Lead in Paints

A Significant Pathway of Lead Exposure in Bangladesh

Environment and Social Development Organization

Lead In Paints: A Significant Pathway of Lead Exposure in Bangladesh
(Country Situation Report 2022)

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Environment and Social Development Organization- ESDO is an action research oriented non-profit and non-government organization based in Bangladesh. It is an environmental action research group dedicated to a toxic-free, zero-waste planet. This entails fighting pollution and building regenerative solutions in cities through local campaigns, shifts in policy and finance, research and communication initiatives, and movement building. ESDO is working relentlessly to ensure biological diversity since its formation in 1990. It is the pioneer organization that initiated the anti-polythene campaign in 1990 which later resulted in a complete ban of polythene shopping bags throughout Bangladesh in 2002.

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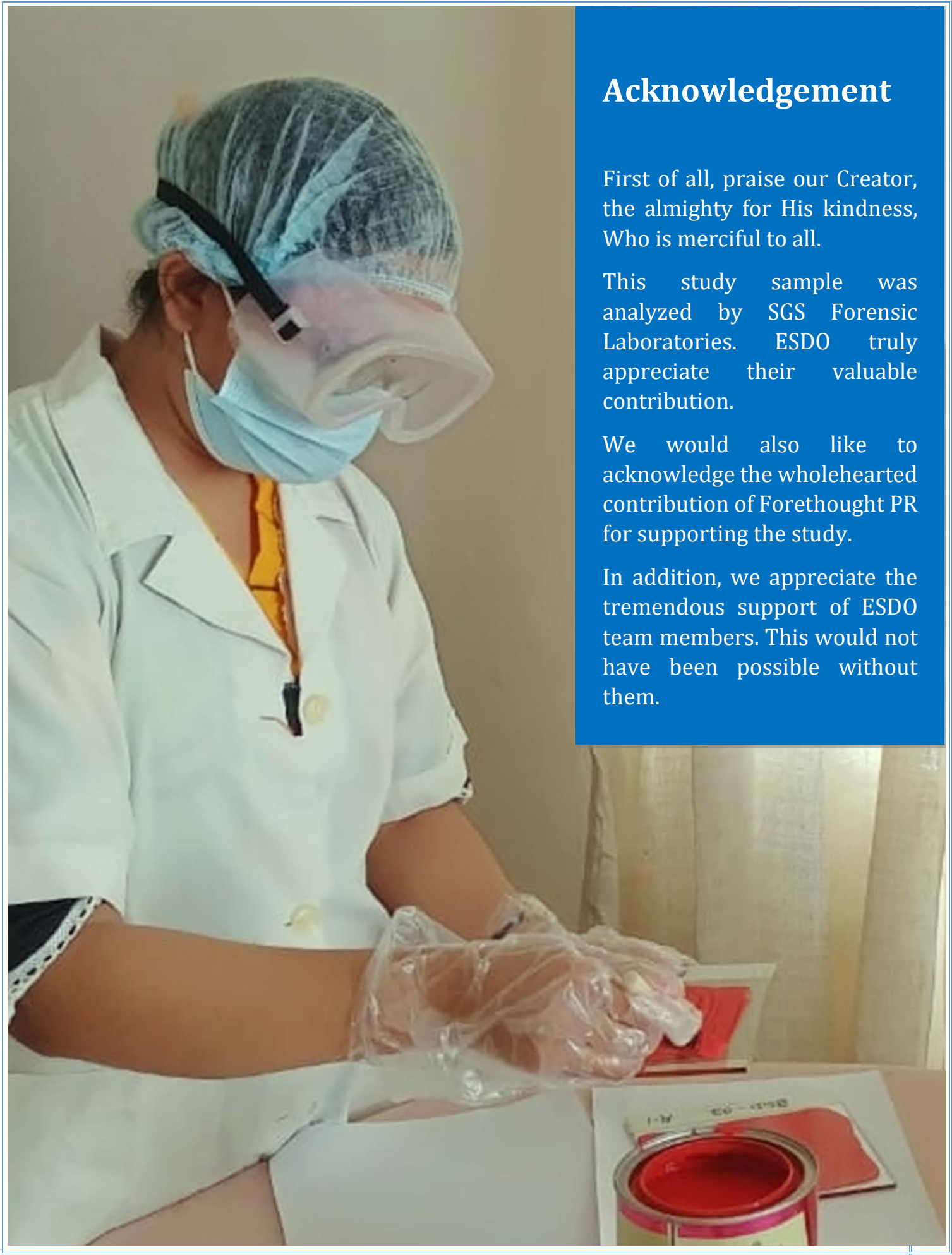

Acknowledgement

First of all, praise our Creator, the almighty for His kindness, Who is merciful to all.

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Table of Content

Executive Summary

Lead poisoning is considered one of the significant public health concerns, particularly for vulnerable groups like children, the elderly, and immune-deprived people. Several studies reported that exposure to high levels of lead may cause anemia, weakness, kidney and brain damage in children. Very high lead exposure can cause death. The exposure source of toxic chemicals is diverse. Lead paint and lead dust are considered to be potential sources of lead contamination. Due to the severe health risk, the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) are actively initiating the global phase-out of lead paint. To accelerate phasing out lead paint in Bangladesh, this year, ESDO conducted a study regarding lead concentrations in paint. Samples were purchased from different areas of Dhaka city, including Mohammadpur Town Hall Market, Kawran Bazar, Kaptan Bazar, Chawk Bazar, and Gulistan Underground Market, and from local markets of Chittagong, Sylhet and Bogura. Industrial paint was analyzed for the first time to show the necessity of a mandatory limit for the paint. An analysis of decorative paints was conducted and also compared with the previous studies to assess the effectiveness of existing regulations. Industrial paints were analyzed to illustrate the scenario and to advocate for standard limit of 90 parts per million (ppm) for industrial paints. Considering the health risk associated with lead paint, this study identified the lead content in some popular decorative and industrial paint brands in Bangladesh. The lead content of 63 paints varied between national and multinational brands. The decorative paints tested, only 15.4% exceeded the standard lead content, and 15.4% have lead content within the permissible limit of 90 ppm. Among the other paints, the lead content was less than 90 parts per million (ppm). In comparison with the previous years, the percentage of lead-based decorative paints has been reduced from 77% to 15.4%, which is a reflection of the success of the existing regulation. 50% of industrial paint samples were found to have a high lead content range between 5000-100000 parts per million (ppm). However, no samples were found lead-free despite having the lead-free logo. Besides these popular brands, thousands of local paint brands are available which are producing paints without any standard limit. The study also shared the glimpse of a few locally available brands with a message for authorities to take these local brands under their umbrella to control safety and quality issues like heavy metal content. Lead paints have already poisoned millions of children and likely to cause similar damage in the future until the proper implementation of the regulation regarding the issue. The study mentioned the success of the existing regulatory limit. Implementation of the regulation can be achieved by showing the current scenario and urging to take the initiative to the relevant authority to impose the 90 parts per million (ppm) standard limit for all industrial paints in Bangladesh. Mass sampling all over the country, including all local brands, is recommended to draw the national scenario of lead paint, which will sensitize the authority to take faster initiative in resolving the issue countrywide.

1. Introduction

Lead is a ubiquitous and versatile metal. It is known to have a toxic impact on most living things at a high dose. It is a naturally occurring chemical and is present in almost all parts of the environment, including food, air, water, soil, dust, paint, and tissues of living organisms, even in the human body. As it is widely available, it is used in manufacturing storage batteries and producing chemicals, paints, and gasoline additives. It is also used in manufacturing various metals such as sheets, lead, solder, and pipes. Lead accumulates in tissues and organs of the human body which cannot be metabolized. Significantly, lead can accumulate in the human brain, causing neurological disease and may introduce cardiovascular disease [2]. Humans are exposed to lead through near-field exposure pathways like non-dietary paints, dust ingestion, and far-field exposure pathways such as dietary exposure. Among exposure pathways of lead, e.g., air, water, soil, dust, and food study indicated that the level of lead exposure through paints is higher than that of exposure from dietary sources [29]. One of the potential and familiar sources of lead pollution is lead paint and contaminated dust [6]. Lead in household dust results from indoor sources such as old lead paint on surfaces that can easily transport to the human body by ingestion, inhalation, and dermal absorption [20]. In urban areas, lead in indoor and outdoor dust has increased dramatically due to rapid urbanization and industrialization [12].

