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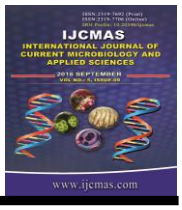

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Textile Industries: Lead Discharge in Barnala Region, Punjab (India) - Devastating Effects on Humans

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A B S T R A C T

The present study was carried out to assess the level of Lead produced by textile industries in Barnala district, Punjab (INDIA) and their harmful effects on human lives. Samples were collected from three different sites A, B and C. For each site, samples were taken from five different sources such as drain water, Surface water, Tap water, Ground water and canal. Lead can be determined by flame Atomic Absorption Spectrometer Method. Maximum value of Lead was found in site C. Lead has many harmful effects on health of children and aldults. For example Young children are particularly vulnerable to the toxic effects of lead and suffer profound and permanent adverse health effects, Particularly affecting the development of the brain and nervous System. Lead also causes long-term harm in adults, including increased risk of high blood pressure and Kidney damage. Exposure of Pregnant women to high levels of lead can cause miscarriage, Stillbirth, premature birth and low birth weight, as well as minor malformations.

Introduction

Textile processing industry is characterised not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes. There is a long sequence of wet processing stages requiring inputs of water, chemical and energy and generating wastes at each stage. The textile industry uses high volumes of water throughout its operations, from the washing of fibres to bleaching, dyeing and washing of finished products. On average, approximately 200 litres of water are required to produce l kg of textiles.

The large volumes of wastewater generated also contain a wide variety of chemicals, used throughout processing. These can cause damage if not properly treated before being discharged into the environment. Of all the steps involved in textiles processing, wet processing creates the highest volume of wastewater.

Textile dyeing and printing industry has high importance in terms of its environmental impact, since it consumes water and produces highly polluted wastewater in large amounts. Pollutants from textile dyeing and printing industries

vary greatly and depend on the chemicals used in various dyeing and printing processes. The receiving water thus becomes brackish. Textile dyes are toxic, highly stable and do not degrade easily and are not removed by conventional wastewater treatment methods. Due to the non degradable nature and long time persistence in the environment the toxic waste often accumulates through tropic level causing a deleterious biological effect (Kannan *et al*., 2005).

This study involves the assessment of level of Lead produced by textile industries in barnala region. Lead is a cumulative toxicant that affects multiple body systems and is particularly harmful to young children.

Lead exposure is estimated to account for 674 000 deaths per year with the highest burden in low- and middle-income countries. Lead exposure is estimated to account for 9.8% of the global burden of idiopathic intellectual disability, 4% of the global burden of ischaemic heart disease, and 5% of the global burden of stroke. Lead in the body is distributed to the brain, liver, kidney and bones. It is stored in the teeth and bones, where it accumulates over time. Human exposure is usually assessed through the measurement of lead in blood. There is no known level of lead exposure that is considered safe.

Lead is a naturally occurring toxic metal found in the Earth's crust. Its widespread use has resulted in extensive environmental contamination.

Health experts agree that any level of lead in one's blood, no matter how small, is cause for concern. Each year in the United States, 310,000 1- to 5-year-old kids are found to have unsafe levels of lead in their blood, which can lead to a wide range of symptoms, from headaches and stomach pain to behavioral problems and anemia (not enough healthy red blood cells). Lead also can affect a child's developing brain. Lead is not only a heavy metal—it's a heavy burden on human health and the environment.

In a sense, the problem is one of our own making. The metal exists in the earth's crust in relatively small amounts, but we've been mining it from below the surface and releasing this toxic chemical into our environment for five millennia. The dangers posed by lead have been recognized since the second century B.C. But in recent years, science has shown us that even low-level lead exposure can cause neurological and cardiovascular disease, infertility, and decreased kidney function. In young children especially, traces of the metal have been linked to learning and behavioral problems, lower IQ, and other health issues that can last a lifetime.

