance, as well as its electrical and radiation shielding properties. Electric storage batteries use both metallic lead (as grids) and lead oxide (as paste), accounting for roughly two-thirds of annual US usage. Since batteries last just 27 months on average and 80 percent of battery lead is re-melted as waste, the secondary smelting and processing industry's primary source of raw lead is this single commodity. Lead alloys are used to protect electricity and telecommunications cables, as well as to create type in the printing industry and solders. Solders are used in a variety of industries, including tin can manufacture, plumbing and repair, and the automotive industry, especially radiator manufacturing and maintenance. Chemical reaction tanks are covered with sheet lead, which is widely used in medical and industrial radiation shields. Metallic lead is also used in the manufacture of firearms, bronze and brass, as well as annealing, galvanizing, and plating [8].

Inorganic lead compounds have long been regarded to be among the best paints available. In the manufacture of polyvinylchloride plastics, glazes for ceramic ware, and glass intended for crystal optical and electrical applications, such as color television image tubes, lead compounds are used as stabilizers. Lead azide and styphnate are used in explosives. In the early nineteenth century, lead salts, notably lead acetate (lead sugar), were used medicinally to manage bleeding and diarrhea; recent analyses of hair samples from Andrew Jackson revealed elevated lead levels, which are consistent with his lifelong affliction of bilious colic, a condition characterized by constipation and intense, cramping abdominal pain.

Recently, the manufacturing of lead in India has been restricted for the year. In contrast to the 18.4 percent increase in Financial Year (FY18), production grew by 14.6 percent in FY19. The expected amount of mined metal production has been reduced by the complete shutdown of opencast operations. During FY19, recycled lead accounted for about 63 percent of all processed lead. Primary lead output grew by 17.6 percent in FY19, compared to a 21.0 percent rise in FY18, while secondary lead, or recycled lead, production increased by 12.9 percent, compared to a 16.9 percent growth in FY18. During FY19, demand for lead rose by 11.6 percent. In India, lead consumption is mainly driven by its usage in the manufacture of lead acid batteries (74 percent) which may be further divided into Starting-Lighting-Ignition (SLI) batteries (50 percent) and Industrial batteries (24 percent)). Automobile production rose by 6.4 percent in FY19 (passenger cars, recreational vehicles, and two and three wheelers).

Lead is also used in remote access power devices, load levelling systems, and glass and plastics composites, as well as for radiation shielding. South Korea, Australia, Malaysia, the United Arab Emirates, and Myanmar import refined lead, which is then shipped to the US, South Korea, Taiwan, Vietnam, and Thailand. India has been a net exporter of processed lead in the last two years (FY18 and FY19). During FY19, exports rose by 10.3 percent, while imports fell by 1.5 percent.

Lead will continue to see strong demand, driven primarily by the automotive and industrial battery industries. Lead consumption is expected to rise by 9.4 percent by the end of FY20.

- Demand for lead acid batteries in the form of replacement demand in vehicles will continue to encourage their use. The market will be slow to react.
- Telecom business network development, smart grid initiative launch, car-charging technology deployment, onus placed on hybrid and electric vehicle production, and growing installation of renewable energy systems will all help lead acid battery growth.

Primary lead production reached new highs in FY19, while aluminum production stagnated and zinc and copper output dropped substantially. Lead costs between $1,900 and $1,950 a ton in United States Dollar (USD). Lead poisoning affects people of all ages, but it appears to cluster into a few specific at-risk groups. The problem's breadth and clinical importance are greatest in young children, ages 1-6, whose main source of exposure is decaying lead paint in their homes. Childhood lead poisoning has been regarded the most serious public health issue for young children in impoverished countries. Adults that participate in lead smelting or reclamation, building or demolition, or the manufacture or maintenance of lead-containing products constitute the second largest category of people who have been exposed at work.

