

ANALYSIS OF PHYSICAL CHEMICAL DRINKING WATER QUALITY PARAMETERS IN SIALKOT

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Received: 23.09.2021 / Accepted: 13.10.2021 / Revised: 17.11.2021 / Available online: 31.05.2022

DOI: 10.2478/jaes-2022-0008

KEYWORDS: Water, Waste water, chemical properties, Physical properties.

ABSTRACT:

Due to increasing in urbanization, agricultural and various human activities are being increased which caused the contamination of surface water and ground water. Present demand of drinking water is not sufficient which should be safe and clean but it is contaminated now a day's coming from different sources. Various treatments and methods are adopted to upgrade the quality of drinking water. Water should be free from the various contaminations viz. Organic and Inorganic pollutants, Heavy metals, Pesticides etc. as well as all its parameter like pH, Conductivity, Calcium, Magnesium, Total Hardness, Carbonate, Bicarbonate, Chloride, Total Dissolved Solid, Alkalinity, Sodium Potassium, Nitrate should be within a permissible limit. For this purpose, different samples were collected from different sources. Category 1: piped water, Category 2: Boreholes with hand pump average depth is 30m, Category 3: Society supply line, Category 4: Simple open hand dug wells that do not sealed walls average depth 5m, Category 5: Surface water. These samples were analyzed for their physical-chemical and microbiological quality (pH, Conductivity, Turbidity, Hardness & Total dissolved solids) in order to identify the rate of contamination and suggest appropriate solutions. Different diseases are accrued in human body which is identified due to the contaminated water. By chemical testing, it can be identified and then suggested some methods of treatment to purify the water for drinking purposes. All parameters are confirmed by comparing with World Health Organization (WHO) standards. Results concluded that quality of drinking water have been adequate of category 3 in which drinking water coming from society treatment plant but category 2 also lies within the acceptable range.

1. INTRODUCTION

Unsafe drinking water and inadequate water supply is major concerns in developing countries. Clean drinking water is one of the major challenges for our country. The joint monitoring program (JMP) for water supply and sanitation implemented by the world health organization (WHO) and UNICEF reports that 783 million people in the world (11% of total population) have no access to save water and 84% whom live in rural areas (Hassan et.al, 2021; Dastgeer et.al, 2020).

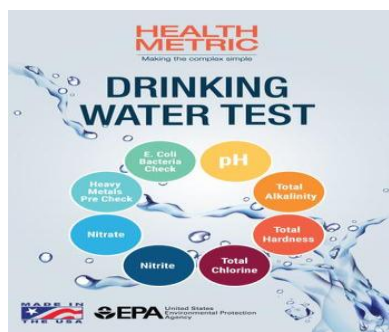


Figure 1. Essential parameters of drinking water quality

Safe and clean drinking water is the basic need of life. Water must be free from all pathogens or chemicals (Riaz and Zia, 2020). According to WHO, 75% diseases in developing countries mostly come from polluted drinking water. So, physical, chemical and bacteriological parameters of water have to be addressed (Padda and Asim, 2019). Various parameters like pH, turbidity, dissolved oxygen and electrical conductivity which affect the water quality index. Acceptable pH range is 6.5-8.5 by WHO. It is very important for humans that pH should be in normal range to normalize the body functions. It occurs in body to regulate enzyme functions and electrical conductivity (Behailu et.al, 2018). Neutral pH is the best quality of drinking water but if it becomes basic or acidic, quality of water becomes poor (Nejat et.al., 2018). Turbidity is the concentration of suspended solid particles both organic and inorganic affecting the quality index of water (Khalid et.al., 2018). Total dissolved solids (TDS) tells us whether it is safe to use or not and these are obtained by industrial pollution and salts contamination. If turbidity will increase the water quality will become poor even not to recommend for drinking purposes (Nejat et.al., 2018). Hardness of water if more than 200mg/lit may cause scale deposition in distribution system and if more than 500mg/lit it is harmful to human health (Lafta, 2017; Walia et.al., 2017). Oxygen is very important to regulate all the metabolic processes in the body to produce energy.

