Journal of Advances and Scholarly Researches in Allied Education
Vol. 18, Issue No. 2, March–2021, (Special Issue), ISSN 2230-7540

Water Pollution and Its Health Impacts on Humans

Dr. Vijendra Singh*

Department of Chemistry, Rajikiya Mahila Snatakottar Mahavidhyalaya, Kandhla, Shamli (UP)

Abstract – Water is renewable but its renewable takes time. In these days, water quality is constantly degrading due to urbanization, industrialization, population explosion and many more reasons. Water pollution can occur on account of any one or more of the agents like biological agents, chemical agents and physical agents. Chemical characteristics of water is explained with the help of many physico-chemical parameters viz. pH, Na+, K+, Ca2+, Mg2+, SO42–, CO32–, HCO3–, TH, Cl–, NO3–, Oil & Grease, Fluoride, etc. Some of them are within permissible limits and some of them are in contamination limit. Many of heavy metals like arsenic, mercury, lead, cadmium, copper, etc. are at alarming levels in drinking water and causes many health issues. This paper emphasizes on many health issues due to water pollutants which are at high concentration in the potable water.

Keywords – Physico–Chemical Parameters, Groundwater, Water Pollution, Heavy Metals and Health Issues.

----------X----------

INTRODUCTION

Our environment has four segments[1] like atmosphere, geosphere, biosphere and hydrosphere. **Atmosphere** is the protective blanket of gases surrounding the earth, which sustains life on earth and saves it from the hostile environment of outer space. **Hydrosphere** includes all types of water resources: oceans, seas, rivers, lakes, streams, reservoirs, glaciers, polar ice caps and ground water. **Lithosphere** is the outer mantle of the solid earth, consisting of minerals occurring in the earth's crust and the soil. The latter comprises a complex mixture of minerals, organic matter, air and water. The soil is the most important part of the lithosphere. **Biosphere** denotes the realm of living organisms and their interactions with the environment, viz. atmosphere, hydrosphere and lithosphere. Both the biosphere and environment are influenced considerably by each other.

At present, there are many environmental issues, which have grown in size and complexity day by day, threatening the survival of mankind and all living organisms on earth. Environmental pollution can be divided among the categories of water, air and soil pollution, all three of these are linked. Water pollution is by far the biggest environmental problem, causing millions of death and so many illnesses per annum. Since water is 'elixir for all types of life' and clean water is essential for healthy life. It is about 60% of our body and 95% by weight of some plants[2]. Water is a renewable content but it takes lots of time to renew by hydrological cycle. This cycle constantly purifies and redistributes water on earth. Water is a limiting factor of the environment, both for biological systems and human systems. Our growing world population is placing great demands upon natural fresh water sources. The rate at which we are using water now may make it necessary to conscientiously protect, consume and replenish our water supply.

CAUSES OF WATER POLLUTION

Water pollution is mainly caused by **Natural Process** in which the decomposed vegetable, animal and weathered products are brought into main water resources. **Anthropogenic processes** such as industrial, agricultural, urban, domestic, radioactive, mining sources, use of pesticides and fertilizers by man etc. These pollutants are constantly poured in water deteriorating it to such an extent that it becomes unfit for living communities.

Water pollution can occur on account of any one or more of the following agents[3] :

- **Biological Agents:** Pathogens such as virus, bacteria, protozoa and worms.
- **Chemical Agents:** It has divided into three types :
  - **Inorganic:** Nitrates, phosphates, chlorides and fluorides

- **Organic:** Pesticides, dyes, chloro-compounds, phenols, paints and plastics
- **Heavy Metals:** Soluble heavy metal ions such as mercury, lead, cadmium, copper, zinc and their organo-metallic compounds.

► **Physical Agents:** Waste heat from industrial plants.

WATER POLLUTION BASED HEALTH HAZARDS

First, there are natural sources of water pollutants such as mineral ores from rocks chemicals from mines and gases from atmosphere. Second, the sources arising due to human activities, which are sewage & domestic wastes, industrial wastes, agricultural wastes, runoff from urban areas, toxic inorganic material, organic chemicals, non–metallic salts, toxic metals, sediments, acids and bases, oils, thermal wastes and radioactive wastes. Water has various components, which are present in major concentrations in potable water, are calcium, magnesium, sodium, potassium, chloride, sulphate, carbonate, bicarbonate, hardness and dissolved solids. Water has also important minor constituents of potable water are aluminium, barium, boron, fluoride, bromide, iodide, nitrate, nitrite, phosphates, polyphosphates, iron, manganese and trace elements, which are of less importance. If all these components are in beyond permissible limits recommened by various agencies like BIS, ICMR, WHO and CPCB then water causes many health issues in humans. Water borne diseases are based on micro-organisms (bacteria, virus and protozoa) and chemicals. Bacterial, Viral and Protozoal infections causes diseases are as follows:

Cause	Water-borne Diseases
Bacterial infections	Typhoid, Cholera, Paratyphoid fever, Bacillary dysentery
Viral infections	Infectious Hepatitis (jaundice), Poliomyelitis
Protozoal infections	Amoebic dysentery

Higher concentrations of various chemical components causes following diseases:

- **Calcium (200 mg/L):** Irrational of the urinary passages resulting in difficulty in passing urine. Calcium and magnesium in drinking water are important protective factors for death from acute myocardial infarction.
- **Magnesium (200 mg/L):** Magnesium affects taste and contributes to hardness of water. It may produce gastrointestinal irritation in the presence of sulphates.
- **Sodium (200 mg/L):** Sodium in blood leads to hypertension. It has adverse physiological effect like : Cardiacrenal and Circulatory disease and women with toxemia associated with pregnancy. **Chloride (250 mg/L):** Chloride gives a salty taste to water. Excessive intake above 2.5 gm/L has been reported to produce hypertension, and other chloride toxicity e.g. Congestive Heart Failure.
- **Sulphate (250 mg/L):** Sulphate is one of the least toxic anion and is poorly absorbed from the human intestine. So luckily, it has no adverse effect upon health.
- **Total Dissolved Solids (500 mg/L):** Total solids include both dissolved solids and suspended solids. Total dissolved solids has laxative, fever and salty taste to water.
- **Chromium (0.05mg/L):** Chromium (Cr^{6+}) is more toxic and causes dermatitis, ulceration, lung cancer and perforation of nasal septum.
- **Manganese (0.5mg/L):** Manganese is not toxic metal but its excessive concentration affects the central nervous system, causes gait and speech disturbance tremors, uncontrollable laughter, lung troubles. Symptoms are visible after 2–3 months of exposure. MnO_2 causes pneumonia, pharyngitis, etc.
- **Nickel (0.02mg/L): Nickel salts** may cause gastrointestinal irritation, diarrhoea, vomiting, development of gastrointestinal and neurological disorder like tremors, chorea like movement and paralysis in experimental animals. The nickel salts may also induce hypersensitivity reactions at the site of contact with skin. **Nickel carbonyl** has been reported to produce pulmonary and nasal carcinomas.
- **Zinc (5 mg/L):** Excessive zinc consumption is linked to damaged pancreas, muscular stiffness, nausea and anemia. Zinc chloride produces skin diseases and zinc oxide causes lung problems.
- **pH (6.5 – 8.5):** Exposure to extreme pH values results in irritation to the eyes, skin and mucous membrane. In sensitive individual, gastrointestinal irritation may also occur. Exposure to low pH values can also result in similar effects. Below pH 4, redness and irritation of the eyes have been reported, the severity of which increase with decreasing pH. Below pH 2.5, damage to the epithelium is irreversible and extensive.
- **Fluoride:** Below 0.5 ppm fluoride causes fluoride deficiency and it leads to dental

caries.0.5 to 1.0 ppm protect against dental caries, takes care of teeth and bones. 1.5 to 3.0 ppm fluoride causes dental fluorosis, 3.0 to 10.0 ppm fluoride causes skeletal fluorosis (adverse changes in bone structure) and more than 10.0 ppm fluoride causes crippling skeletal fluorosis and severe osteosclerosis (increase in bone mass).

- **Nitrate:** There are two distinct threats to human health from nitrates. First, *blue baby disease* or Methemoglobinemia. Second, nitrates can combine with various amines in the gastrointestinal tract to form nitrosamines, many of which are known to be carcinogenic.

- **Arsenic Health Hazards (0.01mg/L):** Excess Arsenic damages to human health like renal, carcinogenic, neurological, hepatic, hematological, respiratory, etc. Acute poisoning involves the central nervous system, leading to comma and for doses of 70-180 mg, to death. Chronic poisoning involves muscular weakness, loss of appetite and nausea, leading to inflammation of the mucous membranes in the eyes, nose, paralysis of lower limbs, larynx and skin lesions.

- **Mercury Health Hazards (0.001mg/L):** Symptoms are ataxia, numbness in hands and feet, muscles weakness, narrowing vision and damage to hearing & speech.

- **Lead Health Hazards (0.01mg/L):** Lead is non-essential for the functioning of human biological systems and it has been recognized as a cumulative poison. Lead is deposited in bones as a cumulative poison. Excess intake of lead creates dullness, restlessness, irritability, poor attention span, headaches, muscle tremor, abdominal cramps, kidney damage, loss of memory, etc. High dose of lead intake may cause acute brain damage and can also lead to death. It can also affect the normal functioning of heart and kidneys. High blood level means that such children can have lower IQ.