Materials and Methods

Barnala is situated between 30° 23' North and 75° 33' East. It has a mean elevation of 227 metres (745 feet). It is located on the Bathinda-chandigarh highway (no-7) and the Jalander-Rewari national highway (no-71). The Sirsa-Ludhiana state highway (no-13) are passes through it. It is 65 km from Bathinda and 85 km from Ludhiana. According to 2011 census, the total population of Barnala district is 595527.It was 526931 in 2001. Water samples were collected from different water sources (Drain water, surface water, tap water, canal, ground water) from three different sites. The Sampling time was between 4:30 pm to 5:30 pm on 18 march, 2016. Plastic bottles were used to collect water samples. Testing was done in Environ Tech Laboratories (NABL Accredited laboratory) Department of

Science and technology, India S.A.S Nagar (Mohali), Punjab.

Determination of Lead by Flame Atomic Absorption Spectrometer Method-

Preservation- samples was Preserved immediately after sampling by acidifying with conc. nitric acid to pH < 2.0. 1.5-3.0 ml conc. HNO_3 for 1 liter sample was used for short term preservation. After acidifying sample, it was preferably stored in refrigerator at approximately 4˚C.

Cleaning of Sample container-Sample containers were cleaned thoroughly with a metal-free non-ionic detergent solution, rinsed with tap water, soaked in acid, and then rinsed with metal free water. Glass material was used, for glass materials 1+1 HNO_3, 1+1 HCl was used for soaking.

Digestion for flame atomic absorption and high level conc.-

Apparatus-Hotplate, conical flask-125ml,150 ml, acid washed and rinsed with water, volumetric flask-100ml capacity, watch glass.

Reagents-conc. Nitric acid (AR grade), HCl conc.(AR grade), K_2Cr_2O7,metal free double distilled water.

Nitric acid digestion-A measured volume 100ml of well mixed acid preserved sample was transferred to a conical flask or beaker. In a hood, 5ml of conc. HNO_3 and boiling chips (glass beads) were added. Brought to a reflux temp. Of approximately 95˚C to achieve a slow boil and evaporated on a hot plate to a lowest volume possible (about 10-20ml) before precipitation occurred. Washed down flask or beaker walls and watch glass covered with metal free distilled water.

Then filtered. Filterate was transferred to a 100ml volumetric flask with two portions of reagent water. Diluted to a mark and mixed thoroughly. Portions of this solution was taken for Lead determination.

Nitric acid-hydrochloric acid digestion-
A measured volume of well mixed, acid preserved sample for the expected metal conc. Was transferred to a conical flask or beaker. In a hood 3ml of conc. HNO_3 was added and covered with a ribbed watch glass. Flask or beaker was placed on a hot plate and cautiously evaporated to less than 5 ml. cooled and rinsed down wall of beaker and watch glass with a minimum of metal free water, 5ml of conc. HNO_3 was added and covered with wath glass and again placed on hot plate. Increased temp. of hot plate so that a gentle reflux action occurred. cooled, then added 10ml (1+1) HCl and 15 ml water and 15 ml water per 100ml anticipated final volume. Heated for an additional 15 minutes to dissolve any precipitate or residue. Cooled and washed down beaker/ conical flask walls and watch glass with water, Filtered to remove insoluble material that could clog the nebulizer and transferred filterate to a 100ml volumetric flask with rinsing. Adjusted to volume and mixed thoroughly.

Interferences and elimination-Atomic absorption is a very specific technique with a few interferences. Since the interference in atomic absorption are well defined, it is easy to eliminate them.

In case of Lead there is no cationic interference but several anionic ones. At high conc. of PO4, CO_3, Iodide, F and acetate anions can depress the Lead signals. This interference can be alleviated by the addition of 0.1 M EDTA.

Preparation of Standard of Lead-

Dissolve 1.598 gm of lead nitrate in 1% HNO_3. Dilute it to 1 liter to give 1000 ppm lead solution.

Results and Discussion

Different water samples for determination of lead of site A are presented in Table 1.

