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Effect of Environmental Pollution on Quality of Water in District Bagh, Azad Kashmir

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Abstract: The present work was done for the estimation of trace metals in eight samples of drinking water collected from springs, wells and taps of Bagh city and around. Springs and wells are open and can be approached by any contaminant. The concentrations of Pb, Cu, Ni, Mn and Zn in water samples were determined. The overall concentration of trace metals ranged from 0-7 ppm. The concentration of lead was found quite high (0-7 ppm). The maximum concentration of lead (7 ppm) was found in the Sample (5). The concentration of copper was also found high (0-4 ppm). The maximum concentration of copper (4 ppm) was recorded in Samples (2) and (5). The concentration of nickel, zinc and manganese were found small (0-3 ppm). Thus, the contamination of drinking water by Ni, Mn and Zn is less as compared to Pb and Cu. Physical analysis of water was carried out to assess the quality of water. Temperature was found between 18-23 ^{0}C for different samples. All samples were tested and found colorless, odorless and tasteless. P^H was determined by pH meter and ranked from 5.5-7. Most of the samples were almost at neutral pH, however, sample (5) was reported acidic (pH 5.5).

Key words: Water pollution, toxic metals, drinking water, city Bagh, lead contamination

Introduction

The environmental pollution is a matter of great concern worldwide, and consequently contamination of food chain is getting increasingly important in view of its role in human health and nutrition. The rate of Urbanization and industrialization is increasing day by day in Kashmir. Besides many problems associated with such developments, the major one is the pollution. There are numerous types of environmental pollutions, which constitute a potential danger to humanity (Khan *et al*., 1996).

Water comprises over 75% of the earth surface. Water pollution occurs when a body of water is adversely affected due to the addition of large amount of material to the water. Two types of water pollutants exist, point source and non point source. Point sources of pollution occur when harmful substances are emitted directly into a body of water. A non point source delivers pollutants indirectly through environmental changes (Terry, 1996). Estimates suggest that nearly 1.5 billion people lack safe drinking water and at least 5 million deaths per year can be attributed to water born diseases (Onsdorff, 1996). It is necessary to establish ongoing knowledge of various pollutants in drinking water. Among various pollutants in the environment, heavy metals are directly related to heath diseases in humans. Although it is difficult to classify trace metal into essential and toxic groups, yet it is well known fact that an essential metal becomes toxic at sufficiently high intakes (Khurshid and Qureshi, 1984).

Lead may enter the atmosphere during mining, smelting, refining, manufacturing processes and by the use of lead containing products (Benneth, 1981). Lead contaminated drinking water is most common in recently constructed homes where lead pipes are used for interior plumbing. Lead pipes were also used to join homes to public water supplies. In 1986 a nation wide ban restricted the use of lead pipes for drinking water supplies (Mery and Sandra, 1996). Excess lead can cause serious damage to the brain, kidneys, nervous system and red blood cells. Young children, infants and fetuses are particularly vulnerable to lead poisoning. US environment protection agency (EPA) has established an enforceable lead action level for public water supplies which is 0.05 ppm (Annnymous, 2002). High concentration of copper oxide may result from welding operation. The corrosion of copper containing alloys in pipe fittings may add measurable amount of copper into the water. Copper content of normal human adult is 50- 120 mg, but above 15 mg causes nausea, vomiting, diarrhea and intestinal pain. Copper deficiency results in anemia and the congenital inability to excrete copper resulting in accumulation and wilsons's disease (Greenwood and Earnshaw, 1986). The enforceable action level of copper for water is 1 ppm. Environmental concentration of nickel is increased by nickel producing and processing industries. Vehicles exhaust a large quantity of nickel which is obtained from the petroleum. Cigarette smoking can increase the inhaled nickel to as

