

*Proceedings of National Conference**“Environmental Conservation and Clean India Programme” December 2014, India***Water pollution caused by heavy metals and resulting hazards for human health****Bharti Khare<sup>1</sup>, Arun Kher<sup>2</sup>, S. K. Sharma<sup>3</sup>, Tripta Sapru<sup>4</sup>, Shakun Mishra<sup>5</sup> and S. K. Mahajan<sup>6</sup>****Received:** October 12, 2014 | **Accepted:** December 04, 2014 | **Online:** December 31, 2014**Abstract**

The present communication deals with the human hazards due to water pollution caused by heavy metals and due to the establishment of cotton and chemical industries in Nimar eco-region of Madhya Pradesh, the harmful effects of water pollution on various crops is briefly discussed.

**Keywords:** Anthropogenic contaminants | toxicity | Industrial wastes | Nimar eco-region | Panwa village

**Introduction**

The future of any nation depends on the health, prosperity and progress of the forthcoming generation. In the present era of industrialization and development, one concern should be the health of the future generation. When water is impaired by anthropogenic contaminants and either does not support a human use like serving as drinking water and/or undergoes a marked shift in its ability to support a biotic community such as fish, then such type of water is considered as polluted (Dahiya *et al*, 2005). Volcanoes, algal blooms, storms and earthquakes are some of the natural phenomena, which cause major changes in water quality and ecological status of water. Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, groundwater), which affects plants and animals living in these bodies. In almost all cases, the effect is damaging either to the individual species and populations but also to the natural biological communities. Water pollution occurs when pollutants are discharged directly

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or indirectly into water bodies without adequate treatment to remove harmful compounds.

In fact, water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases accounting for the deaths of more than 14,000 people daily. It has been estimated that 700 million Indians have no access to a proper toilet and 1000 Indian children die of diarrheas sickness every day. Some 90% China cities suffer from some degree of water pollution and nearly 500 million people lack access to safe drinking water.

Metallic elements possessing high atomic weight and much greater density (5 times) than water, are known as heavy metals. Although there are more than 20 heavy metals, but only four are of particular concern to human health e.g. Lead (Pb), Cadmium (Cd), Mercury (Hg) and inorganic Arsenic (As). According to the U.S. Agency for toxic substances and diseases Registry, these four heavy metals are four of the top six hazards present in toxic waste sites. They are highly toxic and can cause damaging

effects even at very low concentrations. They tend to accumulate in the food chain and in the body and can be stored in soft (e.g. kidney) and hard tissues (e.g. bone). Being metals they exist in a positively charged form and can bind the negatively charged organic molecules to form complexes. . Since no such research work has been done in this tribal region, hence the present investigation has been taken up.

### Materials and method

This investigation was done during the year 2009-10 and in this connection Panwa village and its surrounding areas were surveyed and information was gathered with reference to the adverse effects of cotton and chemical industries on cotton and wheat crops. In Table 1 maximum percentage concentrations in public water supplies has been shown as recommended by EPA (1976). Table 2 indicates the human hazards due to water pollution caused by different heavy metals with their source, lethal dose and symptoms of the disease. Table 3 indicates the parameters for the elemental measurements by AAS (Dahiya *et al.*, 2005).

Metal	Symbol	Maximum permissible concentrations	
		$\mu$ g/l	$\mu$ moles/l
Mercury	Hg	2	0.01
Cadmium	Cd	10	0.09
Lead	Pb	50	0.24
Arsenic	As	50	0.67
Manganese	Mn	50	0.91
Zinc	Zn	5000	76.49

**Table 1:** Maximum permissible concentrations in public water supplies as recommended by EPA (1976)

S. No.	Name of metal	Source of pollution	Lethal dose	Symptoms
1	Mercury (Inorganic and organic)	Industrial discharge vapour	0.5 to 1.0 g	Central peripheral nervous system disorder, renal failure, blurred vision, numbness of limbs, lips muscles etc.
2	Lead	Industrial waste, polluted food, paint	Less particles than 2 $\mu$ diameter	If inhaled, then are dangerous, infertility and lassitude, nervous disorder, renal failure, blood poison and anemic, encephalopathy.
3	Cadmium	Industrial discharge, dust, fumes, polluted water	1 mg to 4 mg / $m^3$	Fatal, renal pulmonary and skeletal diseases, proteinuria, glucosuria, increased salivation kidney necrosis nausea, vomiting headache, shock, chest pain, bronchial pneumonia
4	Arsenic	Polluted water, industrial waste, medicinal use	-	Haemolytic poison, renal failure and death, liver and kidney damage, muscular atrophy, gastrointestinal damage, nervous disorder, respiratory and skin cancer
5	Nickel	Aerosols, industrial dust	-	Pulmonary disorder, dermatitis etc.
6	Chromium	Industrial waste, fumes	-	Respiratory disorder including cancer
7	Tin (Organic and inorganic)	Industrial dust, medicinal use	-	Central nervous system disorder, vision and pneumoconiosis
8	Copper	Earth mines	More than 2 ppm	Poisonous
9	Iron	Earth mines	-	Pollute water bodies
10	Zinc	Earth mines	More than 2 ppm	Poisonous, affects invertebrate animals like snails and insects

