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Review Paper

Water Potability Test of Drinking Water collected from sub Regions of district Jalandhar, Punjab, India: A Review

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Abstract

Water not containing any sufficient quantity saline material and free from contaminants is fit for drinking and is regarded as a mineral water. A water is said to be portable which is without any hamful factor, but due to increase in urbanization , industries and interferance of human activities has lead to increase in water pollution level which causes water unfit for drinking to the human population and causes various harmful diseases. This paper includes the analysis of pHysico-chemical properties of drinking water like BOD, COD, Alkalinity ,hardness, chloride, pH and bacteriological examination of collected tap water from various sub regions of district Jalandhar. Various papers on water portability test by different researchers has also been summarized in this article which are helpful for further treatment of the water system.

Keywords: pH, BOD, COD, minimum probable number (MPN), Eosin methylene blue (EMB) agar.

Introduction

Water is regarded as an essential and abundant source to the living organisms on the earth for their survival and growth but in India, 70% of the available water has been polluted by industries or domestic wastes. Drinking water contaminated with different chemical or physical sources has the greatest impact on health of human being, especially in developing countries. Common contaminants of water has been classified into pHysical, chemical and biological sources. PHysical sources are turbididty, colour, odour and other floating matter. Chemical sources comprises of Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), chlorides, alkalinity, pH, hardness etc. biological source of contaminants are the coliform bacteria and pathogens causing gastrointestinal diorders.

Material and Methods

For analysis of drinking water 10 samples of tap water from different regions of Jalandhar district were collected in sterile bottles. Different parameters were carried out to test the water potability of collected samples such as determination of chlorine for which (0.025N) silver nitrate solution and (5%) postassium dichromate solution were used. For calculating total alkalinity in water samples (0.1N) HCl solution and methyl orange indicator were used, for checking hardness of collected water samples, (0.01M) EDTA solution, Eriochrome black indicator and buffer solution of pH=10 were used. For determining BOD ferrous sulpHate solution, phenosafranin and fehling solution B was used. For determination of COD (0.1N) potassium dichromate, (0.1M) sodium thiosulpHate solution, conc sulpHuric acid and starch solution were used. PH strip was used for checking the nature of collected water samples whether the samples are acidic, basic or neutral and last biological parameter was carried out by determining most probable number count method for presumptive and confirmed test of coliform bacteria in the collected samples for which lactose broth culture tubes and Eosin methylene blue agar plates were cultured.

Review of past work

This study reveals the work done for the groundwater near the polluted canal area on Kiccha town in Uttarakhand state on water quality indexing (WQI).Seven samples were taken from the different hand pumps near the paha canal for analysing different parameters like pH, color, odor, hardness, alkalinity, chloride, BOD, COD, nitrogen, phosphorous and heavy metals. The values were compared with that of standard desirable limit and World Health Organization. The groundwater was found to be very hard in all the locations. The samples taken from near canal were having high values of BOD and COD. Arsenic and mercury were found to be in high concentration above the permissible limit. The values of WQI were found to be in the range of 63.91 to 72.53 revealing that sample collected from handpumps near the polluted canal area is in medium quality range wheras locating far away from the canal are of good quality[1].

In this paper, physico-chemical properties such as Total dissolved solids (TDS), biochemical oxygen demand (BOD), Dissolved oxygen (DO), chemical oxygen demand (COD), alkalinity, hardness, pH, chloride, temperature and bacteriological examination of hot spring water from Vashisht

region of Kullu dist of Himachal Pradesh, India were studied and the results were compared with WHO potability parameters and it was found that water was potable for drinking. Hot springs are the places where temperature of the water lies above the mean of annual air temperature of that region and according to biological parameters, coliforms were found to be absent in this region. Below are the results of the experimental work as compared to the standard values of WHO[2,3].

The study was conducted in rural households of Udupi taluk, Dist Udupi, Karnataka. This study was conducted by using Bactoscope-water portability kit and interview scheduled. A total of 180 households were interviewed and sample of drinking water was collected from each of the households using two stage sampling. The analysis was done using SPSS 15 statistical package. The results were expressed in percentages and proportions. Chi square test was applied to find the results of bacteriological potability of water. And it was estimated that 52.8% of the household were using bacteriologically non potable water for drinking purposes. People below poverty line and Katcha house was significally associated with bacteriologically potable water. 62.8% of the households were collecting the water from open wells. 98.3% of households reported that drinking water is available around the year and majority of them collected the water from the source on a daily basis[4,5].

The study indicates that Examining the bacteriological factor of water depends mainly on the indicator microorganisms such as *E.coli*, coliforms and *P.aeruginosa. E.coli* comes under the coliform group and consider as an indicator of faecal pollution. Faecal coliforms are referred as *thermotolerant* coliforms. At present *E coli* provides best indication of bacterial contaminantion in drinking water. Isolation of *E.coli* from food as an indicator organism not proved for isolation of pathogenic strains of E.coli. Pathogenic strains shown delayed growth at 44 and 45.5 degree celcius. Some of the pathogenic bacteria will not produce acid and gas from lactose in LST or EC broth in between 48 hours of incubation. Media containing sodium lauryl sulpHate causes plasmid loss at 44.5 degree celcius growth which encode virulence factors with pathogenic strains. Therefore, the methods used for detection of *E.coli* as an indicator organism should not be consider for isolating pathogenic strains of bacteria from water or food.

Isolating enterohemorrhagic *E.coli* 0157:H7, a strain of *E.coli* uses different methods for isolating other *E.coli* strain. Below table shows *E.coli* 0157:H7 has some differences from other *E .coli* strains biochemically. From the recent studies we can say that defining *E.coli* by IMViC method is not adequate for identification of *Ecoli* strains which do not show IMViC test. Hense, additional tests are essential for identification.With the emergence of coliform test by using higher incubation temperature selection of coliforms of fecal origin became easy.