In case of site A the values of Lead of the water samples ranged from 0.1115 mg/l to 0.1411 mg/l with an average value of 0.1232 mg/l,(N=5).The highest value of Lead was found in Drain water and lowest value of Lead was found in water sample taken from Tap water and canal. In case of site B the values of Lead of the water samples ranged from 0.103 mg/l to 0.116 mg/l with an average value of 0.109 mg/l (N=5). In case of site C the values of Lead of the water samples ranged from 0.1982 mg/l to 0.2096 mg/l with an average value of 0.2028 mg/l, (N=5).

Harmful effects of Lead on humans-

Health effects from prolonged exposure to lead

A person who is exposed to lead over time may feel:

Abdominal pain
Constipated
Depressed
Distracted
Forgetful
Irritable
Nauseous/Sick, decreased libido

malaise
paresthesia
reduced IQ scores
weakness, decreased bone and muscle growth
poor muscle coordination
damage to the nervous system, kidneys, and/or hearing
speech and language problems

depression/mood changes,
headache
diminished cognitive performance
diminished hand dexterity
diminished reaction time
diminished visual motor performance
dizziness
developmental delay
seizures and unconsciousness (in cases of extremely high lead levels)

irritability or behavioral problems
difficulty concentrating
headaches
loss of appetite

fatigue
forgetfulness
impaired concentration
impotence
increased nervousness
irritability
lethargy

weight loss
sluggishness or fatigue
abdominal pain
vomiting or nausea
constipation
pallor (pale skin) from anemia
metallic taste in mo

Harmful effects of Lead in adults-

Kidneys

Kidney damage occurs with exposure to high levels of lead, and evidence suggests that lower levels can damage kidneys as well (Wright *et al*., 1984). The toxic effect of lead causes nephropathy and may cause Fanconi syndrome, in which the proximal tubular function of the kidney is impaired (Lin *et al*., 1994). Long-term exposure at levels lower than those that cause lead nephropathy have also been reported as nephrotoxic in patients from developed countries that had chronic kidney disease or were at risk because of hypertension or diabetes mellitus. Lead poisoning inhibits excretion of the waste product urate and causes a predisposition for gout, in which urate builds up (Shadick *et al*., 2000). This condition is known as saturnine gout.

Cardiovascular system

Evidence suggests lead exposure is associated with high blood pressure, and studies have also found connections between lead exposure and coronary heart disease, heart rate variability, and death from stroke, but this evidence is more limited. People who have been exposed to higher concentrations of lead may be at a higher risk for cardiac autonomic dysfunction on days when ozone and fine particles are higher (Pokras *et al*., 2008).

Reproductive system

Lead affects both the male and female reproductive systems. In men, when blood lead levels exceed 40 μg/dL, sperm count is reduced and changes occur in volume of sperm, their motility, and their morphology. A pregnant woman's elevated blood lead level can lead to miscarriage, prematurity, low birth weight, and problems with development during childhood. Lead is able to pass through the placenta and into breast milk, and blood lead levels in mothers and infants are usually similar. A fetus may be poisoned in utero if lead from the mother's bones is subsequently mobilized by the changes in metabolism due to pregnancy; increased calcium intake in pregnancy may help mitigate this phenomenon.

Nervous system

The brains of adults who were exposed to lead as children show decreased volume, especially in the prefrontal cortex, on MRI. Areas of volume loss are shown in color over a template of a normal brain (Staudinger *et al*., 1998). Lead affects the peripheral nervous system (especially motor nerves) and the central nervous system (Lanphear *et al*., 2005). Peripheral nervous system effects are more prominent in adults and central nervous system effects are more prominent in children. Lead causes the axons of nerve cells to degenerate and lose their myelin coats (Bellinger, 2005).

