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REVIEW ARTICLE

INSPECTION OF DRINKING WATER CALIBRE TRAIT OF BHIMBER AZAD KASHMIR, PAKISTAN

Raja Asim Zeb^{a*}, Raja Shoaib Zahoor^b, Dr. Ariba Farooq^b

^a *Institute of Earth Sciences, University of Poonch Rawalakot Azad Kashmir, Pakistan*

^b *Department of Chemistry, University of Lahore Punjab, Pakistan*

*Corresponding Author Email: Asim.zeb812@gmail.com

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ABSTRACT

The article summarizes the outcomes of abundant physicochemical equity of drinking water and pathogenic microorganisms conducted for drinking water trait condition of Bhimber Azad Kashmir. Drinking water quality index (DWQI) based on TDS, pH, Ca²⁺, Na⁺, was used to assess the drinking water quality. Being unnerves increase in the population and hasty commercial construction, drinking water quality is highly affected constantly in Bhimber Azad Kashmir. About 18% of whole population of Bhimber Azad Kashmir has approach to secure drinking water. The resting 80% of population is enforced to use perlious drinking water due to the insufficiency of safe and healthful drinking water resources. The principal origin of contamination is microbial contamination, turbidity and Na⁺ which is widely discharge into water system supplies. Anthropogenic exercise cause bone diseases that create about 60-70% of all diseases are answerable. This article emphasizes the drinking water quality, contagion sources and controlling mechanism of water in Bhimber Azad Kashmir. There is an immediate commitment to take precautionary measures and treatment technologies to control on these depressive water contamination statistics of Bhimber Azad Kashmir.

KEYWORDS

Hydro geochemistry, Surface water, Environmental evaluation, Hydrogeology.

1. INTRODUCTION

Water is a predominant module of human body and is the commitment of life (Muhammad et al., 2012). Presence of malicious synthetic substances and pathogenic microorganisms can cause an extreme unexpected issue prevailing to contaminations and demise (Lima et al., 2005). The drinking water debase with any pathogenic microbes is unstable for people and family use (Muhammad et al., 2012). In District Bhimber, the primary water accommodation comes from hand siphons, wells, springs, streams and lakes, which are likewise utilized for drinking and farming purposes. Being withdrawn from snowmelt and water system arrangement of Pakistan, precipitation influences the wealth of surface and underground water in the review region. The general goal of the current work is to evaluate the nature of drinking water sources and conveyance frameworks of locale Bhimber.

The particular destinations of the study region are:

- To examine bacteriological defilement at source and conveyance frameworks;
- To really look at the actual nature of drinking water
- To review critical metal debasement in drinking water resources and transport structures, metal defilements are mineral based which happen ordinarily or get into watershed through modern

releases

- To direct circumstance examination of drinkable water sources/springs.

Like other developing countries water quality is a major concern in AJK. It is confirmed that water can cause the diseases in human beings, it has been observed that diarrhea and other diseases in humans are caused by the bacteria which comes through the use of potable water trait of water stretches as do ecological and anthropogenic elements (Ashbolt, 2014). Dissolved minerals, gases and organic constituents may create aesthetically disgusting color, taste and odors. Moreover, turbidity in surface water is mostly caused due to the erosion of colloidal materials e.g clay, slit and metal oxide from soil (Greenberg et al., 1998). Turbidity is the main cause of taste and osor problem of water and it escapes the distillation abilities of disinfectants (Peavy et al., 1985).

Electrical Conductivity measurement and its relation to cations and anions, and total solid concentration used for pollution detection of surface water and for salinity determination (Ahmad, 2004). The pH determining the corrosiveness of ater and it has no direct impact on water consumers. The exposure to extreme pH values may cause irritation to the eyes, skin, and mucous membrane. pH can damage the degree if deterioration of metals as well as disinfection efficiency (WHO, 2004). Hymavathi while narrate the water condition of stream Mudasarlova, (India and Sastre et al). have

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delineate the study of surface run off but the quality of water of Bhimber District is under studied. The present work inspects the effect of physical and chemical attributes of rainwater on the quality of water of the study area (Mirza et al., 2006). Drinking water should be bacterium free and with good organoleptic features (Nevondo and Cloete, 2000). Contamination of drinking water during or after the assemblage from a safe source has been recognizing as a problem in rural areas exceptionally.