Lead is simultaneously harming our environment. As lead is non-biodegradable, it can transport through the air and water and enter our food chain after use. Despite the adverse health and environmental impact, lead is still used in many manufacturing industries. A recent report on toxic links investigated the paints in India and reported that more than 60% of enamel paints have higher lead content than the standard value [16]. From several awareness-raising activities to policy advocacy, Environment and Social Development Organization-ESDO has been working on the issue of ban lead paint in Bangladesh since 2008. Besides, every year ESDO conducts a study to evaluate the country situation of paints in the market of Bangladesh as a follow-up activity to evaluate the effectiveness of the mandatory standard. Also, this year, ESDO conducted a study to evaluate the country situation of paints in the market of Bangladesh to visualize the effectiveness of the mandatory rules for decorative paints and to urge for a mandatory 90 ppm standard for industrial paints to minimize lead pollution nationwide. ESDO findings portray that many of the paints available in Bangladesh have higher lead content than the permissible limit. In comparison, industrial paint contained more lead content than decorative paints, indicating that existing law is quite effective in reducing the lead used for decorative paints but industrial paints need to take into consideration of the relevant authority. Few renowned companies are moving toward no-lead paint production by achieving third-party certification. An initiative from the relevant authority for proper implementation is crucial. The study focused on determining the lead content of the decorative and industrial paints available in the market in Bangladesh. The study is also expected to support the authority to take necessary implementation techniques and urge for a mandatory limit for industrial paints.

According to the previous report of ESDO, Paint analysis conducted in Bangladesh in 2010 revealed that 24 samples from the 29 decorative paints contained concentrations from 800 to 14,200 ppm lead (dry weight of paint). A study conducted by ESDO in 2012-13, found a different situation. In 2012-13, all paints analyzed from five paint brands, including market leaders Berger and Asian paints, contained less than 90 ppm lead. Nevertheless, nearly two-thirds of the paints sampled in 2012-13 had lead concentrations above 600 ppm and would not be permitted for sale or use in most highly industrialized countries. In 2014-15, ESDO purchased a total of 56 cans of solvent-based enamel decorative paint from stores in Dhaka and Chittagong in Bangladesh. The paints were from 24 paint brands. Most of the brands (22 of 24 brands) selected for analysis were chosen because they were shown to contain lead above 90 ppm in the 2012-13 study. The objective was to determine whether lead levels in paint sold in Bangladeshi markets had changed since the initial study in 2012-13. All paints were analyzed by an accredited laboratory in Europe for their total lead content based on the dry weight

of the paint. Both the 2012-13 and the 2014-15 paint studies were undertaken as part of the Asian Lead Paint Elimination Project. The Asian Lead Paint Elimination Project focuses on eliminating lead paint from the market in seven project countries – Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka, and Thailand [8].

1.1 Objectives

- To identify the situation of lead paint in Bangladesh.
- To assess the lead content in the popular household and industrial paints in Bangladesh.
- To determine the trend of using lead in paints in Bangladesh.
- To evaluate the effectiveness of regulatory controls across the country.
- To urge for a regulatory standard of 90 ppm for industrial paints and implementation of existing standards for decorative paint.

1.2 Problem Statement

Lead poisoning is a kind of slow poisoning, where toxicity is not visible at the beginning but it can draw brain damage in the long run as it is a potential neurotoxin. Still, lead is widely used in industries such as in the production of batteries, fuel additives, pipes, pigments, solder shielding, paints, and many other consumer products. It is a common industrial hazardous element throughout the world that harms us as well as our environment. Unfortunately, lead paint is ubiquitous; through which, we encounter lead dust in our everyday life. The lead paint has become the primary cause of lead poisoning in children in the US following the prohibition on lead-based gasoline [24]. The use of lead in paints and its impacts is not only confined to the US but a global issue. Lead in paint and dust is considered the focus of reducing children's exposure to lead [22].

Lead paints are still widely manufactured and used in many developing countries, including Bangladesh. Bangladesh has established a 90 ppm lead limit for decorative paints but industrial paints are still not under consideration by any law. Without any regulation, it is unavoidable to reduce the use of lead in industrial paints available in the market with elevated lead levels, despite having the mandatory limit. Also, there is little information on lead content in industrial paints. The sampling of industrial paint is also challenging because industrial paints are sold only in bulk amounts.

Many organizations, such as the United Nations Environment Programme, International Lead Association, University of Dhaka, International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B), Environment and Social Development Organization-ESDO and UNICEF have been working on the issues tied to lead exposure, apart from the government [26]. Technical Strategies are crucial to make a national approach and interventions to fight against lead pollution. Establishing national rules, including legislation, regulations, and legally enforceable standards that forbid the use of lead compounds in paints is the most efficient but complicated process. The wide use and distribution also made it hard to implement surveillance. Tracking the illegal sector is another primary concern to be addressed to minimize lead pollution countrywide.

1.3 Justification of the Study

Lead poisoning in Bangladesh has been impairing all national development, from child and maternity health to attaining climate resilience. A report by UNICEF and Pure Earth mentioned that in Bangladesh, it is estimated that 35.5 million children are affected with blood lead levels above 5 µg/dL, making the country the fourth most seriously hit in the world in terms of the number of children affected [1]. Children who are exposed to lead suffer significant and long-lasting effects on their health and development, including lifelong learning problems and the ability to work when they are adults. Since 2008 Environment and Social Development Organization-ESDO has been working to ban lead paint countrywide. As a result of ESDO's continuous policy advocacy, in 2018, Bangladesh Standards and Testing Institution (BSTI) imposed a standard for the paint manufacturing industry with a maximum 90 ppm limit for household paint. Now it is high time to look upon a regulation for industrial paints. Previously ESDO conducted studies on decorative paints to show the scenario, based on what ESDO conducted awareness programs, and advocacy. As a result, a 90 ppm mandatory limit for decorative paint was established. The current study was conducted on both decorative and industrial paints with a view to showing the actual scenario of the paints in Bangladesh. Decorative paints were analyzed to compare the lead paints situation and to compare with the previous studies so that it can help to evaluate the effectiveness of the existing 90 ppm limit. This time, industrial paints were included to show the lead paints scenario in this particular sector. It is expected that the study will help the authority to take necessary steps for setting mandatory limits of 90 ppm for industrial paints as well.

2. Background

2.1 Lead

Lead is the most important toxic heavy metal and it is highly persistent in the environment. Due to its physico-chemical properties, it is a widely distributed and important component despite having detrimental health and environmental effects. It is a naturally occurring chemical in almost all parts of the environment, including food, air-water, soil, dust, paint, and tissues of living organisms, even in the human body. Its crucial qualities, including pliability, malleability, ductility, weak conductivity, and corrosion resistance, have made it difficult to stop using it [3]. Due to its corrosion resistance characteristics, lead powder has become a popular chemical, used in the paint industry.

2.2 Sources

Figure 1: Sources of Lead; [Source: www.epa.gov/lead]

Lead is a ubiquitous and versatile metal. It is known to have a toxic impact on most living things at a high dose. As it is widely available, it is used in manufacturing storage batteries and producing chemicals, paints, and gasoline additives. It is also used to make various metals such as sheets, lead, solder, and pipes. Lead accumulates in tissues and organs of the human body and cannot be metabolized. Especially, lead can accumulate in the human brain, causing neurological disease, and also it may introduce cardiovascular diseases [2]. Humans are exposed to lead through near-field exposure pathways like non-dietary dust ingestion and far-field exposure pathways such as dietary exposure. Several studies reported that food ingestion is the main exposure pathway for people living nearby contaminated areas [5]. Dust is one of the primary carriers of lead which can bear smaller particles of lead [19]. Lead in dust can easily transport to the human body by ingestion, inhalation, and dermal absorption. Lead in indoor and outdoor dust has increased dramatically in urban areas due to rapid urbanization and industrialization in recent years [12].

2.3 Toxicological Aspects

2.3.1 Pathways of Lead Toxicity

Lead can harm various biological systems and pathways if it enters a child's body by ingestion, inhalation, or crossing the placenta. Lead primarily targets the brain and central nervous system, but it can also have an impact on the circulatory system, kidneys, and bones. Lead is a substance that can damage the endocrine system (EDC) [18]. Lead poisoning occurs when lead builds up in the body, often over months or years. Among exposure pathways of lead e.g., air, water, soil, dust, and food study indicated that the level of lead exposure through food is lower than that of the direction from the atmosphere [29]. These toxic consequences range in severity from acute, clinically evident, symptomatic poisoning at high levels of exposure to subclinical (but still

extremely harmful) effects at lower levels. Almost every organ system in the body is susceptible to lead toxicity. The main organs impacted are the cardiovascular, gastrointestinal, renal, endocrine, immunological, and hematological systems, along with the peripheral and central nervous systems. It is commonly acknowledged that, an important component of lead poisoning is its ability to substitute calcium in proteins, bones, and neurotransmitter systems, affecting function and structure and having serious negative effects on health. The cellular structure can be impacted and damaged by lead.

