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A Study of the physical parameters of different water sources, among major four districts of Punjab

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Abstract

People on globe are under tremendous risk due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Due to increased human population, industrialization, use of chemical fertilizers and man-made activities, water is getting highly polluted with different harmful contaminants. It is necessary that the quality of drinking water should be checked at regular time interval, because due to the use of contaminated drinking water, human population suffers from various kinds of water borne diseases. In the present study, physical analysis of water samples from four major districts (Gurdaspur, Bathinda, Ropar and Moga) of Punjab was done and effective results were obtained. The comprehensive value of pH in the four districts from the different sources of water fluctuated within the range between 6.89±0.01 to 8.31±0.14. The maximum pH was reported from Moga in canal water (8.31±0.14) and minimum from Ropar district in Ro water (6.89±0.01). The electrical conductivity (EC) of water samples from the different study areas ranged between 54.24±18.86 to 2338.8±367.02. The least value of conductivity was observed in RO water of Gurdaspur and maximum reported in motor water sample of Bathinda district (household). The values of TDS was ranged in between 37.72±11.55-1651.80±170.45.The salinity of different water sources from the four districts ranged in between 29.70±7.68 to 1138.12±174.54 and the peak salinity of water observed in motor water (household) of Bathinda and least in RO of Gurdaspur district.

Keywords: pH, EC, TDS, Salinity and household

Introduction

Our dependence on fresh water resources has accelerated in last century due to rapid growth in world population and economic development. An access to water of good quality is of basic importance to human physiology. However, consumption of contaminated water causes health risk and it create serious situation in rural areas. In watersheds, quality of surface water significantly decreases due to anthropogenic activities (Anhar *et al*., 1998; Moho *et al*., 1997a; Moho *et al*., 1997b; May *et al*., 2006). The quality of water is vital concern for mankind since it is directly linked with human welfare. It is unique liquid, without which life is impossible (Bhutiani *et al.*, 2016). The world water is polluted within 2 million waste discharged by different sources like sewage, industries and agriculture every day at global level (UNWWAP, 2003). In India, 85% of the rural population solely depended on ground water. Physico-chemical quality of water in rural areas is affected by prolonged discharge of industrial effluents, agricultural chemicals, domestic sewage and solid waste dump. Industries produce millions of cubic meters of effluent every year and the wastewater produced may be released into the surrounding water bodies treated on-site or at municipal treatment plants (Bhutiani *et al.*, 2017). Water as resources is under relentless pressure due to population growth, rapid urbanization, large scale industrialization and Environmental concern (Bhutiani and Ahamad, 2018). It is very essential and important to test the water with different physico-chemical parameters before it is used for drinking, domestic, agricultural or industrial purpose. Physico-chemical tests include the parameters for physical appearance (temperature, pH etc.), chemical nature (BOD, COD, hardness etc.) as well as heavy metals and pesticides residues analysis. The pH is a measure of acidic or basic nature of water and is controlled by the carbon dioxide-bicarbonate-carbonate equilibrium system.

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According to WHO report, pH of raw water range within 6.5-8.5. Extreme values of pH cause corrosion of pipes, reduced photosynthetic activity in plant and many health effects in humans and animals like irritation in eyes and skin (Patil *et al*., 2012; WHO, 2003). The alteration in water pH is accompanied by the change in physio-chemical parameters including organic and inorganic solutes present in water (Vyas *et al.,* 2015; Bhutiani *et al.,* 2017).Total dissolved solids (TDS) comprise inorganic salts (calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that are dissolved in water. According to WHO (2003), dissolved solids in water may affect its taste as follows: excellent (>300 mg/litre), good (300-600 mg/litre), fair (600-900 mg/litre), poor (900-1200 mg/litre) and unacceptable (<1200 mg/litre). In humans, inverse correlation has been found in concentration of dissolved solids and the incidence of cancer, coronary heart disease, arteriosclerotic heart, cardiovascular diseases. Electrical Conductivity (EC) is the ability of water to pass electrical flow. It is directly related to the concentration of dissolved salts and inorganic materials. The conductivity of water does not known to have direct impact on human fitness. The high conductivity lowers the aesthetic value of water by giving mineral taste and cause corrosion of metal surface of equipment which is used for agricultural practices as well as for home appliances (Rahmanian *et al*., 2015). The salinity of water is expressed as parts per thousand (ppt) or g/L. It is defined as the total concentration of all dissolved salts in water. It can be derived from the conductivity reading by using a conversion factor which is usually 0.5. In the present study, the physico-chemical assessment of ground water samples from four major districts of Punjab was determined. The main objective of the study was to analyse the four physical parameters of water samples collected from different water sources.

