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LEAD TESTING IN SOIL CONTAMINATED WITH LEAD AND REDUCING ITS EFFECTS OF HUMAN BY THE ACTIVITY OF ACTIVATED LEAD

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Abstract: **Many chemical contaminants may be present in the city's residential soil, lead appears to present the highest risk, and has been the most studied. Lead poisoning is one of the greatest public health hazards that faced by residents. Exposed children have elevated blood lead levels at a rate eight times greater than the national average. Although the primary source of concern for childhood lead poisoning is within housing units, lead in soil is also a factor and efforts to assess and reduce the amount of lead in soil have been part of the goal to reduce risks of lead poisoning. There are many activities that can cause lead to accumulate in soils. Some of these activities may have happened in the past and no longer add to a site's soil lead contamination. For example, leaded gasoline is no longer used, but residues from its emissions remain in soils near roads. Lead may have also been added to soil from point sources, such as burned trash, metal smelters, jewellery plating operations, or dumped lead batteries.**

I. INTRODUCTION

Lead poisoning has a significant effect on public health for centuries. Despite of the effort to control it and apparent success in decreasing incidence, serious causes of lead poisoning still appear in hospitals, clinics and private physicians. Lead is non-biodegradable. It persists in soil, air, drinking water, and in houses. It causes all social, economic and geographical lines. If left undisturbed, lead is practically immobile. However, once mined and transformed into man-made products, which are dispersed throughout the environment, lead become highly toxic. The objective behind this project is "ESTIMATION OF LEAD CONCENTRATION IN SOIL CONTAMINATED IN INDUSTRIAL AREA" by using XRF TECHNOLOGY.

Lead is a chemical element in the carbon group with symbol Pb (from Latin: plumbum) and atomic number 82. Lead is a soft and malleable metal, which is regarded as a heavy metal and poor metal. Metallic lead has a bluish-white colour after being freshly cut, but it soon tarnishes to a dull greyish colour when exposed to air. Lead has a shiny chrome-silver lustre when it is melted into a liquid.

Lead is used in building construction, lead-acid batteries, bullets and shot, weights, as part of solders, pewters, fusible alloys, and as a radiation shield. Lead has the highest atomic number of all of the stable elements.

Lead, at certain contact degrees, is a poisonous substance to animals, including humans. It damages the nervous system and causes brain disorders. Excessive lead also causes blood disorders in mammals. Like the element mercury, another heavy metal, lead is a neurotoxin that accumulates both in soft tissues and the bones. A lead atom has 82 electrons. Lead is a bright and silvery metal with a slight shade of blue in a dry atmosphere. Upon contact with air, it begins to tarnish by forming a complex mixture of compounds depending on the condition. The colour of the compound can vary. It has few characteristic properties: high density, softness, ductility and malleability, poor electrical conductivity compared to other metals, high resistance to corrosion, and ability to react with organic chemical. Lead is classified as post-transition metal and is also a member of the carbon group. Lead only forms a protective oxide layer although finely powdered highly purified lead can ignite in air. Melted lead is oxidized in air to lead monoxide. All chalcogens oxidize lead upon heating (Thurmer *et al*., 2002). Lead is used in applications where its low melting point, ductility, and high density are advantageous. The low melting point makes casting of lead easy, and therefore small arms ammunition and shotgun pellets can be cast with minimal technique equipment. It is also inexpensive and denser than other common metals. More than half of the US lead production is used for automobiles, mostly as electrodes in the lead-acid battery, used extensively as a battery. Lead is used as electrodes in the process of electrolysis. Lead has many uses in the construction industry (e.g., lead sheets are used as architectural metals in roofing material, cladding, flashing, gutters, and gutter joints, and on roof parapets) (Moore and Michael, 2007).

Sources of Lead

Lead can be found in many products and locations. Some you might never have thought of, including some imported candies, toys, and traditional medicines. The most common cause of lead poisoning is dust and chips from old paint. However, some non-paint sources, though less common, can cause severe cases of lead poisoning.

These include:

- Paint: Lead was used in paint to add color, improve the ability of the paint to hide the surface it covers, and to make it last longer. In 1978 the federal government banned lead paint for use in homes. Homes built before 1978 probably contain lead-based paint. Painted toys and furniture made before 1978 may also contain lead-based paint. Lead-based paint becomes a concern when it chips, turns into dust, or gets into the soil.