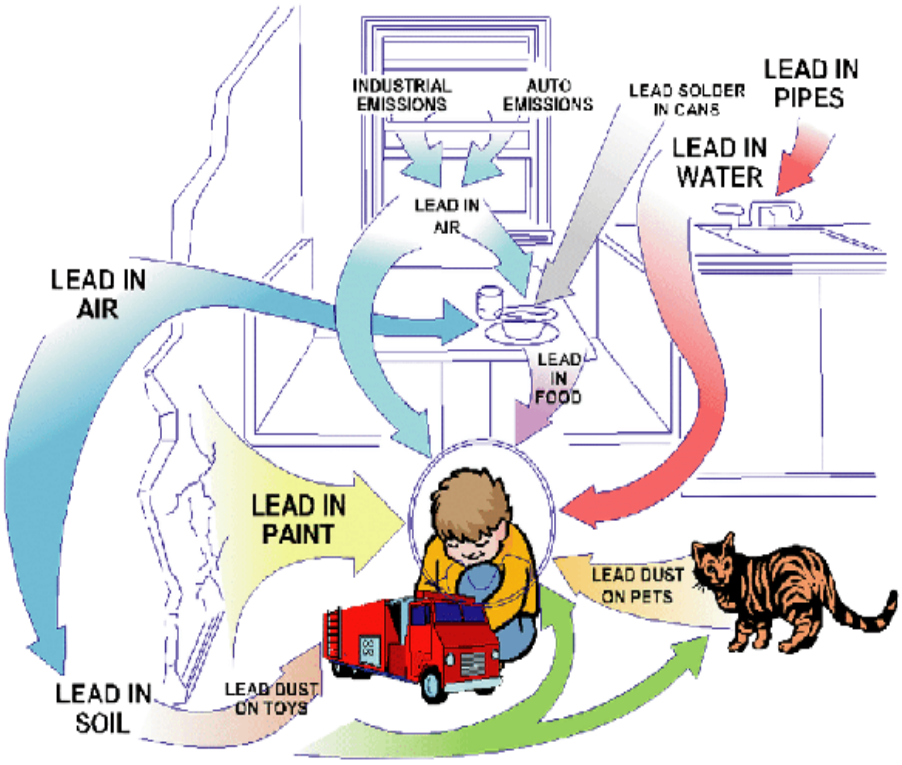


Figure 2: Pathways of Lead Contamination; [Source: Zhang et al., 2018]

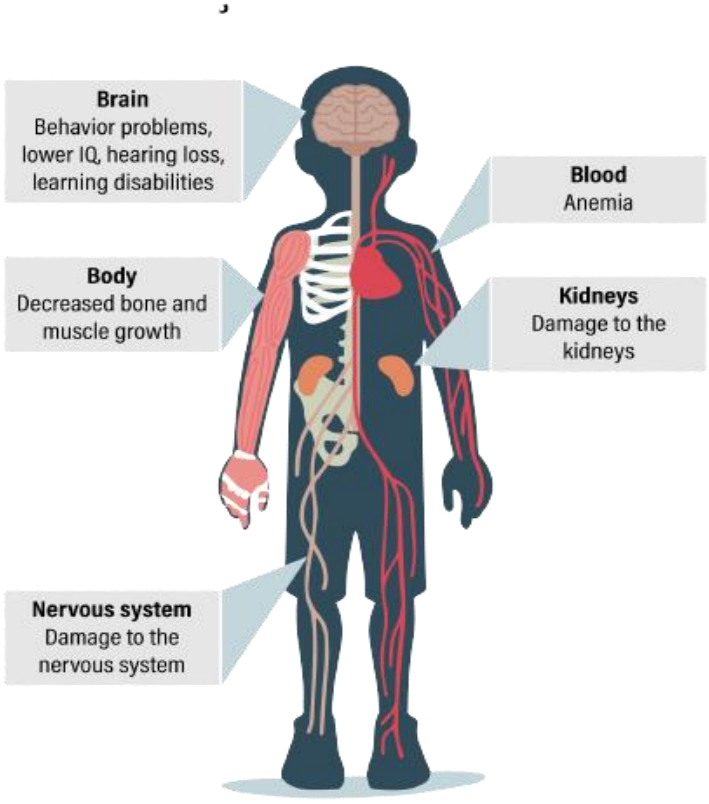


Figure 3: The health impact of lead pollution

2.3.2 Health Impact

Due to their tendency to chew on objects, young children are especially vulnerable to eating harmful lead [11]. This is not healthy for their delicate and growing brains. As part of their normal growth, young children may be indirectly exposed to lead when they put toys, trinkets, or their fingers in their mouths. Children may come into contact with old paint and lead paint dust from houses and buildings that may have landed on toys, trinkets, the floor, windowsills, or their fingers [20]. However, their exposure to lead is most frequently caused by ingestion of household dust or dirt tainted with lead paint. Children may also be exposed to lead if they take lead paint chips [10]. For instance, Old or worn lead paint peels and splits, and little pieces of lead dust land on soil, inside and outside of dwellings. This happens particularly on wells, windowsills, and doors, [20]. Additionally, during building demolition or reconstruction, when the paint is disturbed, lead can be dispersed.

Children are more likely to be subjected to lead poisoning before birth through the mother's exposure to lead poisoning, eating food, drinking water, and breathing air per unit of body weight. They also have an innate curiosity to explore the world, and sometimes engage in pica, an abnormally extreme form of hand-to-mouth behavior. Lead is also transferred through breast milk when the lead is present in a nursing mother [9]. They also spend more time in a single environment, for example- at home, and are more likely to have nutritional deficiencies that increase lead absorption, have more years left in their future lives, and therefore more time to develop delayed effects of early exposures, possibly even dementia, and have less control over the conditions of their environment. For a number of reasons, children are more susceptible to lead than adults [17].

Their constant hand-to-mouth behavior increases their exposure to lead, their growing CNS is more sensitive to toxins than their mature CNS, and their stomach absorbs lead more easily than adults [4]. In general, children begin to exhibit clinical symptoms at large dosages when blood lead levels exceed 60 g/dL. Early symptoms frequently include arthralgia and abdominal discomfort [23]. Early encephalopathy symptoms include clumsiness and staggering, which are followed by headache and behavioral abnormalities. Convulsions, altered states of consciousness, and stupor may develop as a result. Fortunately, encephalopathy is now quite uncommon in the United States. Children who recover from clinical encephalopathy frequently nevertheless struggle with serious cognitive, attentional, and behavioral problems. Children's exposure to lead is frequently difficult to detect. Most kids don't exhibit any obvious immediate signs right away. Children under the age of six are especially vulnerable to the negative health impacts of exposure since their bodies are still growing and developing quickly. Young children are more likely to be exposed to lead than older children because they tend to put their hands or other objects—which can be contaminated with lead dust—into their mouths [17].

2.3.3 Environmental Impact

Lead is persistent in the environment and can be added to soils and sediments through deposition from sources of lead air pollution. Other sources of lead to ecosystems include the direct discharge of waste streams to water bodies and mining. Elevated lead in the environment can result in decreased growth and reproduction in plants and animals, and neurological effects in vertebrates.

Lead moves into and throughout the ecosystem. Atmospheric lead is deposited in vegetation, ground, and water surfaces. The physico-chemical properties of lead as well as the biogeochemical processes within ecosystems will influence the movement of lead through ecosystems. Lead metal can affect all components of the environment and can move through the ecosystem until it reaches an equilibrium. Lead accumulates in the environment, but in certain chemical environments, it will be transformed in such a way as to increase its solubility (e.g., the formation of lead sulfate in soils, its bioavailability, or its toxicity). The effects of lead at the ecosystem level are usually seen as a form of stress.

There are three known ways in which lead can adversely affect the ecosystem. Populations of micro-organisms may be wiped out at soil lead concentrations of 1,000 ppm or more, slowing the rate of decomposition of matter. Populations of plants, micro-organisms, and invertebrates may be affected by lead concentrations of 500 to 1,000 ppm, allowing more lead-tolerant populations of the same or different species to take their place. This will change the present ecosystem. At all ambient atmospheric concentrations of lead, the addition of lead to vegetation and animal surfaces can prevent the normal biochemical process that purifies and re-purifies the calcium pool in grazing animals and decomposer organisms [21].