Lead exposure in young children has been linked to learning disabilities, and children with blood lead concentrations greater than 10 μg/dL are in danger of developmental disabilities. Increased blood lead level in children has been correlated with decreases in intelligence, nonverbal reasoning, short-term memory, attention, reading and arithmetic ability, fine motor skills, emotional regulation, and social engagement. The effect of lead on children's cognitive abilities takes place at very low levels (Nevin, 2007). There is apparently no lower threshold to the dose-response relationship (unlike other heavy metals such as mercury). Reduced academic performance has been associated with lead exposure even at blood lead levels lower than 5 μg/dL. Blood lead levels below 10 μg/dL have been reported to be associated with lower IQ and behavior problems such as aggression, in proportion with blood lead levels. Between the blood lead levels of 5 and 35 μg/dL, an IQ decrease of 2–4 points for each μg/dL increase is reported in children.

High blood lead levels in adults are also associated with decreases in cognitive performance and with psychiatric symptoms such as depression and anxiety. It was found in a large group of current and former inorganic lead workers in Korea that blood lead levels in the range of 20–50 μg/dL were correlated with neuro-cognitive defects.Increases in blood lead levels from about 50 to about 100 μg/dL in adults have been found to be associated with persistent, and possibly permanent, impairment of central nervous system function.(2)

Other Harmful effects of Lead in adults-

Neurological Effects
Peripheral neuropathy
Fatigue / Irritability
Impaired concentration
Hearing loss
Wrist / Foot drop
Seizures
Encephalopathy
Gastrointestinal Effects
Nausea
Dyspepsia
Constipation
Colic
Lead line on gingival tissue
Reproductive Effects
Miscarriages/Stillbirths
Reduced sperm count & motility
Abnormal sperm
Heme Synthesis
Anemia
Erythrocyte protoporphyrin elevation
Renal Effects
Chronic nephropathy with proximal tubular damage
Hypertension
Other
Arthralgia
Myalgia

Table 1 of Site A

Water samples	Conc. of Lead (mg/l)
Drain water	0.1411
Surface water	0.1118
Tap water	0.1115
Ground water	0.1401
Canal	0.1115
Mean	0.1232

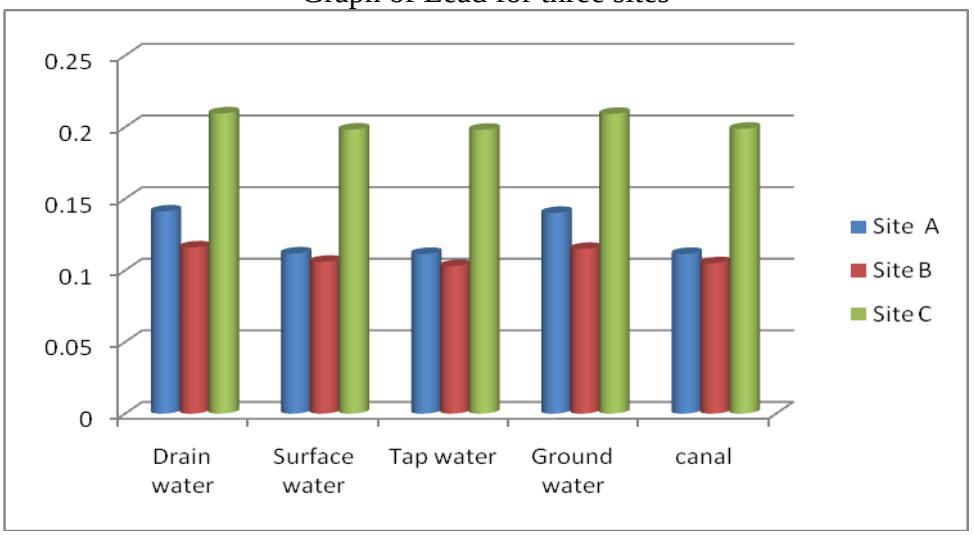
Table 2 of Site B

Water samples	Conc. of Lead (mg/l)
Drain water	0.116
Surface water	0.106
Tap water	0.103
Ground water	0.115
Canal	0.105
Mean	0.109

Table 3 of Site C

Water samples	Conc. of Lead (mg/l)
Drain water	0.2096
Surface water	0.1983
Tap water	0.1982
Ground water	0.2093
canal	0.1989
Mean	0.2028

Graph of Lead for three sites



People with prolonged exposure to lead may also be at risk for high blood pressure, heart disease, kidney disease, and reduced fertility.