- Dust: Lead dust is the most common way that people are exposed to lead. Inside the home, most lead dust comes from chipping and flaking paint or when paint is scraped, sanded, or disturbed during home remodeling. Chipping and peeling paint is found mostly on surfaces that rub or bump up against another surface. These surfaces include doors and windows. Young children usually get exposed to lead when they put something with lead dust on it into their mouths. Lead dust may not be visible to the naked eye.

- Soil: Starting in 1973, the government started a gradual phase-down of lead content in gasoline, and by 1996, banned the sale completely. However, lead from car exhausts mixed with soil near roads and is still there today. Homes near busy streets may have higher levels of lead in the soil. Today, lead still comes from metal smelting, battery manufacturing, and other factories that use lead. This lead gets into the air and then mixes with the soil near homes, especially if the home is near one of these sources. Flaking lead-based paint on the outside of buildings can also mix with the soil close to buildings. Lead-based paint mixing with soil is a problem during home remodeling if workers are not careful. Once the soil has lead in it, wind can stir up lead dust, and blow it into homes and yards.

- Drinking Water: Lead seldom occurs naturally in water supplies like rivers and lakes. Lead enters drinking water primarily as a result of the corrosion, or wearing away, of materials containing lead in the water distribution system and household or building plumbing. These materials include lead-based solder used to join copper pipe, brass and chrome plated brass faucets, and in some cases, pipes made of lead that connect houses and buildings to water mains. In 1986, Congress banned the use of lead solder containing greater than 0.2% lead, and restricted the lead content of faucets, pipes and other plumbing materials to 8.0%. Older construction may still have plumbing that has the potential to contribute lead to drinking water.

- Air: Lead can be present in outdoor and indoor air. Lead in outdoor air comes mainly from industrial sources (e.g., smelters, waste incinerators, utilities, and lead-acid battery manufacturers). Wind-blown soil and road dust also may contain naturally occurring lead as well as lead from industrial sources, deteriorated paint, and the combustion of leaded gasoline and aviation fuel. Sources of lead in indoor air include outdoor air, suspended dust, and some hobbies (e.g., making stained glass objects using lead solder, shooting using lead bullets at indoor firing ranges).

- Folk medicines, ayurvedics and cosmetics: Some folk medicines contain lead. They often are imported from the Middle East, Southeast Asia, India, the Dominican Republic, or Mexico. Two examples are Greta and Azarcon. Azarcon is a bright orange powder also known as Maria Luisa, Rueda, Alarcon, and Coral. Greta is a yellow powder.

They are used to treat an upset stomach. Pay-loo-ah also contains lead. It is a red powder used to treat a rash or a fever. Other folk medicines that contain lead include Bala (or Bala Goli), Golf, Ghasard, and Kandu. Some cosmetics such as Kohl (Alkohl) and Surma also contain lead.

- Ayurveda is a traditional form of medicine practiced in India and other eastern Asian countries. Ayurvedic medications may contain herbs, minerals, metals, or animal products. These medicines may come in both standardized and non-standardized formulations. Ayurvedic medications are typically imported into the United States by both practitioners and followers of Ayurvedic medicine.

- Children's jewelry and toys: Lead has been found in inexpensive children's jewelry sold in vending machines and large volume discount stores across the country. It also has been found in inexpensive metal amulets worn for good luck or protection. Some costume jewelry designed for adults has also been found to contain lead. It is important to make sure that children don't handle or mouth any jewelry.

- The workplace and hobbies: People exposed to lead at work may bring lead home on their clothes, shoes, hair, or skin. Some jobs that expose people to lead include: home improvement; painting and refinishing; car or radiator repair; plumbing; construction; welding and cutting; electronics; municipal waste incineration; lead compound manufacturing; manufacturing of rubber products, batteries, and plastics; lead smelting and refining; working in brass or bronze foundries; demolition; and working with scrap metal.

II. LEAD POISONING

Lead poisoning has a significant effect on public health for centuries. Since lead is a cumulative poison, exposure to lead and its compounds can be toxic to humans, flora and fauna. It is probably the most important chronic environmental illness affecting present generation.