**Table 2:** Human hazards due to water pollution caused by heavy metals

Element	Wave length (nm)	Band width (nm)	Flame	Sensitivity(ug/ML)
Cadmium	228.8	0.5	Air-C <sub>2</sub> H <sub>2</sub>	0.009
Nickel	232.00	0.2	Air-C <sub>2</sub> H <sub>2</sub>	0.04
Lead	217.00	1.0	Air-C <sub>2</sub> H <sub>2</sub>	0.10

**Table 3:** Parameters for the elemental measurements by AAS (Dahiya *et al.*, 2005)

## Results and Discussion

Heavy metals like Mercury, Lead, Cadmium, Nickel, Chromium and Tin generally present in industrial wastes are the main reasons, which create serious water pollution problems (Clements *et al.*, 1980; Smart & Sherlock, 1987; Selvapathy & Sarala Devi, 1995). The sources of mercury pollution are the chlorine producing plants situated on the banks of river. It has been estimated that some 250 g of mercury are released into the water for every tonne of chlorine produced. This mercury is converted into methyl mercury due to the activity of anaerobic bacteria, which dissolves in water and enters through the food chain via phytoplankton → zooplankton → fish respectively. During this process the level of mercury is magnified at every stage of transfer. It is finally deposited in fish. When man eats fish, this mercury enters his body, which creates human hazards (Krishnamurti & Pushpa, 1991)

Similarly millions of tons of lead are produced as a byproduct of silver refining. Lead salts give a sweet taste to foods and retards decomposition. This is due to the fact that when food stuffs or fruit syrups are concealed in lead-lined pots and over a fire and stirred, then they give a sweet taste (FAO/WHO, 1989; Dahiya *et al.*, 2005).

Cadmium occurs in the earth crust with Zinc, Lead-Zinc and Lead-Copper-Zinc ores. It is used for electroplating of metals as a pigment and as stabilizer in plastic materials. About 2000 tones of Cd per year are released into the environment from the Cd- industry as fumes,

sludge and waste water. Cadmium intoxication can lead to kidney, bone and pulmonary damages (Schroeder,1965: WHO,1984 & 1991: FAO/WHO,1993 & 2001).

As regards Arsenic, it possesses smooth medicinal as well as toxic properties. Arsenic is found in natural rocks and soils in various parts of the world. It leaks in water and found in the form of organic arsenic (methyl arsenate, dimethyl arsenate). This is due to oxidation, reduction, methylate and demethylate cycles, which operate in the environment and organisms.

Zinc affects invertebrate animals like snails and insects and acts as a poison in high concentration. During mining operations abandoned copper and iron ore mines create problems unless covered with earth.

Although Copper in the concentration of 0.5 ppm is effectively used to keep ponds free from algae but beyond 2 ppm, Cu concentration is a poison. Fish can survive in 1 ppm and man can tolerate up to 2 ppm of Cu concentration.

Due to the aerial oxidation of iron pyrites in presence of water hydrated ferric oxide and hydrogen ions are produced, which are washed away during rainy season and then pollute water bodies

In Nimar eco-region there are four districts namely Barwani, Khargone , Khandwa and Burhanpur districts. This region is mainly known for the production of cotton and wheat crops. One of the biggest rivers of India called Narmada river passes from here Therefore the soil of this particular region is being very

fertile. Because of large scale production of cotton crop, various cotton industries as well as chemical industries have been established in different parts of this region. But these industries are not having proper pollution and environmental control measure systems. The farmers of this area are facing problems in agriculture because of acid rain and liquid wastes coming from factories. Recently the crops in Panwa village and its surrounding areas up to 5 km have been spoiled due to air and water pollution created by three main industries of cloth and chemical. These industries are using heavy metals and harmful gases in their production units which have become a main cause of these damages. People living in nearby areas are getting water from well and ponds. But these water sources are also polluted by waste coming from these factories. In 2004-05 nearly 201 hectare area of crop was spoiled due to water pollution created by such factories. Madhya Pradesh government paid rupees 6.69 lacs to affected farmers. This figure is increased in 2009-10 up to rupees 18.052 lacs.

Apart from this, latest studies have indicated that adverse effects of heavy metals exposure are in the form of renal tubular damage but they also effect on bone and fracture at lower exposure levels. Methyl mercury in general does not affect health of the public significantly, although certain groups with high fish consumption may attain blood levels associated with a low risk of neurological damage to adults. Recently it is also claimed that dental amalgams made from mercury may

also cause a variety of diseases.

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