EPEC-enteropathogenic *E.coli*, ETEC-enterotoxigenic *E.coli,* EIEC- enteroinvasive *E.coli*

Problems related to *E.coli* used as a indicator for fecal contamination has been found. First it is difficult to find and count their number.Second its life span which is short. Third, it is found in the tropical environment.Therefore presence or absence of *E.coli* via bacterial culture method does not provide positive results.Therefore coliform test became the basis for quality water harvesting[6].

Table-1
Determination of PHysico-chemical properties and comparison of results with WHO

PHysico-chemical properties	Experimental values	WHO standards	Inference
Total Dissolved solids	400mg/lt	500 mg/lt	Portable
Fixed residue	200 mg/lt	00	Portable
Dissolved oxygen	2.52 mg/lt	7 mg/lt	Portable
Biochemical oxygen demand	4.8 mg/lt	30 mg/lt	Portable
Chemical oxygen demand	0.048 mg/lt	250 mg/lt	Portable
Alkalinity	196 mg/lt	200 mg/lt	Portable
Chloride	197.38mg/lt	250mg/lt	Portable
Hardness	165.2mg/lt	300mg/lt	Portable
PH	7	6.5-8.5	Portable

Table-2
Biochemical Tests of Bacterial Isolate

Biochemical test performed	Inferences/results
Indole test	-
Methyl red test	-
Citrate utilization	-
Glucose fermentation	+

This study was also done for the quantification *of E.coli* from drinking water in Bangladesh. Fifty water samples were collected and *E.coli* was determined by observing gas formation in the test tubes after inoculation and incubation of water samples into the lactose fermentation broth (LB). Then quantification of *E.coli* was done on the basis of Minimal Probable number (MPN) method. Then the confirmation test was performed using Eosin Methylene Blue agar from which positive isolates were undergone Gram staining procedure. Out of fifty water samples five test were found to be positive. Microbiological study was carried out with 10 samples of tap water collected from various regions of Jalandhar district. These were collected in sterile bottles and brought into laboratory and kept at appropriate conditions before microbiological analysis.

Isolation of coliform: The presumptive test for the presence of lactose fermenting coliform were determined in the collected tap water samples by observing gas formation in the durham tubes.

For confirmative test positive bacteria from presumtive test were inoculated in Eosin Methylene Blue (EMB) agar plates. After incubation of 24 hrs at 37 degree celcius morpHology of the growth of bacteria were observed. The MPN was done by determining the number of tubes showing gas formation. 4 out of 10 tubes shown positive test results for coliform bacteria ,and the results were compared with values given by Indian Standard Institute [7].

Now on the basis of results carried out in sub regions of Jalandhar dist by collecting 10 water samples from taps in sterile bottles. By performing the water quality tests we have compared the results with that of ISI specifications and found that amount of chlorine to be greater than ISI standards in the areas of PHagwara and cantt dist Jalandhar, which confirms the salty nature of the water. Alkalinity is present in water samples but the amount is within the ISI limits ie: 200mg/lt. pH level is found to be normal in the study area.7 number of coliform bacteria were found to be present in the water samples which indicates sewage contamination in some of the regions. Hardness is found to be within ISI limits ie: 300mg/lt in the study area of Jalandhar dist.

Discussion: From the above results of Jalandhar dist we can say that water of Jalandhar dist is potable for drinking purpose as the values of the tested parameters for water quality test are with in the specified limits of Indian standard specifications.

Table-3
Showing results of IMViC Test by different strains of *E.coli.*

Test performed	E.coli	EPEC	EIEC	0.157:H7	ETEC
Lactose fermentation test	Positive	Positive	V	Positive	Positive
Lactose test	Positive	Positive	Negative	Positive	Positive
Sorbitol fermentation test	Positive	Positive	Negative	V	Positive
Motility test	Positive	Positive	Negative	Positive	Positive
Indole test	Positive	Positive	V	Positive	Positive
Methyl red test	Positive	Positive	Positive	Positive	Positive
Voges-proskauer test	Negative	Negative	Negative	Negative	Negative
Citrate utilization test	Negative	Negative	Negative	Negative	Negative

Table-4
Below are the results analysed in Jalandhar Dist, Punjab in comparison of ISI specifications.

Sample	Chlorine mg/lt	Alkalinity mg/lt	Hardness (ppm)	Bod mg/lt	Cod mg/lt	PH	Coliforms (mpn)
T1	781	80	260	3.0	0.008	7.0	1
T2	710	90	240	3.2	0.008	7.0	0
T3	1420	40	300	2.3	0.007	7.5	2
T4	852	120	200	2.5	0.008	7.0	1
T5	852	120	200	4.0	0.007	7.0	0
T6	710	100	260	3.5	0.006	7.5	2
T7	1136	40	220	2.5	0.006	7.0	0
T8	781	40	240	2.5	0.007	8.0	0
T9	852	60	240	2.2	0.008	7.5	1
T10	710	40	200	4.0	0.0076	8.0	1
ISI specified limits	250 mg/lt	200mg/lt	300 ppm	0.3mg/lt	200	6.5-8.5	1-10 cfu/100 ml

Conclusion

By summarizing the results from the various studies we have concluded that water quality of drinking water has been decreased due to fecal contamination and industralization and health agencies need to take essential measures so as to ensure the safe drinking water among people. Water potability analysis is useful test for detecting water contamination by harmful chemicals or pathogens in order to take preventive measures for the safe drinking water among population.

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