Lead poisoning (also known as plumbism, colica, pictonum, saturnism,devon colic or painter's colic) is a medical condition in humans and other vertebrates caused by the increased levels of heavy metal lead in the body. Lead interferes with a variety of body processes and is toxic to many organs and tissue including the heart, bones, intestine, kidneys, reproductive and nervous system. It interferes with the nervous system and is therefore particularly toxic to children, causing potentially learning and behavioural disorder. Symptoms include abdominal pain, confusion, headache, anaemia, irritability, and in severe causes seizures, coma, and death. Routes of exposures to lead include contaminated air, water, soil, food, and consumer product. Occupational exposure is a common cause of lead poisoning in adults.

One of the main causes for pathology of lead is that it interferes with the activity of an essential enzyme called delta-aminolevulinic acid dehydratase (ALAD), which is important in the biosynthesis of heme, the cofactor found in haemoglobin (Patrick, 2006). Lead also inhibits the enzyme ferrochelatase, another enzyme involved in heme (Barbosa *et al*., 2002). Ferrochelatase catalyses the joining of protoporphyrin and iron to form heme (Fujita *et al*., 2002). Lead's interference with heme synthesis result in the production of Zinc protoporphyrin and the development of anaemia. Another effect of Lead's interference with heme synthesis is the build-up of heme precursors, such as aminolevulinic acid, which may be directly or indirectly harmful to neurons (Xu *et al*., 2009).

Micro-organisms are everywhere . whenever we search for any contamination free place just in that place also they are present .

They are basically everywhere . they are extinct level, extreme level , from low (temperature, pH, Os) to high in any condition. Even they are present in human body as a normal flora, some of them are pre-dominant even in infants.

Whenever we go for microbial growth and assessment for them, we find out varieties of different characteristics and varieties of them. They are quite familiar with human skin , gut, saliva etc. they are found to be commonly everywhere.

XRF INSTRUMENT:

(XRAY FLUOROSCENSE) XRF instrument used to detect the leadcontent in rice samples,paints,foods etc. and many other biological samples.

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The LPA-1 is a state-of-the-art Lead Paint Analyzer using X-Ray Florescence (XRF) and K-Shell technologies, providing readings in as little as 2-4 seconds. It is widely considered the fastest, most reliable lead inspection system today.

Non-destructive testing for lead on painted surfaces.

Fast, efficient and easy to use testing device. Completes readings in 2-4 seconds.

No preparation needed. Simply test on the surfaces in question: doors, window casings, walls, floors, moldings etc.

When sufficient energy light waves (x-ray or photon) are absorbed by an atom, the inner shell electrons are excited to an outer shell or removed completely. The empty inner shell that remains is ‘filled’ by electrons from an outer shell of the atom. The difference in energies between the two shells involved is excess energy; which when generated in this process is emitted as radiation (fluorescence).

In a given element the energy difference between two specific orbital shells is characteristic of that element and is always the same – therefore, the emitted light wave will always have the same energy. By determining the energy emitted by a particular sample we are able to identify the element involved.

X-ray fluorescence (XRF) is the emission of characteristic "secondary" (or fluorescent) X-rays from a material that has been excited by bombarding with high-energy X-rays or gamma rays. The phenomenon is widely used for elemental analysis and chemical analysis, particularly in the investigation of metals, glass, ceramics and building materials, and for research in geochemistry, forensic science and archaeology.

III. REVIEW OF LITERATURE

Lead toxicity:

Lead is a ubiquitous toxic heavy metal with unique physical and chemical properties that make it suitable for a great variety of application. Because of its high persistence in the environment and its use since ancient times for many industrial activities, lead is common environmental and occupational contaminant widely distributed around the world. Even though the toxic effects of lead and its compounds have been investigated for many years in a variety of system, the data existing with regard to its mutagenic, clastogenic and carcinogenic properties are still contradictory. The International Agency for Research on cancer has classified lead as possible human carcinogen (group 2B) and its inorganic compound as probable human carcinogen (group 2A). Furthermore, although the biochemical and molecular mechanism of genotoxicity such as inhibition of DNA repair or production of free radicle (Patrick, 2006).