Effects on children

A fetus developing in the womb of a woman who has elevated blood lead level is susceptible to lead poisoning by intrauterine exposure, and is at greater risk of being born prematurely or with a low birth weight (Vedantam *et al*., 2007).

Children are more at risk for lead poisoning because their smaller bodies are in a continuous state of growth and development. Lead is absorbed at a faster rate compared to adults, which causes more physical harm than to older people. Furthermore, children, especially as they are learning to crawl and walk, are constantly on the floor and therefore more prone to ingesting and inhaling dust that is contaminated with lead (Park *et al*., 2008).

The classic signs and symptoms in children are loss of appetite, abdominal pain, vomiting, weight loss, constipation, anemia, kidney failure, irritability, lethargy, learning disabilities, and behavioral problems. Slow development of normal childhood behaviors, such as talking and use of words, and permanent intellectual disability are both commonly seen. Although less common, it is possible for fingernails to develop leukonychia striata if exposed to abnormally high lead concentrations.

Complications

Lead affects every one of the body's organ systems, especially the nervous system, but also the bones and teeth, the kidneys, and the cardiovascular, immune, and reproductive systems. Hearing loss and tooth decay have been linked to lead exposure (Kosnett *et al*., 2007), as have cataracts. Intrauterine and neonatal lead exposure promote tooth decay. Aside from the developmental effects unique to young children, the health effects experienced by adults are similar to those in children, although the thresholds are generally higher.

In conclusion, from the above result and discussion it is concluded that values of Lead are higher than standard values in barnala region in three different sites.Due to higher values of Lead, People may suffer

from many harmful diseases mostly in children, Lead is absorbed at a faster rate compared to adults, which causes more physical harm than to older people. Adults may suffer from complication in kidneys, Cardiovascular system, Reproductive system and Nervous system.

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References

Staudinger, K.C., Roth, V.S. 1998. Balmes, John, ed. "Decreased Brain Volume in Adults with Childhood Lead Exposure". *PLOS Med.*, 5 (5): e112. doi:10.1371/journal.pmed. 0050112. PMC 2689675. PMID 18507499.

Lanphear, B.P., Hornung, R., Khoury, J., Yolton, K., Baghurst, P., Bellinger, D.C., Canfield, R.L., Dietrich, K.N. *et al*. 2005. New and evolving concepts in the neurotoxicology of lead". *Toxicol. Appl. Pharmacol.*, 225(1): 1–27. doi:10.1016/j.taap.2007.08.001. PMID 17904601.

Wright, L.F., Saylor, R.P., Cecere, F.A. 1984. Lead-related nephrotoxicity: a review of the epidemiologic evidence". *Kidney Int.*, 70(12): 2074–84. doi:10.1038/sj.ki.5001809. PMID 17063179.

Lin, J.L., Huang, P.T. 1994. Occult lead intoxication in patients with gout and kidney disease. *J. Rheumatol.*, 11(4): 517–20. PMID 6434739.

Shadick, N.A., Kim, R., Weiss, S., Liang, M.H., Sparrow, D., Hu, H. 2000. Body lead stores and urate excretion in men with chronic renal disease. *J. Rheumatol.*, 21(4): 705–9. PMID 8035397.

Wright, L.F., Saylor, R.P., Cecere, F.A. 1984. Lead-related nephrotoxicity: a review of the epidemiologic evidence. *Kidney Int.*, 70(12): 2074–84. doi:10.1038/sj.ki.5001809. PMID 17063179.

Lin, J.L., Huang, P.T. 1994. Occult lead intoxication in patients with gout and kidney disease". *J. Rheumatol.*, 11(4): 517–20. PMID 6434739.