2.3.3 Expert's Perspective on Lead Pollution

According to the World Health Organization (WHO), 'Lead has no essential role in the human body, and lead poisoning accounts for about 0.6 percent of the global burden of disease.' Evidence of reduced intelligence caused by childhood exposure to lead has led WHO to list 'lead-caused mental retardation' as a recognized disease. WHO also lists it as one of the top ten diseases whose health burden among children is due to modifiable environmental factors. In recent years, medical researchers have been documenting significant health impacts in children from lower and lower levels of lead exposure. According to the factsheet on Lead Poisoning and Health from WHO, 'There is no known level of lead exposure that is considered safe' [18]. The damage to a young child's neurological system caused by lead exposure increases the likelihood that the youngster will struggle in school and display impulsive and aggressive conduct. Young children who are exposed to lead are also more likely to exhibit hyperactivity, inattentiveness, drop out of high school, conduct disorder, juvenile delinquency, drug use, and imprisonment. Lead exposure affects kids for the rest of their lives, has a lasting effect on how they perform at work and is generally linked to less financial success. According to recent research, the cumulative monetary burden of childhood lead exposure on the economy of all low- and middle-income nations is $977 billion international dollars* annually [15].

2.3.4 Lead Pollution in Bangladesh

Lead (Pb) poses a severe threat to human health and the environment. Worldwide lead production and consumption have significantly increased. Lead is highly persistent in nature and its bioaccumulation in the food chain can lead to adverse health impacts. Children are the most vulnerable group. Infants and young children absorb about 4-5 times more of the lead that enters their bodies than adults. Children get exposed to lead from many consumer products, like water pipes, paints, food cans, spices, cosmetics, and traditional medicines. Most of the children impacted by lead live in Africa and Asia**.** A third of the world's children are poisoned by lead and Bangladesh is the fourth most seriously hit in terms of the number of children affected. According to UNICEF and Pure Earth study, in Bangladesh, it is estimated that 35.5 million children are affected with blood lead levels above 5 µg/dL, making the country the fourth most seriously hit in the world in terms of the number of children affected.

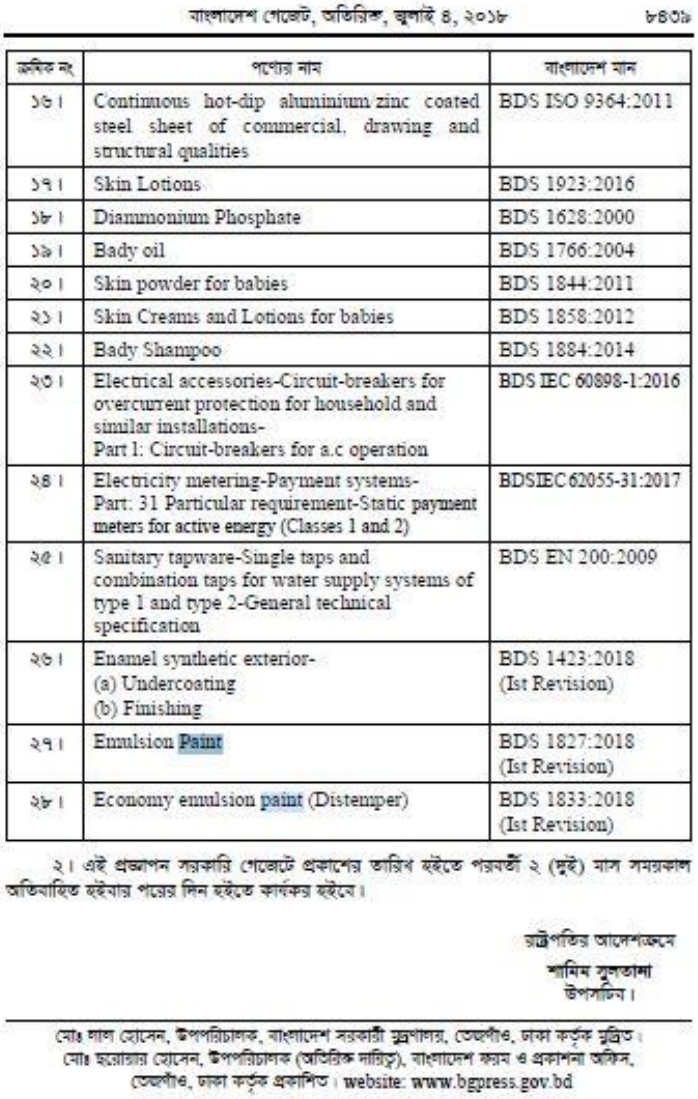
2.5 The Use of Lead in Paint

When the paint maker purposefully adds one or more lead-containing compounds to the paint for a specific purpose, the paint will contain high amounts of lead. When lead-contaminated paint materials are utilized in paint products or when cross-contamination occurs from other product lines in the same plant, a paint product may also include some lead [25]. Due to their chemical characteristics, lead paint components are most frequently utilized on purpose in solvent-based paint, and solvent-based paints have been discovered to contain significant levels of lead in several nations. As a pigment, various lead compounds are added to the paint, each of which gives the paint a distinct color. For instance, the use of lead tetroxide (Pb_3O_4) produces brilliant red paint, and lead (II) carbonate ($PbCO_3$), also known as white lead, gives the paint a white or cream tint [7]. Other lead compounds, like vivid yellow lead chromate ($PbCrO_4$), are used as colored pigments. Additionally, the heavy metal addition shortens the drying time of the paint, increases its durability, and increases its moisture resistance. As a result, lead paint is perfect for use in residences, on weather-sensitive metal, and even on children's toys.

There are several uses for lead in oil-based paint, including Lead compounds are frequently employed as pigments. Pigments are used to give the paint its color and make the paint opaque (so it covers well), especially for bright colors like yellow and red, and shield the paint and the underlying surface from deterioration brought on by sunlight exposure. Lead-based pigments can be used both on their own and in mixtures with other colors. Lead paints may also contain lead-based chemicals as driers (sometimes called drying agents or drying catalysts). In order to prevent rust or corrosion, lead-based compounds are occasionally added to paints that are used on metal surfaces. Lead tetroxide sometimes referred to as red lead or minimum, is the most prevalent of them [7]. Lead is used as a corrosion resistance agent in paints for metal surfaces, including marine paints, to stop rust and corrosion. These paints, however, are outside the focus of this investigation of domestic paints. Since many years ago, non-lead-based pigments, driers, and anti-corrosive agents have been readily accessible and are employed by producers of the best caliber paints. The lead content of paint will be very low—less than 90 ppm lead by dry weight, and frequently as low as 10 ppm or less—when a paint manufacturer will not purposefully add lead compounds in the formulation of its paints and take care to avoid using paint ingredients that are lead-contaminated. In the early 1970s and 1980s, the majority of highly industrialized nations implemented legislation or regulations to regulate the lead level in decorative paints [13]. Many have established restrictions on the lead content of paints used on toys and for other purposes that may expose children to lead. These regulatory steps were implemented in response to scientific and medical evidence that Pb (lead) exposure in children has substantial adverse effects, especially in children under the age of six, and that lead exposure in children is mainly caused by lead paint. In the European Union, lead is not allowed to be used in the manufacture of decorative paint due to laws governing the security of consumer goods and particular bans on the majority of lead-based raw materials. Standards defining a maximum lead limit are in existence in the United States, Canada, Australia, and other nations with laws prohibiting the use of lead-based components in decorative paint. A producer can sell its paint everywhere in the globe by complying with the existing standard for decorative paints, which is a total maximum lead level of 90 ppm in countries including the United States, the Philippines, and India. The Model Law and Guidance for Regulating Lead Paint*, which was developed by the Global Alliance to Eliminate Lead Paint (GAELP) and released by the United Nations Environment Programme, also recommends this level.

2.6 Paint Market and Regulatory Framework in Bangladesh

Three standards for different types of paints, including enamel, synthetic, and exterior paints for undercoating and finishing applications (BDS 1423:2018); emulsion paints (BDS 1827:2018); and economy emulsion paints or distempers, were developed by the Bangladesh Standards and Testing Institution (BSTI) under the Ministry of Industries (MoInd) in 2018. These paints are frequently used in home and office design. A mandatory total lead limit of 90 ppm is established by the three standards in the Statutory Regulatory Order (SRO) No. 221-Law/2018 for paint manufacture.