Signs and symptoms:

Lead poisoning can cause a variety of symptoms and signs which vary depending on the individual and the duration of lead exposure (Karri et al., 2008). Symptoms are nonspecific and may be subtle and patient with elevated lead levels may be asymptomatic. Symptoms usually develop over weeks to months as lead accumulates in the body during a chronic exposure, acute symptoms from brief, intense exposure also occur. Symptoms from exposure to organic lead, which is probably more toxic than inorganic lead due to its lipid solubility, occur rapidly (Timbrell, 2008). Poisoning by organic lead compound has symptoms predominantly in the central nervous system, such as insomnia, delirium, cognitive deficits, tremor, hallucination and convulsion. Symptoms may be different in adults and in children; the main symptoms in adults are headache, abdominal pain, memory loss, kidney failure, male reproductive problem, weakness and pain (Pearce, 2007). Early symptoms of lead poisoning of adults are commonly nonspecific and include depression, loss of appetite, intermitted abdominal pain, nausea, diarrhea, constipation, and muscle pain (Patrick, 2006). In adults, symptoms can occur at a level above 40µg/dL, but are more likely to occur only above 50-60 µg/dL. Symptoms begin to appear in children generally around 60 µg/dL. (Needleman, 2004). At blood lead level between 25 and 60 µg/dL, neuropsychiatric effects such as delayed reaction times, irritability, and difficulty in concentration as well as slowed motor nerve conduction and headache can occur. Anemia can occur at blood lead levels higher than 50 µg/dL.

Acute poisoning:

In acute poisoning, typical neurological signs are pain, muscle weakness, paraesthesia and rarely symptoms accociated with encephalitis. Abnormal pain, nausea, vomitting, diarrhea and constipation are acute symptoms. Lead's effect on mouth include astingency and a metalic taste (James et al., 2005). Gastrointestinal problems, such as constipation, diarrhea, poor appetite, or weight loss, are common in acute poisoning. Absorbtion of large amounts of lead over a short time can cause shock (insufficient fluid in the circulatory system) due to loss of water from the gastrointestinal tract. Hemolysis (the rupture of red blood cells) due to acute poisoning can cause anemia and hemoglobin in the urine. Damage to kidneys can cause changes in urination such as decreased urine output. People who survive acute poisoning often go on to display symptoms of chronic poisoning (Pearce, 2007).

Chronic poisoning:

Chronic poisoning usually presents with symptoms affecting multiple systems, but is associated with three main types of symptoms: gastrointestinal, neuromuscular, and neurological. Central nervous system and neuromuscular symptoms usually results from intense exposure, while gastrointestinal symptoms usually result from exposure over longer periods. Signs of chronic exposure include loss of short-term memory or concentration, depression, nausea, abdominal pain, loss of coordination, and numbness and tingling in the extremities. Fatigue, problems with sleep, headache, stupor, slurred speech, and anemia are also found in chronic lead poisoning "lead hue" of the skin with pallor in another feature (Ekong et al., 2005). A blue line along the gum, with bluish black edging to the teeth, known as Burton line is another indication of chronic lead poisoning. Children with chronic poisoning may refuse to play or may have hyperkinetic or aggressive behaviour disorder (Pearce, 2007).

IV. PROCEDURE

We did a project on lead detection on various soil and dust samples_collected from different sites in Yeshwanthpur by using XRF (XRAY FLUORESCENCE)INSTRUMENT.

1. SAMPLES: SAMPLES(12 samples) collected from different places.

2. PLACES: Battery repair shops

Radiator repair shops

3. SUBJECT: LEAD AS WELL AS OTHER ELEMENTS DETECTION IN THE SAMPLES BY XRF INSTRUMENT.

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V. OBSERVATIONS

standard	COMPONENTS	PPM	+/-
Soil (surface layer)	Titanium (Ti)	29768	794
	Iron (Fe)	>5%	1%
	Copper (Cu)	9741	1332
	Zinc (Zn)	10741	189
	Lead (Pb)	>2%	1%
	Cadmium (Cd)	79	18
	Molybdenum (Mo)	44	16
	Antimony (Sb)	701	42
	Tin (Sn)	1342	594