Material and Methods

A cross sectional prospective study was conducted in rural areas of four major districts viz. Gurdaspur, Bathinda, Ropar and Moga, Punjab in the year 2015. Water samples were collected from all the sites to assess the physico-chemical quality of both domestic water and water used for agricultural activities. The water samples were collected from five sources namely: household RO, household submersible, hand pump, canal water and field submersible. From each sampling source, three replicates were collected. In the current study, major four water quality parameters viz. pH, salinity, total dissolved solids (TDS) and Electrical conductivity (EC) were tested using APHA 2012, Khanna and Bhtiani 2011. The household samples were collected from submersible pump and filter water sources from randomly selected houses. For the collection of samples, 500ml polyethylene (PE) bottles washed with deionized water were used. Before sampling and to get truly representative samples, taps were fully opened and allowed to run for 2-3 minutes. The pH, salinity, total dissolved solids (TDS) and electrical conductivity (EC) of the water samples were analysed using PCSTestr 35. Data was analyzed by using wasp 1.0. The values were tabulated as mean ± S.D. The results of physico-chemical analyses were compared for different sources and also with national (BIS) and international (WHO) standards for drinking water. The p-value < 0.05 was considered to indicate statistically significant association.

Results and Discussion

Increase in urbanization, industrialization, agriculture activity and various human activities have increase the pollution of surface water & ground water. As the safe & potable drinking water is needed. various treatment methods are adopted to raise 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, Electrical Conductivity, Calcium, Magnesium, Total Hardness, Carbonate, Bicarbonate, Chloride, Total Dissolved Solid, Alkalinity, Sodium Potassium, Nitrate, DO should be within a permissible limit . The quality of water is a vital concern for mankind, since it is directly linked with human welfare. It is a matter of history that fiscal pollution of drinking water caused water borne diseases which wiped out entire population of these cities. At present, the menace of water borne diseases and epidemics still booms large on the horizons of developing countries. Polluted water is the culprit in such cases

Table1. Various physical parameters of wate r sources

Water Sample Sources		District	pH	EC	TDS ppm	Salinity
Household	RO Water	**Moga***	7.45±0.12	153.26±73.50	108.72±52.44	74.95±32.07
		Gurdaspur**	6.96±0.11	54.24±18.86	37.72±11.55	29.70±7.68
		Ropar***	6.89±0.01	59.90±12.83	43.03±9.7	31.45±5.58
		Bathinda******	7.55±0.09	285.44±42.59	201.67±29.54	134.17±20.21
		CD (p=0.05)	**0.21**	**84.28**	**52.25**	**32.91**
	Motor	**Moga**	7.55±0.03	1122.05±325.54	863.67±205.2	496.50±215.14
		Gurdaspur	7.40±0.16	701.30±26.73	497.83±19.59	336.78±14.47
		Ropar	7.17±0.1	837.50±131.17	595.67±92.67	406.34±65.67
		Bathinda	7.73±0.05	2338.8±367.02	1651.80±170.45	1138.12±174.54
		CD (p=0.05)	**0.18**	**525.25**	**291.73**	**290.95**
Field	Canal	**Moga**	8.31±0.14	225.67±2.51	163.00±2.00	110.33±1.53
		Gurdaspur	7.91±0.1	178.91±5.51	127.67±5.03	85.70±2.96
		Ropar	7.56±0.04	213.33±0.58	151.67±0.58	101.33±0.58
		Bathinda	7.08±0.07	240.67±1.53	172.33±1.53	114.00±1.00
		CD (p=0.05)	**0.14**	**6.89**	**6.09**	**3.80**
	Submersible	**Moga**	7.63±0.04	762.67±6.51	541.33±5.03	365.33±4.16
		Gurdaspur	7.40±0.16	701.30±26.73	497.83±19.59	336.78±14.47
		Ropar	7.30±0.06	622.67±2.08	443.33±3.06	298.33±0.58
		Bathinda	7.72±0.01	1315.00±0.01	944.00±2.00	653.00±1.00
		CD (p=0.05)	**0.19**	**25.62**	**18.99**	**14.67**
Hand Pump		**Moga**	7.98±0.25	1575.84±294.04	1121.87±211.54	782.69±150.97
		Gurdaspur	7.26±0.04	798.00±58.82	566.00±41.79	385.11±29.34
		Ropar	7.47±0.04	406.17±61.17	841.83±122.50	593.50±82.17
		Bathinda	7.97±0.07	1837.11±7.34	1308.33±2.89	914.89±2.17
		CD (p=0.05)	**0.27**	**291.85**	**233.53**	**165.59**