বাংলাদেশ গেজেট, অতিরিক্ত, জুলাই ৪, ২০১৮ ৮৪৩৯

ক্রমিক নং	পণ্যের নাম	বাংলাদেশ মান
১৬।	Continuous hot-dip aluminium/zinc coated steel sheet of commercial, drawing and structural qualities	BDS ISO 9364:2011
১৭।	Skin Lotions	BDS 1923:2016
১৮।	Diammonium Phosphate	BDS 1628:2000
১৯।	Bady oil	BDS 1766:2004
২০।	Skin powder for babies	BDS 1844:2011
২১।	Skin Creams and Lotions for babies	BDS 1858:2012
২২।	Bady Shampoo	BDS 1884:2014
২৩।	Electrical accessories-Circuit-breakers for overcurrent protection for household and similar installations- Part 1: Circuit-breakers for a.c operation	BDS IEC 60898-1:2016
২৪।	Electricity metering-Payment systems- Part: 31 Particular requirement-Static payment meters for active energy (Classes 1 and 2)	BDSIEC 62055-31:2017
২৫।	Sanitary tapware-Single taps and combination taps for water supply systems of type 1 and type 2-General technical specification	BDS EN 200:2009
২৬।	Enamel synthetic exterior- (a) Undercoating (b) Finishing	BDS 1423:2018 (Ist Revision)
২৭।	Emulsion Paint	BDS 1827:2018 (Ist Revision)
২৮।	Economy emulsion paint (Distemper)	BDS 1833:2018 (Ist Revision)

২। এই প্রজ্ঞাপন সরকারি গেজেটে প্রকাশের তারিখ হইতে পরবর্তী ২ (দুই) মাস সময়কাল অতিবাহিত হইবার পরের দিন হইতে কার্যকর হইবে।

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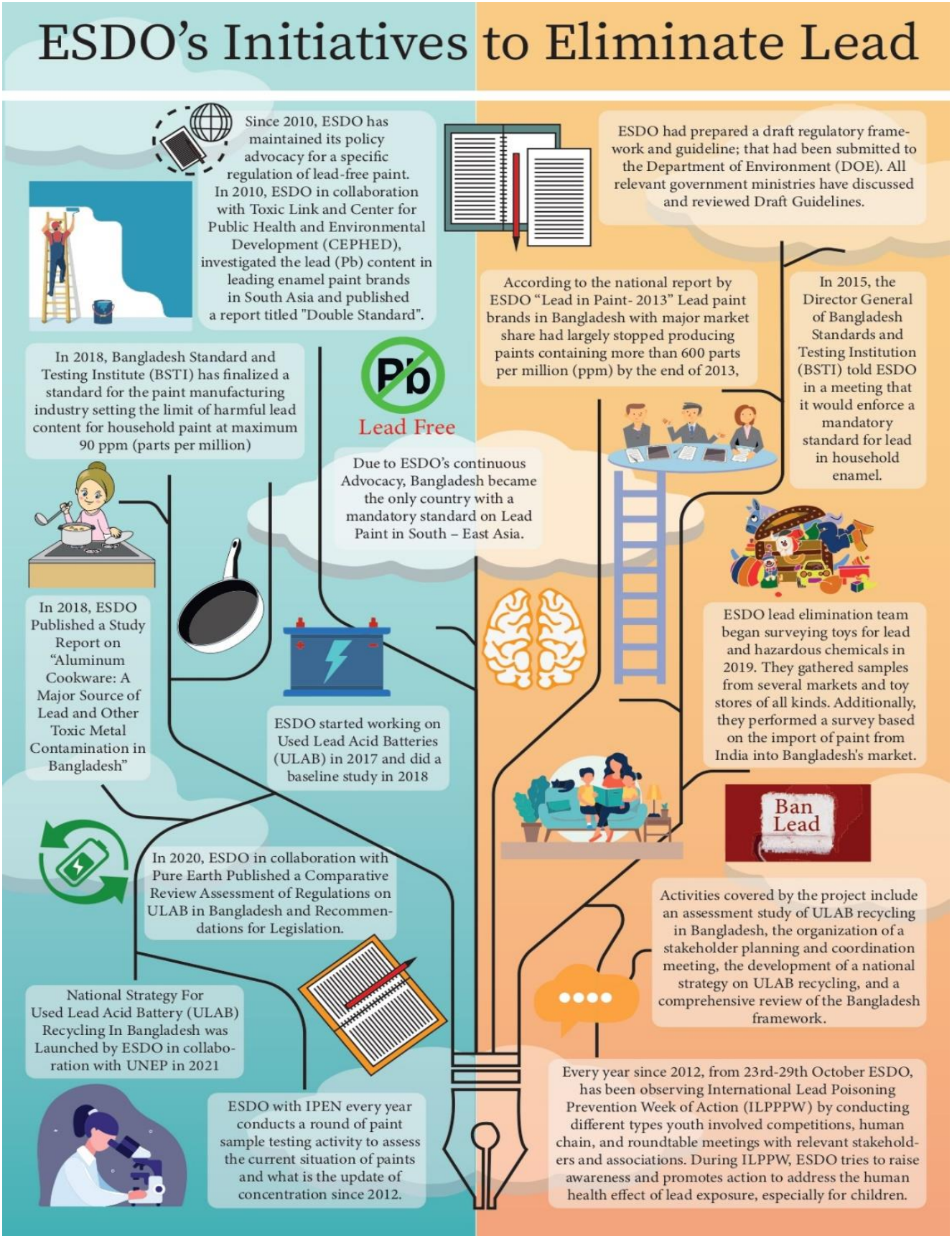
2.7 Initiatives to Establish a Lead Paint Standard

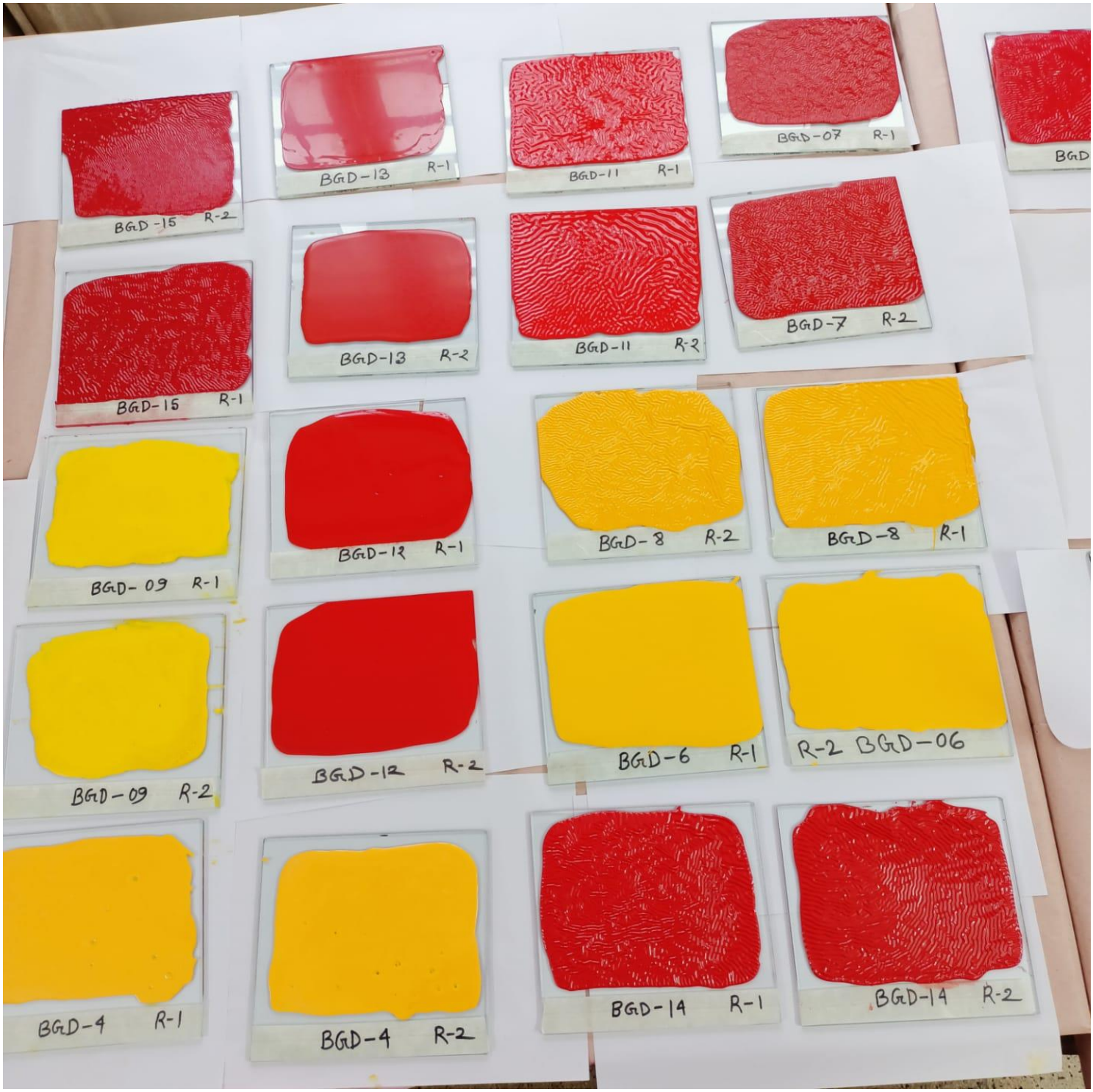
For years, ESDO has been advocating for a clear regulation of lead-free paint. Since 2010, ESDO has maintained its policy advocacy to ban lead paint. ESDO's primary goal is to eradicate lead paint in Bangladesh by encouraging the adoption of a mandatory 90 ppm lead limit in paint. The Department of Environment (DoE) had received the proposed regulatory framework and guidelines that ESDO had produced and submitted. In order to raise awareness about the issue of lead in paint and discuss the significance of developing a regulation that will control its use in all types of paints, ESDO held a number of consultative dialogues and meetings with a variety of stakeholders between 2018 and 2021, including paint manufacturers, the Paint Manufacturers Association, and Policymakers in Bangladesh. The establishment of such laws under Bangladeshi law has received support from the Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Health & Family Welfare (MoH&FW), Ministry of Commerce (MoC), Ministry of Industries (MoInd), Bangladesh Council of Scientific and Industrial Research (BCSIR), and the Department of Public Health Engineering (DPHE). As a result, the Bangladesh Standards and Testing Institution (BSTI) set a standard in 2018 for the paint manufacturing sector, establishing the maximum permissible lead concentration for residential paint at 90 ppm. However, monitoring and enforcement methods continue to be difficult. Thus, IPEN and ESDO are evaluating paint companies' compliance with the legislation through an examination of the paints that are sold in the market. Several ESDO's activities have been aimed at raising awareness and advocating for 'Ban Lead Paint' in Bangladesh since 2008. Since 2012, each year ESDO has conducted a study to visualize the country's paint market situation. Also, this year, ESDO conducted