II. LITERATURE REVIEW

H. Frumkin highlighted that the adverse effects of different environmental exposures, such as toxic chemicals, radiation, and biological and physical agents, have been the focus of environmental health research and education. Certain types of environmental exposures, on the other hand, may have beneficial health benefits. Humans are naturally drawn to other living species, according to the biophilia theory. Later philosophers elaborated on this idea, claiming that humans have an inherent connection to nature in general. This indicates that such types of real world interaction may be beneficial to one's health. This theory is supported by evidence from four different elements of the natural world: animals, plants, ecosystems, and wildness. Finally, the implications of this theory for a wider public health agenda, including both negative and good effects, are examined. This agenda calls for studies on a variety of potentially harmful environmental exposures, cooperation among practitioners from various disciplines ranging from public health to landscape design to community planning, and research-based approaches [3].

B. P. Lanphear et al. claimed that the processes and pathways for lead intake among urban children, as well as the relative contributions of different lead sources to lead-contaminated household dust, were investigated using a linear structural equation modelling technique. Dust lead levels were shown to be substantially linked to blood lead levels in neonates, both indirectly and directly through hand lead. Lead levels in home dust were influenced by both soil and paint lead, but paint contributed substantially more lead to house dust than soil ($P<0.001$). Blood lead levels in children is significantly influenced by their ethnicity and economic status. Finally, time spent outside was connected to kids placing dust or gravel in their teeth, which was linked to blood lead levels in children. These findings suggest that mouthing habits are a major cause of lead poisoning in urban children with low blood lead levels, and that lead-based paint is a bigger source of lead in household dust than lead-contaminated soil [4].

III. DISCUSSIONS

Under today's advanced civilizations, wide chemical exposures through polluted air, water, and food are rare, yet they may possibly harm a whole population in exceptional circumstances. Exotic sources, such as tainted traditional medicines, cosmetics, swallowed lead foreign bodies, stored bullets, artists or other sharp objects, shooting ranges, unregulated distilled alcoholic drinks, and drugs of violence, are sometimes found. Since ancient times, it has been used in cosmetics, internal and topical medicinal compositions, paint pigments, and glazes. Lead Tetroxide is the most common sindur used by married Hindu women on the parting of their scalp hair, whereas Muslim women use Lead Sulphide as an eyeliner.

Hindus use sindur as a cosmetic item during prayer and other occasions. As a traditional sign of auspiciousness, married women place it to the parting of their hair. To create quick and bright red hues, most sindur on the market is products, lime, with lead and mercury salts. Long-term usage of the sindur may result in health problems. Over the last half-century, there has been a lot of debate at the global level regarding the use of healthy colorants the manufacture of consumer goods like to textiles, vegetables, and cosmetics. Because of the detrimental effects of synthetic dyes on people and the environment, Germany was the first to prohibit the manufacture and use of a range of transparent azo-dyes. Similar limitations have been implemented in the Netherlands, India, and a few other nations. The majority of countries have enacted appropriate rules and regulations relating to public health and safety, industrial process management, pesticide usage, wastewater disposal, and environmental protection. Protection and environmental regulations will continue to regulate the commerce in the current work community, and the processor will need to evaluate the adjustments that must be done to meet these requirements. The crimson sindur were usually with alum as well as turmeric. When combined, the turmeric powder turns red. It may also be manufactured plant, or from sandalwood combined with musk (safflower).

Sindur may be worn by women aesthetic purposes, or by both men and women for religious reasons. Manufacturers frequently use red lead color (lead tetroxide, Pb_3O_4) [9]. Irritability, intellectual deficits, stomach, decreased development, behavior are all symptoms of lead poisoning in infants. Furthermore, no blood lead level (BLL) in children is considered healthy. Individuals and families have been reported to have been lead poisoned as a result of inadvertently eating lead contaminated sindur. Blood tests showed in 2004, according to doctors. A lead testing for blood showed deciliter in the kid, with BLLs of 85 and 95 µg/dL in the father and mother, respectively. Utilizing an X-Ray Fluorescence (XRF) equipment, discovered increasing levels of lead in a jar labelled. Following further testing for lead level, it was determined that the sindur contained 58 percent. During, it was discovered that this sindur had been used as a food coloring addition [10].