Nevin, R. 2007. How lead exposure relates to temporal changes in IQ, violent crime, and unwed pregnancy. *Environ. Res.*, 83(1): 1–22. Bibcode: 2000ER.....83....1N.doi:10.1006/enrs.1999.4045. PMID 10845777.

Vedantam, Shankar. 2007. Understanding international crime trends: the legacy of preschool lead exposure. *Environ. Res.*, 104(3): 315–36. Bibcode: 2007ER..104..315N. doi:10.1016/j.envres.2007.02.008. PMID 17451672.

Pokras, M.A., Kneeland, M.R. 2008. Low-Level Environmental Lead Exposure and Children's Intellectual Function: An International Pooled Analysis". *Environ. Health Perspectives*, 113(7): 894–9. doi:10.1289/ehp.7688. PMC 1257652. PMID 16002379.

Kosnett, M.J., Wedeen, R.P., Rothenberg, S.J., Hipkins, K.L., Materna, B.L., Schwartz, B.S., Hu, H., Woolf, A. 2007. Cumulative Lead Dose and Cognitive Function in Adults: A Review of Studies That Measured Both Blood Lead and Bone Lead". *Environ. Health Perspectives*, 115(3): 483–92. doi:10.1289/ehp.9786. PMC 1849945. PMID 17431502.

Bellinger, D.C. 2005. Lead hazards for pregnant women and children: part 1: immigrants and the poor shoulder most of the burden of lead exposure in this country. Part 1 of a two-part

article details how exposure happens, whom it affects, and the harm it can do". *American J. Nursing*, 108(10): 40–9; quiz 50. doi:10.1097/01.NAJ.0000337736.76730.66. PMID 18827541.

Park, S.K., O'Neill, M.S., Vokonas, P.S., Sparrow, D., Wright, R.O., Coull, B., Nie, H., Hu, H., *et al*. 2008. Lead Exposure and Cardiovascular Disease-A Systematic Review. *Environ. Health Perspectives*, 115(3): 472–82. doi:10.1289/ehp.9785. PMC 1849948. PMID 17431501.

Goyer, R.A. 1990. Lead in enamel and saliva, dental caries, and the use of enamel biopsies for mesuring past exposure to lead" (PDF). *J. Dent. Res.*, 5(10): 1165–1171. doi:10.1177/00220345770560100701. PMID 272374.Transplacental transport of lead.

Needleman, H.L., Schell, A., Bellinger, D., Leviton, A., Allred, E.N. 1990. Very low lead exposures and children's neurodevelopment. *Curr. Opi. Pediatrics*, 20(2): 172–7. doi:10.1097/MOP.0b013e3282f4f97b. PMID 18332714.

Woolf, A.D., Goldman, R., Bellinger, D.C. 2007. Absorption of lead from dust and soil". *Postgrad Med. J.*, 51(601): 801–4. doi:10.1136/pgmj.51.601.801. PMC 2496115. PMID 1208289.

Kannan, V., R. Ramesh and C. Sasikumar. 2005. Study on ground water characteristics and the effects of discharged effluents from textile units at Karur District. *J. Environ. Biol.*, 26: 269-272.

Yogita Sharma, Kamalpreet kaur and Vinesh kumar. Textile effluents changes Physico-chemical Parameters of water in Barnala region : Threat for human lives". International conference on Innovative Research in Material Sciences, Energy Technologies and Environmental Engineering for climate change Mitigation, (New Delhi)

Yogita Sharma, Kamalpreet kaur and Vinesh kumar, "An Assessment of Physico-chemical Parameters of water in Barnala Region: Risk to human lives". International conference on Recent Innovations In Sciences, Management, Education and Technology.

Yogita Sharma and Kamalpreet kaur. Determination of Nitrates and Sulphates in water of Barnala region and their harmful effects on human lives. *Int. J. Adv. Res. Edu. Technol.*,

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