A comprehensive diversity of pathogens is associated with water to cause severe diseases such as diarrhea, Poliomyelitis and hepatitis. The microbes such as, Vibrio cholera, Rotavirus, Astrovirus, Cryptosporidium, Gardia, Entamoeba histolytica, Shigella etc are important bacterias can cause severe blow to human health interact to unsafe water (Gundry et al., 2004; Hamer et al., 1998). In developing countries enormous population are suffering from health issues linked with insufficiency of drinking water or infect drinking water (Leeuwen, 2000). In Pakistan it has been approximately that 40% of all deaths and 30% of all diseases is correlated to unsafe water. Every fifth agonize from illness because of polluted water. It has been approximating that three million Pakistanis suffer, while 0.1 million die from waterborne diseases annually (Haydar et al., 2009).

It has been predicted that 44% of the Pakistani population does not have access to safe drinking water, while the figures ascent to 80 percent in rural area population. Almost 1.1 billion people are inadequate requisite approach to water, whereas 2.4 billion people live without ample sanitation (Rosemann, 2005). The impartial of this study was to synthesize and highlight the bacteriological trait of drinking water at three different measures such as sources, water supply system and household and possible subjection to the 247 pathogenic bacteria during daily depletion of water in the Bhimber Azad Kashmir Pakistan (Akbar et al., 2013).

Entrance to safe drinking water is not only the dominant need for abundance and health but is also basic human rights (WHO, 2000). Well-being of drinking water remains a principal public health concern extremely in emergency circumstances (Ferretti et al., 2010). Pathogens that cause diarrheal diseases are being linked with polluted water consumption such pathogens are the main cause of gastrointestinal infections. The childhood mortality outlay because of diarrheal diseases is 2.5 million annually (Muhammad et al., 2012; Oswald et al., 2007). Each year round about five million children die due to the use of polluted water (Shar et al., 2010). Approximately 1.8 million kids died in struggling countries bring about by biological negotiator or microorganisms originating from food and water in year 1998 (Akbar and Anal 2011).

Unprotected and uncertain drinking water supplies are subsidize in high rate of human morbidity and correctness worldwide. It has been a national interest in United States of America to equip safe drinking water since before the 20th century (Sobsey, 2006). Endangered or protected corporate water sources are the pointer means of edible water in many developing countries (Gundry et al., 2004; WHO, 2000). It has been approximate that 1/3 of the total world population use ground water for drinking purpose (Nickson et al., 2005). Unprotected sewage and sanitation lines and direct send out of waste to natural source and water bodies are the extensive cause of fecal pollution (Huttly, 1990).

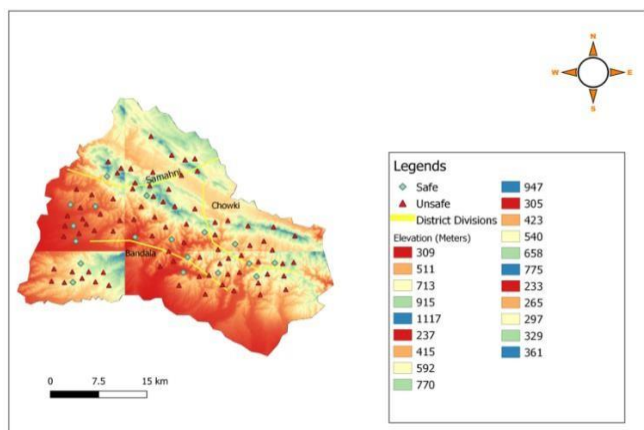


Figure 1: Sample location and hydrological map of Study area

This examinations was led to gauge the generally quality (physic-synthetic) of various water sources to comprehend the contamination load and to investigation of water quality regarding physic-compound and miniature natural boundary to find watter quality at source and the effect of this water quality on human wellbeing and the sort of water borne

diseases in nearby individuals of region Bhimber. Bhimber District lies at a latitude 32.48 to 33.34° and longitude 73.55 to 74.45° and encompass of 1516 square Kilometer area. It is located at the foot hills of Himalayas at 275 - 975 meters above sea level with a population of above 0.335 million. The study conducts in distinct areas of district Bhimber, Azad Jammu and Kashmir Pakistan. Topography of the study area is mountainous and seniority of the people used to live in small distributed villages depending on natural springs exceptionally well and flowing water channels generally as their main source of water (drinking and household use). The area was firmly affected by October, 2005 earthquake. In the ongoing study a definate survey regarding the existing drinking water quality of the area in term of microbiological contamination was attend (Figure 1).