SAMPLES 1	COMPONENTS	PPM	+/-
Soil (surface layer)	Titanium (Ti)	29768	4194
	Iron (Fe)	>10%	1%
	Copper (Cu)	89741	4332
	Zinc (Zn)	12741	689
	Lead (Pb)	>10%	1%
	Cadmium (Cd)	219	61
	Molybdenum (Mo)	80	40
	Antimony (Sb)	1553	142
	Tin (Sn)	54342	2594

starndard	COMPONENTS	PPM	+/-
Soil (deep layer)	Fe(iron)	42823	242
	Zn(zinc)	1307	33
	Pb(lead)	2920	57
	Rb(rubidium)	67	4
	Sr(strontium)	128	6
	Zr(zincronium)	183	7
	Mo (Molybdenum)	36	5
	Ti (Titatnium)	2536	328
	Mn (Manganese)	300	7
	As (Arsenic)	245	35
	SN (tin)	335	20

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SAMPLE 2	COMPONENTS	PPM	+/-
Soil (deep layer)	Fe(iron)	42823	842
	Zn(zinc)	1307	43
	Pb(lead)	2920	67
	Rb(rubidium)	67	4
	Sr(strontium)	128	6
	Zr(zincronium)	183	7
	Mo (Molybdenum)	36	5
	Ti (Titatnium)	2536	628
	Mn (Manganese)	300	7
	As (Arsenic)	245	45
	SN (tin)	335	30

SAMPLES 3	COMPONENTS	PPM	+/-
Soil (Deep layer)	Fe(iron)	42100	805
	Zn(zinc)	1221	40
	Pb(lead)	2998	66
	Rb(rubidium)	71	4
	Sn(Tin)	137	6
	Zr(zicronium)	206	7
	Mo(molybdenum)	39	5
	Ti (Titatnium)	3728	615
	Mn (Manganese)	294	75
	Cu (Copper)	816	38

SAMPLE 4	COMPONENTS	PPM	+/-
Soil (Surface)	Fe(iron)	33683	601
	Zn(zinc)	1024	33
	Pb(lead)	2631	54
	Rb(rubidium)	64	4
	Sr(strontium)	147	5
	Zr(zicronium)	162	6
	Mo(molybdenum)	21	4
	Ti (Titanium)	2674	528
	Cu (Copper)	616	30
	Mn (Manganese)	304	6
	Sn (Tin)	355	28

SAMPLE 6	COMPONENTS	PPM	+/-
Soil (Surface)	Fe(iron)	70122	1587
	Rb(rubidium)	35	8
	Sr(strontium)	13508	297
	Zr(zicronium)	141	8
	Mo(molybdenum)	38	6
	Zn(zinc)	3965	117
	Pb(lead)	35859	768
	Ti (Titanium)	5350	1029
	Cu (Copper)	16742	394
	Co (Cobalt)	793	214
	Au (Gold)	71	15
	Sb (Antimony)	369	45

SAMPLE 7	COMPONENTS	PPM	+/-
Soil (Deep Layer)	Fe(iron)	59768	1080
	Zn(zinc)	68	9
	Pb(lead)	23	6
	Rb(rubidium)	38	3
	Sr(strontium)	137	5
	Zr(zicronium)	221	7
	Mo(molybdenum)	31	5
	Ti (Titanium)	9042	810
	Cu (Copper)	49	14
	Mn (Manganese)	400	83

SAMPLES 8	COMPONENTS	PPM	+/-
Soil (Surface)	Fe(iron)	>10%	1%
	Zn(zinc)	490	34
	Pb(lead)	128	16
	Rb(rubidium)	34	5
	Sr(strontium)	242	11
	Zr(zicronium)	252	11
	Mo(molybdenum)	23	7
	Ti (Titanium)	19613	2085
	Cr (Chromium)	696	231
	Mn (Manganese)	1514	301
	Co (Cobalt)	2537	627
	Cu (Copper)	148	30

SAMPLES 9	COMPONENTS	PPM	+/-
Soil (surface)	Fe(iron)	>10%	1%
	Zn(zinc)	876	41
	Pb(lead)	88	13
	Rb(rubidium)	42	4
	Sr(strontium)	214	9
	Zr(zicronium)	389	12
	Mo(molybdenum)	23	6
	TI (Titanium)	13156	1661
	Mn (Manganese)	1528	253
	Co (Cobalt)	2631	523
	Cu (Copper)	296	32