Dissolved oxygen (DO) is the basis of biological oxygen demand test to evaluate pollution potential of waste water in units of mg/lit (Alam et.al, 2017). Water quality index increases till the oxygen concentration up to 100mg/lit but if concentration becomes above 100mg/lit quality index decreases and water quality becomes poor (Rahmanian et.al., 2017; Divya and Neetu, 2017). A study conducted in Araba Minch Town showing disturbed levels of chloride and fluoride. All others parameters are in permissible range (Sanaullah et.al., 2016). Another study conducted which points towards water quality parameters of public transport drinking water sources. It concludes that bacterial contamination, high chloride levels and alkalinity makes unfavorable for drinking purposes (Mahajan et.al., 2016; Shahid et.al., 2015). Unsafe drinking water is a big issue all over the world in developing countries which have to overcome the diseases produced from contaminated water. The joint monitoring program (JMP) for water supply and sanitation are implemented by the World Health (Tariq, 2014).

Organization (WHO) and UNICEF reports that 783 million people in the world (11% of total population) have no access to safe water and 84% of whom live in rural areas and 2.5 billion people don't have proper sanitation (Arora et.al, 2014).

Quality of water is disturbed by environmental conditions, soil erosion and urbanization, agricultural pesticides and use of fertilizers, industrial activities and human exploitation of water. Ground water is the least polluted but there is a need of proper water quality parameters to maintain standards (Yadav et.al, 2013). Heavy metals and inorganic present in water have the tendency to accumulate in human organs and affect normal functioning of organs. Lead (Pb), arsenic (As), magnesium (Mg), nickel (Ni), copper (Cu), Zinc (Zn) may cause risks to human health and environment unhealthy (Alam et.al., 2017). Arsenic is toxic and carcinogenic and cause malfunctioning of cell respiration, cell enzymes and mitosis. Lead exposure to humans is either through food or drinking water. It causes damage even at low concentration (World Health Organization, 2011). It is extremely toxic. Mercury cause neurological and behavioral problems. 4.chloride in water may affect human health and gives unfavorable taste to water.

2. PROBLEM STATEMENT

Nowadays, contaminants in water coming from different locations like industrial and sewage etc. have a big source of water pollution. This may affect the human health which may cause diseases of different symptoms.

2.1 Objectives

Objectives of this study are:

- To check the quality of drinking water by testing of physical parameters (pH, Turbidity, conductivity, Taste & odour).

- To check the quality of drinking water by testing of chemical parameters (lead, Fluoride, Arsenic, Chloride).

3. MATERIALS & METHODS

Study area of this research is Sialkot located on the north east Punjab. Sialkot is one of the most industrialized regions. Three region of this Zone have been selected named Bhano K., Baig Chuk and Jamke Chema. It is mainly rural area with difficult access of safe drinking water.

Depth of water table varies from region to region. For drinking purposes water quality is checked by physical and chemical testing and samples are collected from different sources. Water is collected from five categories of one selected area.

- **Category 1:** Piped water.
- **Category 2:** Boreholes with hand pumps (30 meters)
- **Category 3:** Open dug wells with concrete walls. (Depth 16 meters)
- **Category 4:** Commercial Water
- **Category 5:** Surface water

Three types of water from different sources have been selected of one region named as Sialkot for the study of different categories 1, 2, 3, 4 and 5 respectively (Table 1).

Sr No	Village	Sources More Used
1	Jamke Cheema	Category 1
		Category 2
		Category 3
		Category 4
		Category 5
2	Bano Ka	Category 1
		Category 2
		Category 3
		Category 4
		Category 5
3	Baig Chuk	Category 1
		Category 2
		Category 3
		Category 4
		Category 5

Table 1. Primary Water Sources of the Targeted Villages

Collected samples are analyzed for their physical quality like pH, Conductivity (Figure 2), Turbidity (Figure 3), Hardness & Total Dissolved Solids.