Climate of the area in the state of Azad Jammu and Kashmir, there are hot plains of the Bhimber and Mirpur and cold lands of poonch division etc. The area has different weather settings at different places because of the giant mountains like the Pirpanjal range that probe the moisture-laden winds from set foot in the valleys. In summers, the outer plains and the outer hills receive rainfall from monsoon winds while in winter's winds from the Mediterranean cause snowfall and rainfall in the Valleys of Kashmir. The exclusive climatic precedence in the zone of the Middle Mountains and its valleys are set on by the altitude, which in turn determines the degree of coolness and preferment in the form of precipitation and summer temperature. Winters are cold and of longtime span and with increasing altitude it gets colder still as snow falls. Summers, however, are breezy but short. Winters last from November to March. Spring begins after 15th of March. Humidity in the monsoon season draw over July and August is as high as 70% and with increasing temperature summers can be uncomfortable. Climate of the Bhimber District from the mountainous Districts of Azad Kashmir and is as hot as Jhelum and Gujrat, the adjoining districts of Punjab, Pakistan

2. MATERIAL AND METHODS

2.1 Sample assortment and scrutiny

Drinking water quality survey of Bhimber has been carried out a total of 100 random samples were collected from springs, Bore water, and well water standard methods & protocols were put in for collection of water sampling, recording and tabulation of data inspection of water samples and development of GIS data base for DWSS and spring water quality survey of district Bhimber in AJK. Examination of any water samples start rightly at site. During sampling, one needs to reveal great care to rule out the intrusion of any external elements which may alter the composition of any sample and the effects the results. Water samples for physiochemical analysis were collected in polystyrene bottles of 1-liter capacity Before sampling, the bottles are washed properly 2-3 times first with water and then with distilled water. For bacterial analysis, samples were collected directly in sterilized containers provided with field testing kit (water check, Ready cult, MERCK). Boric acid was used as preservatives in the sampling bottles for nitrates and nitrogen prior to move to the field.

Activities during samplings coding on sample bottles with permanent marker, Filling of data collection form, Recording of GPS coordinates on sampling site, Preservation of samples, Bacteriological analysis on all sampling sites, labeling and marking of samples after collection of samples, samples are carried to water testing lab within 5-6 hours. A detailed lab test for microbial and chemical parameters is then carried out in lab. To avoid even a small change in the composition of samples due to external interference, it is made sure that such analysis starts within a period of 4-6 hours after collecting sample. The analysis of chemical parameters is done with the help of hightech spectrophotometer Lovibond XD 7500. The parameter like pH, dissolved oxygen, conductivity, temperature and turbidity is done with the advanced multi parameter equipment.

To measure major cations like Na^+ , a flame photometer (PFP7, JENWAY) was used.

Charge balance error (CBE) was calculated for each water samples. Water sample having high concentration of cations show positive Charge Balance Error (CBE) value while Water samples having high concentration of anions show negative Charge balance error (CBE) was calculate by Equation (1);

$$\text{CBE} = \frac{[\Sigma \text{cations} - \Sigma \text{anions}]}{[\Sigma \text{cations} + \Sigma \text{anions}]} \times 100$$

Where concentrations of ions are expressed in mill equivalent per liter (meq/L). According to the standard methods & protocols, only those

water samples that shows ±5% CBE were accepted for drinking. Aquachem software is used to assess the different framework of water, (Total hardness, TDS, Piper diagrams, DO, Durov diagram,)

For considerate water quality ratio, first each of the nine criterion are authorize by weight (WI) based on their importance to overall quality of drinking water. Total dissolved salts, sodium and chlorides are given a weight of 4 because of their consequence in drinking water while bicarbonates are given a weight of 1 due to their minor role. Other framework is in between 1 & 4 based on their effect in water quality.

After elect the weight of water parameter, the corresponding weight (WI) was also calculated by using this equation (2).

$$WI = \frac{w_i}{\sum_{i=1}^n w_i} \quad (2)$$

Where in this equation WI is the relative weight, w_i is the weight associated to each parameter and n is the number of its parameters and next step for calculating the WQI is to assigned water quality rating scale for each parameter .The water quality rating scale is calculated by following formula (Equation 3) $Q_i = \frac{C_i}{S_i} \times 100$

Where q_i is the quality rating scale for each parameter C_i is the concentration of physiochemical parameter expressed in mg/L, S_i is the sandard for each of parameter expressed in mg/L. The sub-index (S_i) is the recommended standard value of ith parameter and is calculated by following equation (Equation 4)

$$S_i = W_i \times q_i \quad (4)$$

$$WQI = \sum_{i=1}^n S_i \quad (5)$$

Where S_i is subindex of ith parameter nW_i is the relative weight of ith parameter,

Q_i is the rating scale based on the concentration of ith parameter, and n is the number of its parameters.