much as 4 μg per pack of cigarette. Most of the manganese in air is due to the burning of fossil fuels. Limited evidences suggest that high Mn intake from drinking water may be associated with neurological symptoms similar to those of Parkinson's disease. Severe neurological symptoms were reported in 25 people who drank water contaminated with Mn and other contaminants from dry cell batteries for two to three months (Kawamura, 1941). A study of adults in Greece found a high prevalence of neurological symptoms in those exposed to water manganese levels of 1.8-2.3 mg l^{-1} (Kondakis *et al*., 1989). The enforceable action level of Mn for water is 0.05 ppm. The EPA has stated that drinking water should not contain more than 5 mg Zinc per liter (5 ppm). Even though zinc is non toxic to human beings, concentrations above 5 ppm can result in milky iridescent color in water and an irritant for human digestive system. Zinc in low quantity, however, is beneficial and essential element for body growth (Annonymous, 1989).

Materials and Methods

Sample collection and preparation: Eight samples of drinking water were collected from various spots in and around the Bagh city. The sampling was made at reasonable distances from various springs, wells and taps. All collections were made in precleaned plastic bottles. Water samples were prepared by taking 1 ml sample in 10 ml conical flask and added 0.5 ml of conc. HNO_3. Final volume was made with 6 N HCl for analysis.

Instrumentation: The Perkin-Elmer Atomic absorption spectrophotometer, model AA-2380 was employed in the analysis of samples. Hollow cathode lamps (Mito-Riko) were used. The instrumental conditions for the elements are given in Tables 2 and 3. Air/acetylene was used as fuel (Table 1). During atomization the background was corrected. Three such determinations were taken for each sample and mean was taken as the observed value. The absorption signals of the samples were evaluated after subtracting the mean value of the blank.

Standards: Certified AAS stock standards of Pb, Cu, Ni, Zn and Mn containing 1000 mg dm^{-3} were obtained from Canada for calibration curve. The standards were prepared by proper dilution of stock standard solution in 6N HCl.

Working standard solution: Pb, Ni, Cu, Zn and Mn standards containing 1-100 ppm were prepared from stock standard solutions.

Blank solution: Blank solutions were prepared and treated exactly in the same way as the samples except metal ion concentration. The absorption signals of sample solution were evaluated by subtracting the mean value of blank from the signals of the sample.

Table 1: Standard analytical conditions for aas analysis

Element	Wave length (nm)	HCl (mA) current	Types of frame	Slit width (nm)	Sensitivity Check(ppm)	Fuel flow rate	Oxidant
Cu	324.7	15	Air acetylene	0.7	4	20 L min^{-1}	40 L min^{-1}
Ni	231.0	25	-do-	0.2	7	-do-	-do-
Pb	283.3	10	-do-	0.7	25	-do-	-do-
Mn	279.5	13	-do-	0.2	2.5	-do-	-do-
Zn	213.9	15	-do-	0.7	0.8	-do-	-do-

Table 2: For perkin-elmer instrument

Element	Wavelength(nm)	Sensitivity	Detection limits
Pb	283.3	0.45	0.03
Mn	285.2	0.008	0.0001
Zn	213.9	0.018	0.002
Ni	232.0	0.14	0.009
Cu	324.7	0.08	0.002

Table 3: Certified reference values

Name of standard	Type	Cu	Pb	Zn	Ni	Mn
BN	Liquid	2 mg L^{-1}	< 3 mg L^{-1}	3 mg L^{-1}	< 2 mg L^{-1}	10 mg L^{-1}
BM	Liquid	4 mg L^{-1}	< 3mg L^{-1}	< 1mg L^{-1}	< 2 mg L^{-1}	5 mg L^{-1}

Results and Discussion

Environmental pollution is one of the most serious problems, which requires our urgent practical attention. Environmental pollution whether in solid, liquid or gaseous form is causing adverse effects on the behaviour and life of mankind and considerably damaging the animal and plant life. The primary sources of these pollutants are garbage's, trash, raw sewage, chemical effluents of the industries and emission of irritant and harmful gases from various sources. These pollutants emerge from rapid population growth, massive urbanization and extensive industrialization throughout the world (Raja *et al*., 1996). Like many other countries, in Kashmir too, pollution is attributed to major urban and industrial centers along with poor methods of water disposal. The problem is serious because the whole chain of food production to consumption neither controlled nor regulated.