IV. CONCLUSION

According to the aforementioned study and results, the Health Department practitioners do not completely depend on FP-XRF analyzers produced commercially available lead test kits for evaluating non-sindur or sindur. Because these are two criteria for any screening test, performed in the trials were very promising. Under today's advanced civilizations, wide chemical exposures through polluted air, water, and food are rare, yet they may possibly harm a whole population in exceptional circumstances. Exotic sources, such as tainted traditional medicines, cosmetics, swallowed lead foreign bodies, stored bullets, artists or other sharp objects, shooting ranges, unregulated distilled alcoholic drinks, and drugs of violence, are sometimes found. Since ancient times, it has been used in cosmetics, internal and topical medicinal compositions, paint pigments, and glazes. Lead Tetroxide is the most common sindur used by married Hindu women on the parting of their scalp hair, whereas Muslim women use Lead Sulphide as an eyeliner.

Measures was important that screening equipment were accurate and reliable in identifying the substance in issue. Because are based on prevalence, it has been considered as important. The possibility of employing an FP-XRF analyzer equipped for lead in paint to assess the presence of lead was also emphasized as requiring excellent sensitivity and negative predictive values. Researchers should focus on evaluating other techniques that may be utilized in the future, that are intended for use with lead-centered paint and detect lead and other particles. The efficacy of ex-situ FP-XERF analysis and the quantitative measurement utilizing has been motivated by these findings.

REFERENCES

[1] M. P. Shah, D. G. Shendell, Q. Meng, P. Ohman-Strickland, and W. Halperin, “Efficacy of a lead based paint XRF analyzer and a commercially available colorimetric lead test kit as qualitative field tools for determining presence of lead in religious powders,” J. Occup. Environ. Hyg., 2018, doi: 10.1080/15459624.2018.1468078.

[2] Centers for Disease Control and Prevention (CDC), “Childhood lead exposure associated with the use of kajal, an eye cosmetic from Afghanistan - Albuquerque, New Mexico, 2013.,” MMWR. Morb. Mortal. Wkly. Rep., 2013.

[3] H. Frumkin, “Human Health and the Natural Environment,” Am. J. Prev. Med., 2001.

[4] B. P. Lanphear and K. J. Roghmann, “Pathways of lead exposure in urban children,” Environ. Res., 1997, doi: 10.1006/enrs.1997.3726.

[5] C. W. Schmidt, “Unsafe harbor?: Elevated blood lead levels in refugee children,” Environ. Health Perspect., 2013, doi: 10.1289/ehp.121-a190.

[6] C. G. Lin, L. A. Schaider, D. J. Brabander, and A. D. Woolf, “Pediatric lead exposure from Imported indian spices and cultural powders,” Pediatrics, 2010, doi: 10.1542/peds.2009-1396.

[7] R. Saidalavi, H. A., K. K. B., L. P. K., and P. Adake, “Analysis of lead and arsenic in cosmetics and assessment of students awareness about cosmetic toxicity,” Int. J. Basic Clin. Pharmacol., 2017, doi: 10.18203/2319-2003.ijbcp20172235.

[8] S. A. Pratinidhi, A. A. Sagare, and A. J. Patil, “Heavy Metal Levels in Commonly used Cosmetic Products in Asia,” MMJ-A J. by MIMER Med. Coll. Pune, India, 2018, doi: 10.15713/ins.mmj.30.

[9] E. C. Gorospe and S. L. Gerstenberger, “Atypical sources of childhood lead poisoning in the United States: A systematic review from 1966-2006,” Clin. Toxicol., 2008, doi: 10.1080/15563650701481862.

[10] Z. P. Vassilev et al., “Case of elevated blood lead in a South Asian family that has used sindur for food coloring,” Clin. Toxicol., 2005, doi: 10.1081/CLT-200066087.