3. RESULTS AND DISCUSSION

3.1 Physicochemical properties Groundwater

The current analysis determined that EC value ranges from 86-3000 within moderate value of 777.58 µS/cm, these results distinctly reveal that water in the study area was not substantially ionized and has the minor level of ionic consolidation activity due to small dissolved solids. Out of 100 samples, the electrical conductivity of 8 samples exceeds the limits. Conductivity does not have forthright brunt on human health (Table 3). High electrical conductivity may edge to lowering the aesthetic value of water by giving mineral taste to water.

Source	Point of Use type	No.	Unsafe	% age	Causes
Bore Water	Tap	75	65	86%	MBC, TB, Na ⁺
Well Water	Tap	19	14	73%	MBC, TB
Spring Water	Tap	6	4	66%	MBC, TB

MBC Microbial contamination, *TB* Turbidity

The water with immense TDS value indicated that water is eminently mineralized. The enticing limit of TDS is 500 mg/l which prescribed for drinking purpose. The mean absorption of TDS in all unions councils of Bhimber was observed average range of 399.12mg, high value of TDS in drinking water are commonly not adverse to human beings ,but high concentration of these may affect persons who are suffering from kidney and heart diseases. Water enclose high solid may cause cathartic or constipation effects (Figure 2).

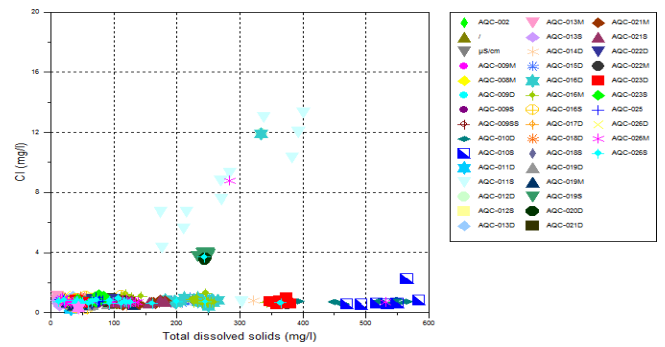


Figure 2: Diagram dissipates total dissolve solids

The PH of water samples is ranges from 6.6–8.3 within the average of 7.37, the comprehensive result evaluate that water sources in union councils of Bhimber are within fascinating and convenient range. The median temperature of water specimens of the study realm was 28.49 °C and in the range of 28–29 °C (Table 3). Temperature in this study was begin within bearable limit of (WHO) (30 °C).

Union Councils	Total	NSWL	%	NSBL	%	Issues
Bandala	40	4	10%	36	90%	Turbidity, Microbial contamination , Chemical concentration.
Samahni	40	6	15%	34	85%	Turbidity, Microbial contamination , Chemical concentration.
Chowki	20	7	35%	13	65%	Turbidity, Microbial contamination , Chemical concentration.

*NSWL Number of sample within limit**NSBL Number of sample beyond limit*

The turbidity values obtained for union councils of Bhimber is 0.01 to 24.4 within the average of (2.76NTU) and the WHO recommended value of 5.00 NTU. Out of 100 samples, 16 samples exceeding the limits of (WHO) recommended value. A very constructive technique to take out turbidity is with reverse osmosis (“RO”) or ultrafiltration (“UF”) membrane systems RO and UF systems can be used by home owners, small communities and commercial sites to lessen turbidity and bring about crystal clear water less than 0.1 NTUs (Table 2, 3).

3.2 Solute chemistry and cations and anions distributions

The solute science of groundwater is bound by Na+ for cations with the scope of 2 mg/L to 112 mg/L inside the normal of 22.28 mg/L, Ca+2 territory from 25 mg/L to 142 mg/L inside the normal of 87.05 mg/L, Mg+ goes from 11 mg/L to 90 mg/L inside the normal of 36.63.

Index	Unit	Min	Max	Mean	SD	WHO guidelines	%age
COND	µs /cm	86	3000	777.58	31.27	1000	9.1%
TDS	Ppm	206	1500	399.12	16.20	<500mg/l	4%
PH	-	6.6	8.3	7.37	0.038	6.5-8.5	-
Turbidity	NTU	0.01	24.4	2.76	0.477	5	14%
Ca ⁺	Mg/l	25	142	87.05	2.15	200	-
T.H	Mg/l	51	220	129.4	3.24	500	-
Mg ⁺	Mg/l	11	90	36.63	1.64	150	-
Na ⁺	Mg/l	2	112	22.28	2.04	50	9.1%
As	Ppb	0	0	0	0	5	-
F-	Mg/l	0	1.11	0.10	0.018	1.5	-
Cl-	Mg/l	19	190	57.51	3.055	250	-

SD Standard Deviation *WHO Word health organization*

mg/L. Out of 100 samples of concerned areas of Bhimber in 9 samples the concentration of sodium exceeding the limits of WHO recommended value which is 50 mg/l, intense effects may include nausea, vomiting, convulsions, muscular twitching and rigidity, and cerebral and pulmonary oedema (Table 3).