Effect of environmental pollution on water has been a matter of great concern for both the developing and the industrialized countries. Bagh is a newly born district. It has no doubt a big loud of newly settled population but the city is less industrialized. However, city is facing the loud of transportation especially the automobiles. Automobiles (Cars, Scooters, Motorcycles) are the greatest source of air pollution. They produce nearly two thirds of carbon monoxide and one half of the hydrocarbons and nitrous oxide. The automobile exhaust also contains leaded gas and particulate lead. Roadside plants contain high concentration of lead in their tissues and this has a sub lethal effect on the health and longevity of animals. Traffic policemen and other who are exposed for long periods to heavy traffic have higher than average levels of lead in their blood. Lead levels of 20-40 μg per 100 g of blood (0.2-0.4 ppm) are considered normal and harmless for city dwellers. But 0.8 ppm levels in adult humans causes over symptoms such as anemia, kidney disease and convulsions. However, in children 0.6 ppm level in blood may cause lead poisoning and ultimate death in human. There are many causes of water pollution but two general categories exist: direct and indirect contamination sources. Direct sources include effluent outfalls from factories, refineries, and waste treatment plants etc. that emit fluid of varying quality directly into urban water supplies. In United States and other countries, these practices are regulated, although this does not mean that pollutants can not be found in these waters. Indirect sources include the contaminants that enter the water supply from soil/ground water systems and from the atmosphere via rain water. Soil and underground water contain the residues of human agriculture practices (fertilizers and pesticides) and improperly disposed off waste material. Municipal sewage water also adds various types of pollutants which contaminate water. Domestic sewage and waste-water is about 99.9% water and 0.02-0.04% solids of which proteins and carbohydrates each comprises 40-50% and fats 5-10% (Qayyum and Ashraf, 2001). In other words, sewage includes mostly biodegradable pollutants such as human faecal matter, animal wastes, and certain dissolved organic compounds and inorganic salts such as nitrates and phosphates of detergents and sodium, potassium, calcium and chloride ions. Under natural processes most of the biodegradable pollutants of sewage are rapidly decomposed, but, when they accumulate in large quantities, they create problems. There is no systematic sewerage system in the Bagh city. House waste, hospital waste, mini industries and live stock waste are the source of pollution.

The present work was done for the estimation of trace metals in eight samples of drinking water collected from springs, wells and taps of Bagh city and around. Underground water, springs and wells are the major sources of water in the region, which is supplied either through pipe system or by own carriage. Springs and wells are open and can be approached by any contaminant. People use this water for drinking and cooking. The concentrations of Pb, Cu, Ni, Mn and Zn in water samples were determined by atomic absorption spectrophotometer. The overall concentration of trace metals ranged from 0-7 ppm (Table 5). The concentration of lead was found quite high (0-7 ppm). The maximum concentration of lead (7 ppm) was recorded in the Sample (5) as shown in (Fig. 1). This Sample is located near Lorri Adda so, it is contaminated due to automobiles, welding shops and frequent movement of man and animals. Metallic sheets used for roofing material in the surrounding area also add to the contamination. The concentration of copper was also found high (0-4 ppm). The maximum concentration of copper (4 ppm) was recorded in Samples (2) and (5). Copper can leach into the drinking water from pipes in the distribution system. The regulation of copper is however, complicated by the fact that it is necessary to the normal functioning of body and toxic to body at high level. The concentration of nickel, zinc and manganese were found small (0-3 ppm). Thus, the contamination of drinking water by Ni, Mn and Zn is less as compared to Pb and Cu (Fig. 1). Physical analysis of water was also carried out to assess the quality of water (Table 4). Temperature was found between 18-23 ^{0}C for different samples. The small variation in temperature is due to location of water sources. All samples were tested and found colorless, odorless and tasteless. pH was found by pH meter and ranked form 5.5-7. Most of the samples were almost at neutral pH, however, sample (5)