a study to determine the lead content of popular household and industrial paints in Bangladesh and compare the situation with the previous year.



2.8 International Lead Poisoning Prevention Week of Action (ILPPW)

Since 2008, ESDO has been the first civil society group to actively advocate for the eradication of lead in paint by promoting a particular rule on 'lead free paint.' Since 2012, ESDO has been observing the International Lead Poisoning Prevention Week of Action (ILPPW) on the last week of October from 23rd to 24th by hosting various youth-focused events, human chains, and round table discussions with pertinent stakeholders and international partners led by the Global Alliance to Eliminate Lead in Paint (GAELP) to create awareness and promote actions that will address the human health effects of lead exposure. ESDO is attempting to increase awareness and encourage action to address the negative effects of lead exposure on human health, particularly in children, during this International Lead Poisoning Prevention Week (ILPPW). Government, academicians, businesses, and civil society collaborate and take initiatives to stop children's lead poisoning and to pursue special regulations to get rid of lead in the paint throughout the week. To evaluate the present state of paints and the update in concentration after the obligatory law, ESDO and IPEN began another round of paint sample testing activities in 2020. In 2021, ESDO organized a human chain on 23rd October where the Youth urged a regulation on total lead paints. Apart from this rally, ESDO organized a High-Level Policy Dialogue and National Report Launching event jointly with the Directorate General of Health Services – DGHS and the International Pollutants Elimination Network – IPEN. Children's painting, poster-making, and essay-writing competitions, as well as the creation of information, education, and communication (IEC) products emphasizing the effects of lead paint on human health and the environment, were some of ESDO's further awareness-raising initiatives. The ESDO website and social media channels were used to share these IEC resources with the print and electronic media. Additionally, ESDO created a brief video that promoted better and safer alternatives while calling for the importation, production, and use of lead paint and lead pigments to be outlawed in Bangladesh.



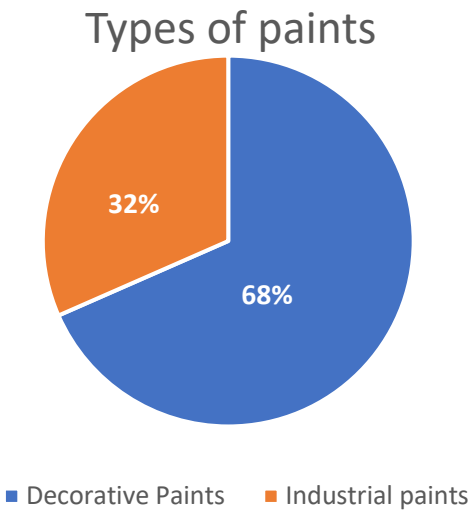
3. Methodology

Paints including both decorative and industrial paints between July and August 2022 from different shops in Dhaka, Chittagong, Sylhet and Bogura were collected by ESDO and ForeThought PR. The paints represented 39 different brands produced by local and multinational manufacturers. Red, yellow, and golden yellow are the colors of the paints used for sampling. Among these paints, industrial paints were also included in decorative paints in this study. These paints' accessibility in retail shops showed that they were meant for use in residential and commercial settings. Each can of paint was thoroughly stirred and was subsequently applied onto individually numbered duplicates of untreated, labeled glass pieces using different unused, single-use paintbrushes. After properly drying, the flakes of samples were collected and placed in individually labeled resealable plastic bags, and shipped for analysis of lead content to Forensic Analytical Laboratories, Inc. in the

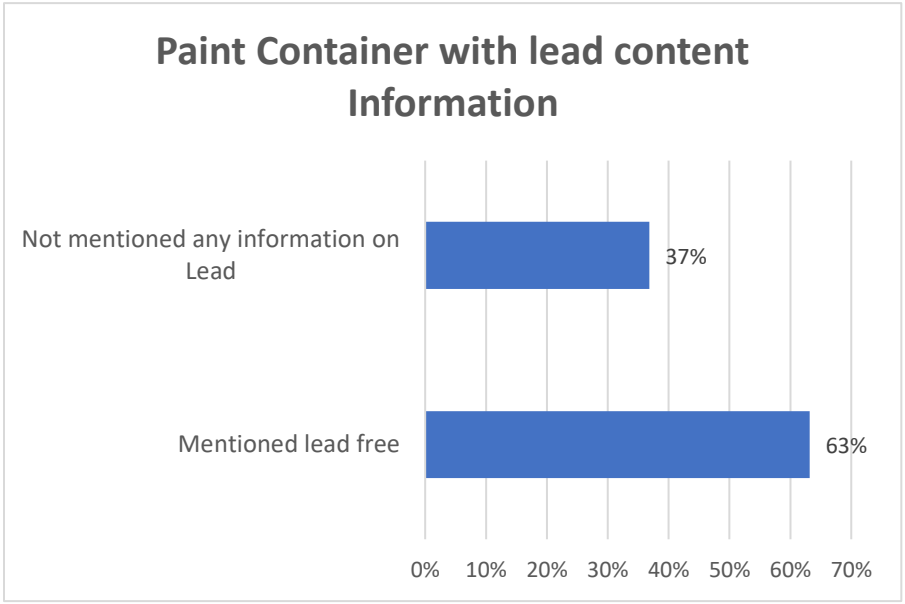
United States of America. The laboratory participated in the Environmental Lead Proficiency Analytical Testing (ELPAT) Program operated by the American Industrial Hygiene Association. In the laboratory selection process, the paint samples were analyzed using method EPA3050B/7000B, i.e., through acid digestion of the samples, followed by Flame Atomic Absorption Spectrometry, as recognized by the WHO as appropriate for the purpose. The laboratory's lower limit of detection for the lead concentration in the paint samples is dependent on the amount of paint in the samples. Generally, the lowest detection limit for the method used is 60 ppm, but if only a small amount of paint is available, the detection limit increases.