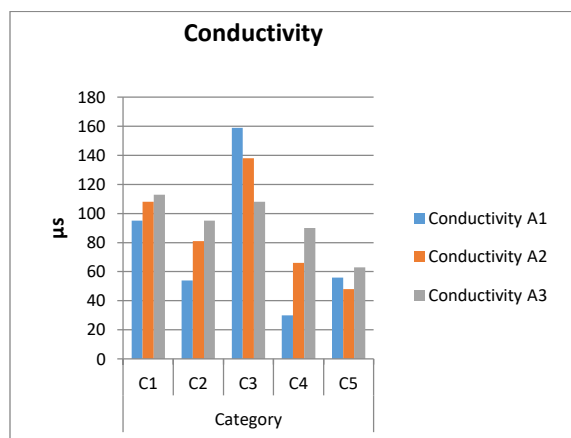


Figure 2. Conductivity at different category

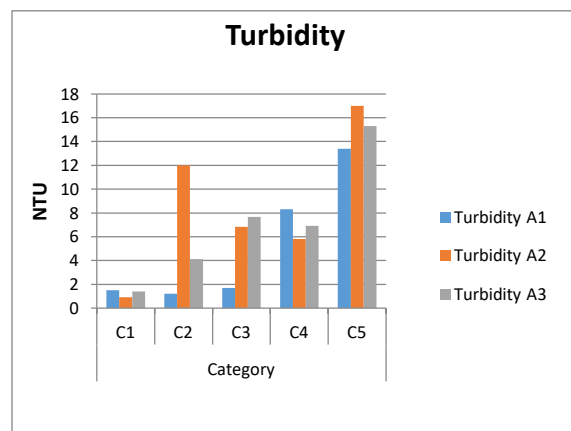


Figure 3. Turbidity at different category

In order to identify the rate of contamination, Chemical quality is analyzed like Fluoride, Nitrate, Phosphate, Iron, Manganese, Zinc. Presence of chemically identified salts either in excess or shortage can cause diseases and many others create minor changes in human body (Table 2).

De- scription	Area	Category					WHO	Stand- ard Value
		C1	C2	C3	C4	C5		
pH	A1	6.8	6.8	6.4	6.1	6.6	6.5- 8.5	6.5- 8.5
	A2	6.1	6.4	7.4	6.4	7.9		
	A3	6.9	7.0	6.8	5.9	6.5		
Turbidity (NTU)	A1	1.5	1.2	1.7	8.3	13.4	<5NTU	<5NTU
	A2	0.9	12	6.83	5.8	17		
	A3	1.4	4.1	7.67	6.9	15.3		
Conductivity (µs)	A1	95	54	159	30	56	< 1000	< 1000
	A2	108	81	138	66	48		
	A3	113	95	108	90	63		
Ta ste	A1	Unobjectionable/Acceptable					-	-
	A2							

Odour	A3	Unobjectionable/Acceptable	-	-
	A1			
	A2			
	A3			

Table 2. Results of Physical Parameter of Drinking Water

4. RESULTS & DISCUSSIONS

Majority of the sources have a pH lower than neutrality. Low pH values were typically of boreholes and open dug wells, while piped and surface waters were near to neutrality. There is no health based guideline for pH, although a range 6.5 to 8.5 is suggested by WHO and Punjab Environmental Protection Department. As a consequence, low pH values indirectly affect human health, since heavy metals released into water from pipes can have adverse effects on people and may cause dangerous diseases (Figure 4, Table 3).

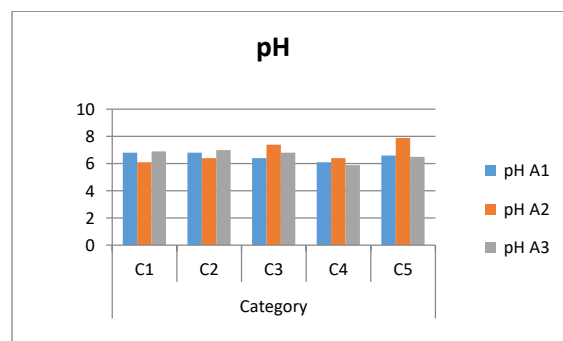


Figure 4. pH at different category

Des- cription	Area	Category					WHO	Stand- ard Value
		C1	C2	C3	C4	C5		
Fluoride (mg/l)	A1	0.11	0.05	0.07	0.05	0.09	< 1.5	< 1.5
	A2	0.8	0.03	0.05	0.04	0.15		
	A3	0.7	0.08	0.06	0.04	0.05		
Lead (mg/l)	A1	0.01	0.03	0.02	0.03	0.01	<0.01	< 0.05
	A2	0.03	0.06	0.05	0.02	0.03		
	A3	0.05	0.05	0.03	0.06	0.04		
Iron (mg/l)	A1	0.00	0.00	0.05	0.04	0.20	< 0.3	< 1.0
	A2	0.00	0.01	0.02	0.16	0.18		
	A3	0.02	0.04	0.05	0.19	0.23		
Chloride (mg/l)	A1	2.93	4.5	4.8	5.5	8.0	< 250	< 250
	A2	3.3	4.8	4.0	5.0	6.9		
	A3	2.53	3.9	5.1	4.9	7.4		

Table 3. Results of Chemical Parameter of Drinking water

Different concentration of minerals is present in water. With the presence of these minerals either in excess or lack, human body can be affected and may suffer many diseases.