Table 4: Physical analysis of drinking water

Sample identity	Color	Odor	Temperature	pH	Suspended particle
Sample 1	Colorless	Odorless	19°C	6.5	Nil
Sample 2	Colorless	Odorless	20°C	6	Nil
Sample 3	Colorless	Odorless	23°C	7	Nil
Sample 4	Colorless	Odorless	19°C	6	Nil
Sample 5	Colorless	Odorless	20°C	5.5	Nil
Sample 6	Colorless	Odorless	18°C	6.5	Nil
Sample 7	Colorless	Odorless	18°C	6.5	Nil
Sample 8	Colorless	Odorless	20°C	7	Nil

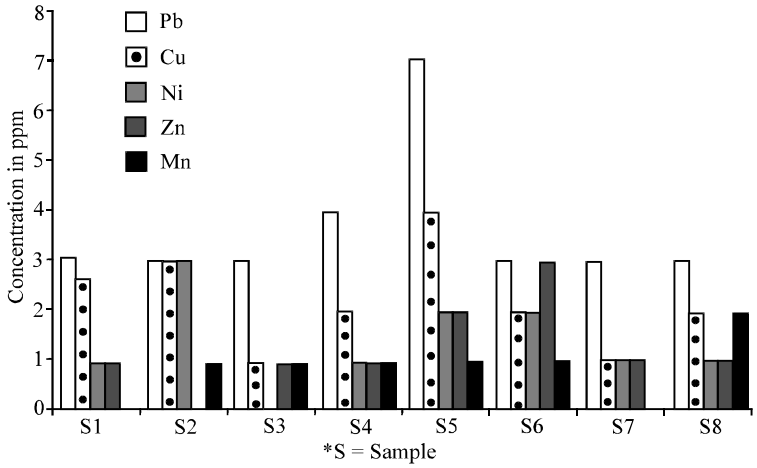

Fig. 1: Concentration of toxic metals in drinking water

Table 5: Concentration of toxic metals in drinking water

	Elements				
Sample identity	Pb	Cu	Ni	Zn	Mn
DW1- Sample 1	<3	2	1	<1	-
DW2- Sample 1	3	3	<1	1	-
DW1- Sample 2	3	2	3	-	<1
DW2- Sample 2	<3	4	1	-	1
DW 1- Sample 3	<3	1	-	<1	1
DW 2- Sample 3	-	-	-	1	-
DW 1- Sample 4	3	2	-	2	1
DW 2- Sample 4	4	2	1	1	<1
DW 1- Sample 5	7	4	2	1	1
DW 2 -Sample 5	5	3	2	2	1
DW 1- Sample 6	3	1	1	-	-
DW 2- Sample 6	2	2	2	3	<1
DW 1- Sample 7	-	1	<1	<1	-
DW 2- Sample 7	<3	-	-	<1	-
DW 1- Sample 8	3	2	1	1	2
DW 2- Sample 8	<3	<1	1	-	-

* DW= Drinking water

was reported acidic (pH 5.5). Corrosive water (which has very high or low pH) can dissolve lead and copper from the supply pipe lines. Excess carbon dioxide makes the water acidic. In the light of above results, sample (5) is strongly recommended unfit for drinking. Following recommendations may be useful for controlling contamination to some extent.

1. The water sources must be properly covered.
2. We must properly dispose off house hold waste so they do not end up in sewage.
3. In our yards, we must find whether essential nutrients are needed before fertilizers are applied, and look for alternatives where fertilizers might run off into surface water.
4. We should preserve existing trees and plant new trees and shrubs to help prevent soil erosion and promote infiltration of water into the soil.
5. Do not drink the water that has been sitting in the plumbing lines for more than six hours. The longer the water sits in the pipes, the greater the exposure to lead and other contaminants.
6. Use only cold water for drinking and cooking. Hot water dissolves lead more quickly than cold water.
7. For building a home lead free material should be used for plumbing installation.
8. Calcite filters can be installed between the faucets and lead soldered pipes.

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