- **Cadmium Health Hazards (0.01mg/L):** Acute cadmium poisoning, when due to ingestion, is characterized by severe gastrointestinal irritation and circulatory collapse. Acute poisoning due to inhalation of cadmium fumes results in cough, soar throat, vertigo, dyspnoea, cyanosis, high blood pressure, kidney damage and bronchopneumonia. Chronic cadmium poisoning causes a characteristic yellow pigmentation of teeth, insomnia, emphysema and proteinuria. Cadmium also affects liver and pancreas. Cadmium is a cumulative poison and can exist in the body for more than 10 years. An extremely painful cadmium poisoning disease called **'itai–itai'**. The disease seriously affects the bones, gradually causing them to disintegrate.

- **Copper Health Hazards (0.05mg/L):** Deficiency of copper may cause anaemia, neutripenia, diarrhoea, demineralization of bones and the amyelination of the central nervous system of the newborn. The *Menkes Disease* is characterized by kinky, depigmented hair, physical and mental retardation with degradation of brain, hypothermia and eventually death, has also been linked to copper deficiency. Acute and Chronic toxic levels of copper may result in nausea, metallic taste, vomiting, diarrhoea, jaundice, extensive lever damage, hypertension, coma, melena, anuria, hemoglobinuria and hematuria.

CONCLUSION

India's environment is becoming fragile and has been causing concern due to increasing industrialization, urbanization, population growth and unconscious attitude towards the environment. In India, 12% of people get clean drinking water, the rest 88% quench their thirst from polluted lakes, tanks, rivers and wells due to which more than three million get affected or die of enteric diseases every year. Two third of India's surface water are contaminated sufficiently to be considered dangerous to human health. Those who have privilege of having river in their villages, it becomes the source of drinking water.

It is concluded that the water contain excessive levels of various major & minor components and toxic heavy metals in groundwater have detrimental health risk to humans and posed environment stresses. Water sources may be contaminated by all pollutants owing to the incomplete treatment and may not be acceptable for drinking purposes.

So, the water treatment plants should be installed in rural areas. Create the awareness about the effects of high concentration of nitrate, fluoride, solids and hardness among villagers. The Government and Community should do better water management in conserving water. The Govt. should immediately make laws for banning industrial pollution. Failure to do so will lead to substantial penalties and fine. Environmental courts should be set up in every district to deal with the cases relating to violations of environmental laws.

REFERENCES

1. *Standard Methods for the Examination of Water and Waste Water,* edited by Lenore

S. Clesceri, 17th edition, APHA, AWWA, WPCF, Washington DC (1989).

2. Saxena M.M. (1994). Environmental Analysis of Water, Soil and Air, *Agro Botanical Publishers* (India).

3. Rubenowitz E., G. Axilsson and R. Raylander (1996). *Am. J. Epidemol*, **143**: pp. 456.

4. Kudesia V.P. (1996). Environmental & Health Technology, *Pragati Prakashan*, Meerut.

5. Guidelines for Drinking Water Quality, Vol. II, Health Criteria and Other Supporting Information, *World Health Organization*, Geneva (1996).

6. IS–BIS, *Manual of Drinking Water Standards*, New Delhi, (1991 & 1999).

7. De A.K. (2000). Environmental Chemistry, 4th Edition, *New Age International (P) Ltd*, New Delhi, India.

8. Barua A.K. (2001). Water Technology Management, Vol. 1, *Dominant Publishers and Distributors*, New Delhi.

9. Verma Mahendra Kumar, Vijendra Singh and C.P. Singh Chandel (2003). Study of Nitrate Concentration of Industrial Wastewater and Ground Water, *Indian Water Works Association*, **35(3)**: pp. 228–229.

10. Sharma B.K. (2005). Environmental Chemistry, 8th Edi., *Krishna Prakashan Media (P) Ltd.*, Meerut.

11. Singh Vijendra (2016). Evaluation of Heavy Metals in Groundwater at Residential Area nearby Major Industrial Areas of Jaipur, *Journal of Advances in Science and Technology*, 11(22): pp. 1-4.

12. Singh Vijendra and Kumar Suresh (2017). Assessment of Fluoride Contamination in Industrial Waste Water and Groud Water of Its Suburb Areas of Jaipur, Rajasthan, *International Journal of Environmental Rehabilitation and Conservation*, 8(2): pp. 77-81.

13. Singh Vijendra (2019). Appraisal of Toxic Heavy Metals in Groundwater at Suburban Area nearby Major Industrial Regions of Jaipur, *Journal of Advances and Scholarly Research in Allied Education*, 16(4): pp. 1288-1290.

14. Singh Vijendra (2020). Environmental Chemistry : Water and Soil Polltuion, *Horizon Books*, Haryana.

Corresponding Author

Dr. Vijendra Singh*

Department of Chemistry, Rajikiya Mahila Snatakottar Mahavidhyalaya, Kandhla, Shamli (UP)