Figure 4: Paint Sampling in Glass Slide

4. Results & Discussion

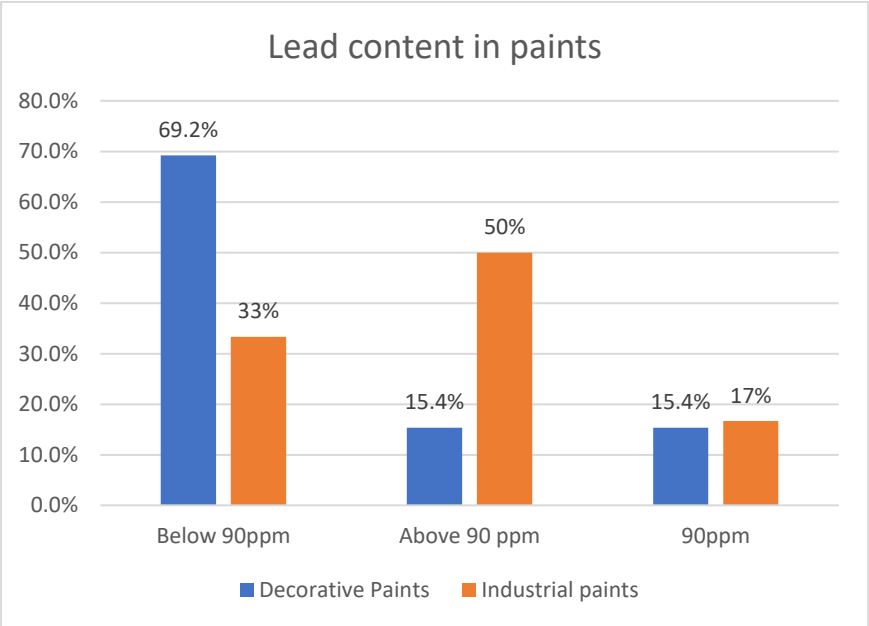


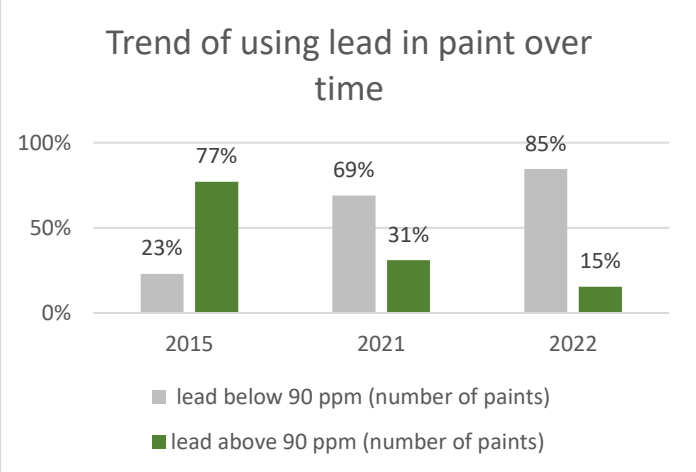
63 samples of 39 national and multinational brands were analyzed. Samples were purchased from different areas of Dhaka city, including Mohammadpur Town Hall Market, Kawran Bazar, Kaptan Bazar, Chawk Bazar, and Gulistan Underground Market, and from local markets of Chittagong, Sylhet, and Bogura. Among them, 32% were from industrial paints, and 68% were from decorative paints. All of the analyzed samples were identified to have a different amount of lead.

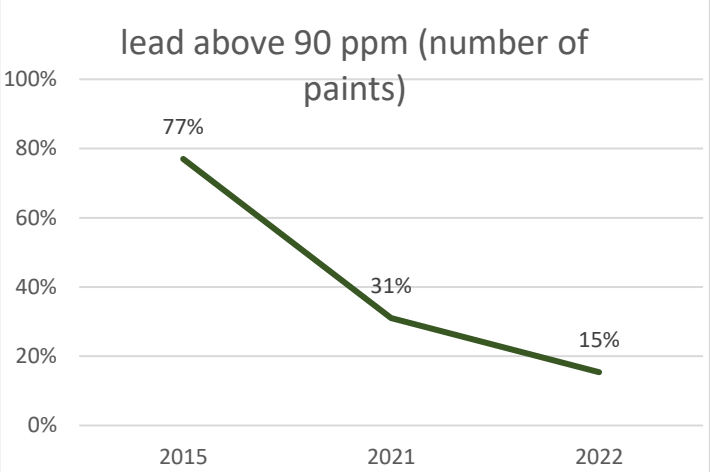


63% of the total samples were mentioned as lead-free. The remaining 37% of paint samples did not clarify any information on any aspects of lead safety. No samples were identified to have any information as Labeling on lead content. According to the lab analysis, all of the samples were found with different amounts of lead content despite having lead-free mentioning. However, Lead-free paint is defined as a paint that does not contain any white lead in it or similar lead compounds. Since 1997, no domestic paint has been allowed to contain more than 0.1 percent of lead. As those paints were mentioned as lead, the lead content should have been under 0.1 percent, but no samples were found with lead content less than 60 ppm.

Among the analyzed samples, 30.8% of the decorative paints were found to possess lead, containing a range of 90–250 ppm. The rest, 69.2% of decorative paints, have a lead content of less than 90 ppm. For industrial paints, a devastating scenario has been identified. 50 % of the total samples were identified as having high lead content. The highest lead concentrations detected were 97,000 ppm for orange color industrial paints. The rest of the 50% industrial paints have lead content within and below 90 ppm. One painting from a renowned brand contained 97,000 ppm lead levels despite having a 'Lead-Free' logo. Moreover, no samples were identified as fully lead-free despite mentioning as lead-free. Most warning symbols on the paint cans indicated the flammability of the paints, but no precautionary warnings on the effects of lead dust on children and pregnant women were provided.







In this study, lead levels among paints have been compared to the results of a similar paint study conducted by ESDO in 2015 and 2021. In the previous study, 77% of the total 90 paint samples were identified to have high lead content (above 90 ppm). In 2021 the percentage has reduced to 31% (out of 63 samples); in the current study, the status of high lead-contained decorative paint was reduced to 26% (out of 63 total samples where 43 were decorative). This demonstrates that many paint manufacturers have already reformulated their paints without using lead ingredients.

Analyzed samples are selected from the famous and most common brands available in the local market of Bangladesh. The study listed few locally available brands, but a nationwide survey is required to draw the national scenario. However, there are many local brands available that are not popular but are being used. These unknown local brands are selling throughout the country.

Local Paint Companies' Details

Sl. No.	Company Name	Company Address	Major Selling Products		Products Selling Area	Remarks
			Water Based	Oil Based		
1	**Menilla Paint**	Chittagong	No	Yes (Only B grade products)	Chatkhil, Raipur, Laxmipur, Ramgonj, Chandragonj.	
2	**Borison Paint**	Barishal	Yes (All water-based products)	Yes (Only B grade products)	Laxmipur, Dalabazar.	
3	**Solar Paint**	Chittagong	No	Yes (Only B grade products)	Raipur	Small Shop sales
4	**S One**	Dhaka	No	Yes (Only B grade products)	Chatkhil, Raipur, Laxmipur,Ramgonj, Chandragonj, Maigdee, Sonaimuri.	
5	**Aqua Paint**	Dhaka	Yes (All water-based products)	Yes (All products)	Laxmipur, Chatkhil.	Small Shop sales
6	**Polac**	Dhaka	Yes (All water based products)	Yes (Only B grade products)	Dagonbhiya, Bashurhat, Kabirhat,Laxmipur, Raipur	Small Shop sales
7	**abc Paints**	Dhaka	Yes (All water based products)	No	Halishahar	
8	**Olympic Paints**	Dhaka	Yes (All water based products)	Yes (Only B grade products)	Barodarogahat, Shitakunda, Banskhali	Small Shop sales
9	**Naphew paints**	Chittagong	No	Yes (Only B grade products)	Feni, Chagolniya, Baroierhat,Shitakundu, Barabkundu, Mirsharai, Heako, Khagrachari, Ramgor, Najirhat, Fathikchari, Rawjan, Chittagong city area, Chandanaish, Satkaniya.	Small Shop sales
10	**Universal Chemical**	Dhaka	Yes (Only Interior Sealer)	No	Chagolniya, Heako, Khagrachari, Ramgor.	
11	**Al Hossen Paint**	Chittagong	No	Yes (Only B grade products)	Noakhali, Feni, Baroierhat, Shitakundu, Barabkundu, Mirsharai, Chagolniya, Heako, Khagrachari, Ramgor.	
12	**Alpha Paint**	Chittagong	Yes (Only Water proofing products)	Yes (Only B grade products)	Agrabad, Chowmuhuni, Kazirdewri	Small Shop sales
13	**James Bond Chemical**	Dhaka	Yes (Only Interior & Exterior Sealer)	Yes (Only B grade products) Brand name G-Paint	All over Noakhali, Laxmipur & Feni, Rawjan,Rangunia, Kaptai, Fathikchari, Hathazari, Najirhat, Cox'sbazar, Teknaf.	
14	**Fast Corporation**	Dhaka	Yes (Only Distemper, Exterior & Interior Sealer)	No	All over Noakhali & Feni	
15	**Pelicon**	Dhaka	No	Yes (Only B grade products)	Chowmuhuni Noakhali	Small Shop sales
16	**King Star**	Chittagong	No	Yes (Only B grade products)	Chittagong city area, Anwara, Chandanaish, Satkaniya, Rawjan, Fathikchari, Hathazari, Najirhat, Ukhiya, Banskhali, Moheshkali.	Small Shop sales
17	**Lion Paint**	Chittagong	No	Yes (Only B grade products)	Rawjan, Fathikchari, Hathazari, Najirhat	Small Shop sales
18	**Mowshumi Paint**	Chittagong	No	Yes (Only B grade products)	Noakhali, Feni, Rawjan, Fathikchari, Hathazari, Najirhat	Small pack size are selling. Main consumers are Ricksha's parts selling shop.
19	**Madina Paint**	Chittagong	No	Yes (Only B grade products)	All over Noakhali & Feni	Small Shop sales
20	**Sun Star Paint**	Chittagong	No	Yes (Only B grade products)	All over Noakhali & Feni	Small Shop sales