Deficiency of Iron in the water may causes anemia, deficiency of fluoride cause tooth decay & osteoporosis, excessive lead affects brain, learning disabilities, hearing problems & shorter stature in children and, chlorine contaminated water can cause no of health problems including bad taste and odors, increased risk of cancer, hazardous for children health, increased risk of asthma and results in heart problem (Figures 5-8).

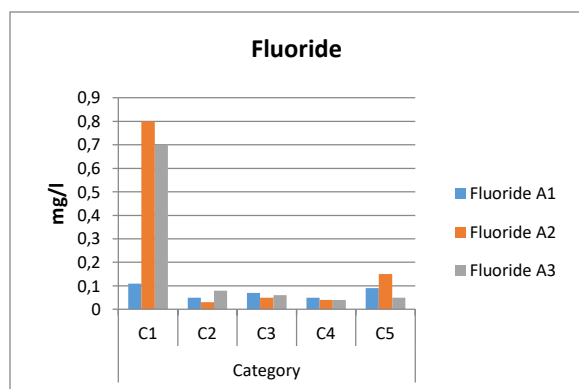


Figure 5. Fluoride at different category

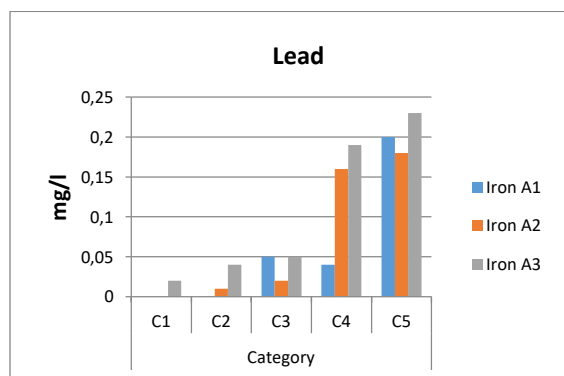


Figure 6. Lead at different category

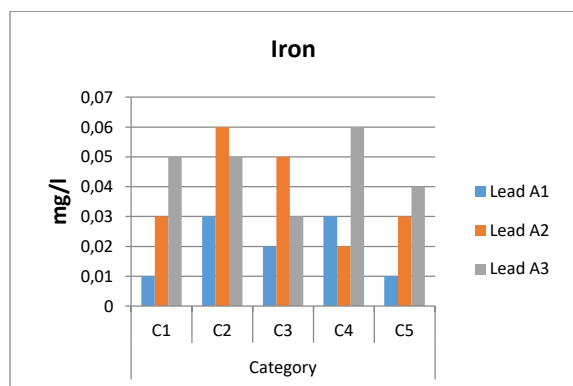


Figure 7. Iron at different category

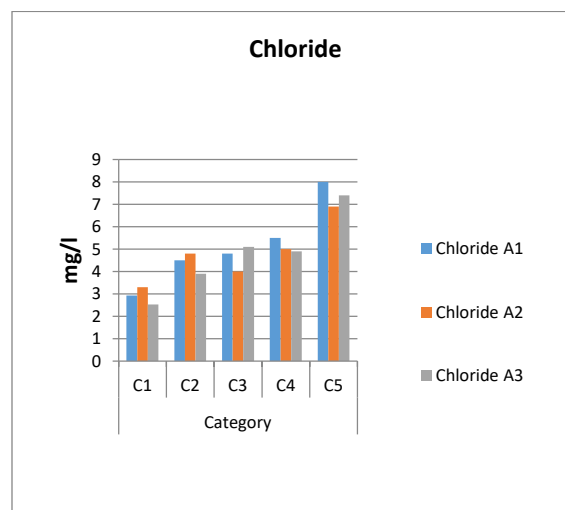


Figure 8. Chloride at different category

5. CONCLUSIONS

Following conclusions have been drawn of this research:

- Drinking water should be free from odor and turbidity. Category 1 and category 2 have is better than other because physical parameters are in acceptable range.
- Drinking water sources have good physical quality of piped and hand pump water others do not have good quality due to the presence of contaminants lead and chloride especially which may cause the diseases in humans.
- Drinking water sources have enough chemical contamination. If contamination are more than the acceptable limits than water is not recommended for drinking purposes.

6. ACKNOWLEDGEMENT

The authors gratefully acknowledge the assistance provided by The University of Engineering & Technology, Lahore, and facilitation from The University of Lahore, Pakistan. Authors also thankful to the staff of Environmental Lab staff of The University of Lahore who provide me assistance to complete my research.

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