p (0.05) of city within different water sources (pH) = 0.28*, 0.22**, 0.11***, 0.12****
p (0.05) of city within different water sources (EC)=328.98*, 59.53**, 114.44***, 309.63****
p (0.05) of city within different water sources (TDS)= 225.61*, 41.65**, 283.785*** ,145.14****
p (0.05) of city within different water sources (Salinity)= 194.71*, 29.19**, 79.19***, 146.17****
p(0.05) of overall (pH) = 0.17
p (0.05) of overall (EC) =217.51
p (0.05) of overall (TDS) = 136.60
p (0.05) of overall (Salinity) = 121.86

(Nollet, 2000). The pH values of water samples from each of the sample areas are presented in table The comprehensive value of pH in the four districts from the different sources of water fluctuated within the range between 6.89±0.01 to 8.31±0.14. The maximum pH was reported from Moga in canal water (8.31±0.14), while minimum from Ropar district in Ro water (6.89±0.01). The values of pH was significantly varried ($p < 0.05$) across the various water sources from an identical district

and same trends also follow within the alike water source from different districts. However, the pH ranged between 6.5 and 8.5 usually considered good water quality (WHO 2003).

The electrical conductivity (EC) of water samples from the different study areas ranged between 54.24±18.86 to 2338.8±367.02. The least value of conductivity in various water sources from four districts was observed in RO of Gurdaspur and maximum reported in motor water sample of Bathinda district (household). The value of electrical conductivity was significantly varied ($p \leq 0.05$) between different districts of same water sources and also in same district within different water sources given in table1. It was documented that if same water source between all districts studied then the trend of maximum EC was found in Bathinda, which was followed by Moga district and rest other districts were on bottom line. From Bathinda district the maximum value of EC reported in motor (household), that was significantly varied from the rest of other sources. In Moga district the maximum EC level reported from handpump sample (1575.84±294.01), which was also significantly varied from other water sources. The values of TDS ranged in between 37.72±11.55-1651.80±170.45. The TDS values of Bathinda district water samples from the various sources were found comparatively maximum as compared to other districts. The water samples of various sources from the four districts were significantly different ($p \leq 0.05$, 136.60) with each other (detail in table1.). It was reported that the TDS within different water sources of districts Moga, Gurdaspur, Ropar and Bathinda varied significantly with p=0.05 values 225.61, 41.65, 283.78 and 145.14, respectively. .

The pooled salinity of four district from the different sources of water was varied significantly (p=0.05, 121.86) with each other. The salinity of various water sources from the four districts ranged in between 29.70±7.68 to 1138.12±174.54 and peak salinity reported in motor water (household) of Bathinda and least in RO water of Gurdaspur district. It was revealed that the salinity level of Moga, Gurdaspur, Ropar and Bathinda within different water sources varied differently with p=0.05 values 194.71, 29.19, 79.19 and 146.17, respectively. The RO, motor (household), canal, submersible (field) and handpump whithin four study districts were also varied significantly with p=0.05 values 32.91, 290.95, 3.80, 14.67 and 165.59, respectively.

Conclusion

In this study four water parameters pH, EC, TDS and Salinity under four districts Moga, Gurdaspur, Ropar and Bathinda were studied with the use of various water sources. The good quality water is an indispensable feature for preventing diseases and improving the quality of life. The quality of water mainly depends on the type of the pollutant and nature of mineral found at particular zone. It was concluded that the pH value of water from the four districts was within permissible level (6.5-8.5) of WHO 1984.The TDS level of water is an important parameter to measure water quality and comprises with the inorganic salts and little amount of organic matter that are dissolved in water (WHO 2003). The motor (1651.80±170.45) (household) and handpump (1308.33±2.89) water from bathinda district reported above the permissible range (1200 ppm) of WHO 1984, which is not suitable for drinking and on the other hand the water samples of handpump from Moga district was also on the borderline of TDS value, which is also not feasible for drinking, according to WHO. The availability of good quality water is an indispensable feature for preventing diseases and improving the quality of life. It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physical-chemical parameters.

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