Table 1: Glimpse of local brands

The study specifies that the use of lead in household paints has reduced over the years, which reflects the success of the 90 ppm mandatory limit for decorative paint imposed by BSTI. However, industrial paints have no regulation to limit the lead content. A mandatory limit for industrial paint is crucial to save children from lead pollution. The study showed that the highest amount of lead is identified in a specific industrial paint which is alarming.

Lead paint remains a global issue, requiring urgent international attention. The Global Alliance to Eliminate Lead Paint (GAELP) is a voluntary partnership formed by the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) to prevent exposure to lead by promoting the phase-out of paints containing lead. The Global Alliance to Eliminate Lead Paint (GAELP) has published its Annual Update on the Global Status of Legal Limits on Lead in Paint to draw the current scenario and also Model Law and Guidance for Regulating Lead Paint to take effective steps to prevent lead paint globally. 84 nations, or 43% of all nations, have legally binding restrictions on the manufacture, importation, and distribution of lead paint. Regulations already limit the use of lead paint in residential applications in the United States and the majority of high-income nations [10]. Many countries have implemented complete prohibitions on the use of lead paints. At the UN International Conference on Chemicals Management (ICCM), more than 120 nations decided to vote for phasing out all lead paints in 2009. Since then, countries, including the Philippines and Nepal, enacted regulators to prevent the use of lead for both decorative and industrial paints. Bangladesh has regulations for household paint that mention a 90 ppm mandatory limit. International paint industries are moving forward to lead-free paints. The available evidence suggests that written comments from paint industry leaders acknowledged and are ready to cooperate to eliminate lead from paint in all applications.

Every year ESDO conducts a study to evaluate the country's situation of paints in the market Bangladesh. According to the report of ESDO conducted in 2011, 77% of the decorative paint samples were found to have high lead content. In 2018, ESDO's continuous policy advocacy for a standard for the paint manufacturing industry setting the limit for household paint at a maximum of 90 ppm has imposed by Bangladesh Standards and Testing Institution (BSTI). In 2021, a study was carried out to evaluate the lead content in paint to identify the lead paints in Bangladesh as a follow-up activity to evaluate the effectiveness of the mandatory standard. In 2021, the percentage of lead-contained decorative paints have reduced to 31% whereas this year it was reduced to 15%. The reduction is considered a great success of the existing regulation as well as the initiatives of ESDO.

It is high time we may proceed toward a regulation for industrial paints. Through the regulation, we can hope to prevent the use of toxic chemical lead from one of the primary sources of lead poisoning. Almost all nations have implemented laws prohibiting the use of lead gasoline additives over the past 20 years [10]. The success of this effort must now be replicated in banning the use of lead in all types of paints and coatings globally. Once and for all, a concerted effort is needed to expand existing restrictions to ban these dangerous and unnecessary uses of lead compounds. This would most efficiently be accomplished by regulating the total lead content of paints and coatings for all applications rather than the piecemeal approach that invites a fight on each compound.

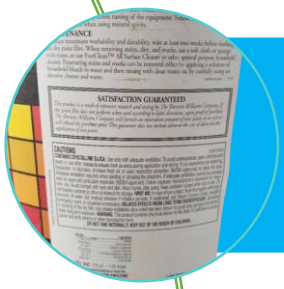
Market Share of the Leading Paint Companies

In the year 2019, the Bangladesh paints market was found to be consolidated. Major players in the market were found to be Berger Paint Bangladesh Limited, Asian Paint, Roxy Paint Limited, Kansai Nerolac Paints Bangladesh Limited, RAK Paints, and Aqua Paints, among others. Above 80% of the country's paint market is in the hands of foreign brands.

According to the Bangladesh Bureau of Statistics, in the past two decades, the urban population of the country grew from 28.61 million to nearly 42 million. By the end of 2020, approximately 36.5% of the country is expected to be urbanized. The development in the real estate sector due to increasing urbanization and a gradual increase in consumer awareness about the need for the protection of houses is fueling the growth of the paints and coatings industry in the region. Moreover, the availability of low-cost home loans, growth in home renovations, and a shift from semi-permanent to permanent housing structures in the country are further acting as a catalyst for the construction chemical market and the whole construction sector. Bangladesh is a subtropical monsoon country and thus experiences heavy rains, hot and humid summers, and foggy winters. Due to the extreme temperature conditions, buildings and other infrastructures in the country tend to have a shorter life span compared to other climates. Major companies present in the country such as Berger paint company are coming up with technologically modified paints and coatings suitable to the climate of Bangladesh. Most of the paint manufacturing in the binuclear paint industry of Bangladesh takes place in mega-cities like Dhaka and Chittagong. Although industrial coatings and paints have virtually doubled in size over the last ten years, the spiraling prices of raw materials in international markets, depreciation of the local currency, and new supplementary duties can slow down the sector's growth to a great extent. Moreover, excessive land prices are also restricting the urban market's growth, as around 80% of the housing sector's cost is related to land prices [27].

5. Recommendations

Since the Global Alliance's Model Law and Guidance for Regulating Lead Paint* standard of lead paint for decorative household paints has already been adopted by Bangladesh Standards and Testing Institution (BSTI), they should now draft additional standards that will prohibit the production, import, export, distribution, sale, and use of other types of paints, including industrial paints, that contain total lead concentrations exceeding 90 ppm.



There are still a lot of products on the market whose labels exclude any indication of the chemicals they include. Therefore, it must be mandatory for paint companies to publish enough information on the labels of paint cans identifying dangerous ingredients.

All parties involved, including the BPMA, academics, BSTI, technical advisers from chemical divisions, significant government ministries, and regulatory bodies, need to join forces and work cohesively to advance a firm policy that will get rid of lead paint in Bangladesh.

All local brands are suggested to keep under the umbrella of the paint association for proper tracking and surveillance to minimize the use of lead.

A national survey is suggested which covers all local, national and international brands of Bangladesh.

6. Conclusions

Lead exposure can have a significant negative impact on a child's health, including brain and nervous system damage, slower growth and development, issues with learning and behavior, hearing, and speech. Children may come into contact with lead for their hand-to-mouth behavior from the sources like home walls, toys, and many more where lead paint is usually used. As a primary source of lead poisoning, paint must be prevented as a means of minimizing pollution. Acknowledging the matter, Bangladesh Standards and Testing Institution (BSTI) has already established a 90 ppm lead limit for decorative paints. However, industrial paints are lagging behind in terms of regulation. So, lead is still used for industrial paints. The study conducted by ESDO focused to visualize a comparative result on the lead content of decorative paints available in Bangladesh to show the effectiveness of the current regulation. ESDO's continuous policy advocacy has resulted in a 90 ppm lead limit for decorative paints set by BSTI in 2018. This year's study shows that the lead content of decorative paints has decreased compared with previous years, indicating that the regulation is working effectively. However, industrial paints are still far away. Law is crucial to minimize the use of lead in industrial paints and take adequate steps to reduce lead pollution countrywide. The study specified that the lead content of decorative paints has diminished compared with the previous years, but industrial paints are still having high lead content as no law can restrict the use of lead. Regulation is crucial to minimize the use of lead in industrial paints and take practical steps to reduce lead pollution countrywide.

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