Standard	COMPONENTS	PPM	+/-
Dust	Fe(iron)	28249	111
	Zn(zinc)	293	16
	Rb(rubidium)	21	2
	Sr(strontium)	78	1
	Zr(zicronium)	46	3
	Mo(molybdenum)	41	5
	Pb(lead)	204	5
	Ti (Titanium)	989	105
	Co (Cobalt)	178	65
	Cu (Copper)	199	18

SAMPLE 10	COMPONENTS	PPM	+/-
Dust	Fe(iron)	28249	521
	Zn(zinc)	593	24
	Rb(rubidium)	31	3
	Sr(strontium)	108	5
	Zr(zicronium)	83	4
	Mo(molybdenum)	41	5
	Pb(lead)	152	10
	Ti (Titanium)	2122	464
	Co (Cobalt)	333	100
	Cu (Copper)	197	18

SAMPLE 11	COMPONENTS	PPM	+/-
Dust	Fe(iron)	27827	497
	Zn(zinc)	523	22
	Rb(rubidium)	27	2
	Sr(strontium)	86	4
	Zr(zicronium)	77	4
	Mo(molybdenum)	45	4
	Pb(lead)	162	10
	Ti (Titanium)	1825	451
	Cu (Copper)	143	16
	Co (Cobalt)	347	96

SAMPLE 12	COMPONENTS	PPM	+/-
Dust	Fe(iron)	>10%	0%
	Zn(zinc)	330	20
	Rb(rubidium)	18	3
	Sr(strontium)	85	5
	Zr(zicronium)	103	5
	Mo(molybdenum)	40	5
	Pb(lead)	94	10
	Ti (Titanium)	4612	814
	Cu (Copper)	215	22
	Co (Cobalt)	2216	277

VI. DISCUSSION

Level of Risk:

According to the certifications, following are the standards of lead pollution based on the concentrations.

- 0-150 ppm

The areas with average concentrations below 150 ppm fall into the Lead-Free Standard category, and do not pose a risk to people, or require any remediation measures.

- 150-500 ppm

The areas with average concentrations between 150-500 ppm are considered Lead-Safe, and are safe for older children and adults. If small children who eat more dirt than others or absorb lead easily use these properties, efforts to make such lots Lead-Free are suggested. With nearly half of the lots in this category, the study suggests that many of the city's lots require fairly simple and relatively low cost measures for lead soil risk reduction.

- 500-1,000 ppm

The areas with average concentrations between 500-1,000 ppm require efforts to keep the contaminated soil covered. Here is a list of ways suggested to cover soil: 4 inches of gravel, 6 inches of mulch, 3 inches of lead-free soil, or new grass.

- 1,000-10,000 ppm

The areas with average concentrations above 1,000 ppm pose a Significant Environmental Lead Hazard. Here are four ways the suggested to manage this hazard:

- Tilling with damp lead-free soil to reduce the concentration of lead in the soil to less than 1,000 followed by covering the soil by any of the methods mentioned above.
- Covering the soil with concrete, asphalt or any other permanent cover approved in writing by the authorities.
- Soil removal and disposal
- A site-specific remediation plan which has been approved in writing by the authorities.

With roughly 10% of the total lots in this category, this study suggests that only a relatively small number of the area pose a significant environmental hazard, and require remediation that is both expensive and complex.

- Above 10,000 ppm

If soil concentrations are higher than 10,000 ppm, excavation is required by regulations, unless a variance is obtained.

OBJECTIVE OF THE STUDY:

1. Testing the lead for the presence of soli.
2. To measure the amount of lead in soil collected from battery industry.
3. Estimation of lead in dust sample from the yashvantpur battery industry.
4. Minimum inhibitory concentration on lead on microbes.

VII. CONCLUSIONS

Various soil and dust samples from different sites in Yeshvanthapura contain different amounts of heavy metals like iron, copper, etc and also some lighter metals. Here we have mainly focused on lead detection. The estimation of the diiferent materials are depend on the different layer of soil surface , dust and locations.

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