The main anion are Cl⁻ followed by the F⁻ ranges from 19 mg/l to 190 mg/l within the average of 57.51 d, F⁻ ranges from 0 mg/l to 1.11 within the average of 0.10 mg/l. Exterior water bodies often have low attentiveness of chlorides as contrast to ground water. It has clue significance for metabolism venture in human body and other main physiological operations. According to (WHO) standards, concentration of chloride should not exceed 250 mg/l. In the study areas.

3.3 Bacterial contamination

Fecal pollution is the main factor of bacteria in water. Wastewater discharges in fresh water are also the major source of fecal microorganism including pathogens. Out of 100 samples of concerned areas 78 are contaminated. It is a central measure of suitability of water for depletion. If large numbers of coliforms are set up in water there is a high expectation that other pathogenic bacteria exist. The WHO drinking water guidelines require the absence of total coliform in public drinking water supplies (Table 2, 3)

3.4 Health threats and controlling mechanism of groundwater

After revealing and examining the results the main cause of ground water contamination in Bhimber area is turbidity, microbial contamination and Na⁺ which are beyond the limit. The main origin of turbidity in drinking water is clay, silt, organic and inorganic matter, algae; liquefy colored organic compounds and planktons & other microscopic organisms. Turbidity creates water cloudy or opaque. The contamination in drinking water is mainly because of fecal matter, particularly human fecal matter, containing pathogenic organisms. Excessive salt intake seriously aggravates chronic congestive heart failure, and ill effects due to high levels of sodium in drinking-water have been documented Sodium (salt) cannot be easily removed from drinking water and cannot be removed through boiling or conventional filtration. Reverse osmosis, ion exchange or distillation systems can reduce sodium levels but these systems may be expensive to operate. The water treatment required to remove or destroy pathogenic microorganisms. The treatment process from microbiological contamination includes roughing filters, micro staining, high rate clarification, dissolved air flotation, slow sand filtration, membrane filtration -micro filtration and chlorine disinfection. The material that causes turbidity can harbor bacteria and viruses. Turbidity can be removed through our multi barrier water treatment process which includes coagulation, flocculation, sedimentation, filtration and disinfection.

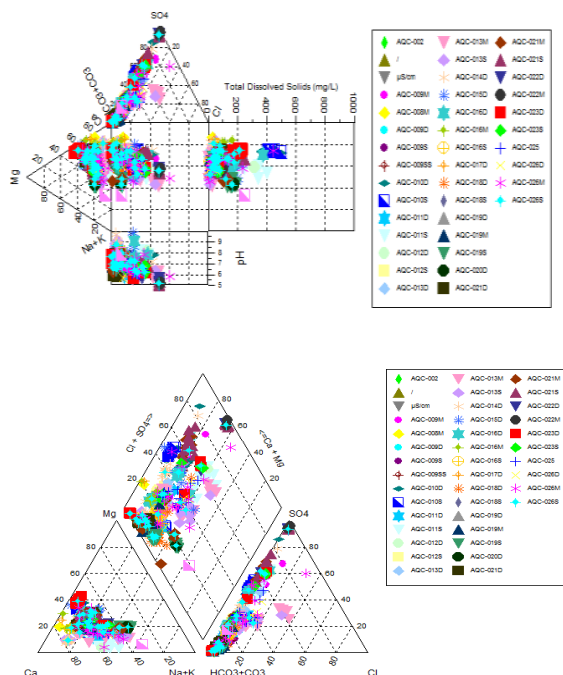


Figure 3: Diagram shows analysis of hydro geochemical processes in Bhimber

4. CONCLUSION

The results from this review regulate in Bhimber Azad Kashmir on drinking water characteristic appraisal. Bacteriological tainting was clear in all water sources with not many exemptions. Along these lines huge number of individuals is experiencing water borne infections around here. Anyway, no huge variety was seen in physical and compound nature of water. This accounted a few blending in with drinking water as essential and auxiliary pollution. Essential pollution is because of helpless sewerage arrangement of business and private wastage and optional defilement is because of inclusion of some harmful synthetic mixtures. Quantitative and subjective investigation of water regarding microbes and mindfulness about water borne illnesses ought to be started at the earliest opportunity. The outcomes finished up from this review alarm that the water serve water contamination should be mulls over as significant medical problems. Contextual investigation strongly suggests that, change the sewerage framework and keeps up the precise assessment arrangement of currently introduced water review plants.

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