ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

DETECTION OF QUALITY OF WATER FROM DIFFERENT PLACES OF DEHRADUN, UTTRAKHAND STATE

Naveen Gaurav

(Assistant Professor Department of Biotechnology, S G R R P G College Dehradun, U.K.)

Sumaya Bashir

(M.Sc Biotechnology and Project Trainee, Department of Biotechnology , SGRRPG College Dehradun, U.K. **)**

Kumud Saklani

(Assistant Professor, Department of Biotechnology, S G R R P G College Dehradun, U.K.)

Arun Kumar

(Assistant Professor, Department of Biotechnology, S G R R P G College Dehradun, U.K.)

Hemchandra Pant

(JRF, Department of Biotechnology, S G R R P G College Dehradun, U.K.**)**

Komal

(M.Sc, Department of Biotechnology, S G R R P G College Dehradun, U.K.**)**

Hira Singh Gariya

(B.Sc, Department of Biotechnology, S G R R P G College Dehradun, U.K.)

1. ABSTRACT

Based on the discoveries of satellites, it appears that water is a unique substance in our discovered universe. The presence of water on earth is in itself unique, for the planet earth

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

has few natural liquids. Water is odorless, tasteless, transparent liquid that is colorless in small amounts but exhibits a bluish tinge in large quantities. It is the most familiar and abundant Liquid on earth. As a chemical compound, a water molecule contains one oxygen and two hydrogen atoms that are connected by covalent bonds. Water is a liquid at standard ambient temperature and pressure, but it often co-exists on Earth with its solid state, ice; and gaseous state, steam (water vapor). It also exists as snow, fog, dew and cloud. In solid form (ice) and liquid form it covers about 70% of the earth's surface. It is present in varying amounts in the atmosphere. Water covers about 71% of the Earth's surface. On Earth, 96.5% of the planet's water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies, and 0.001% in the air as vapor, clouds (formed of ice and liquid water suspended in air), and precipitation. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice (excepting ice in clouds) and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, Water is the prime resource of man's food supply and his most important household and industrial tool. But most important is the fact that water is a major constituent of all living matter, Most of the living tissue of a human being is made up of water; it constitutes about 92% of blood plasma, about 80% of muscle tissue, about 60% of red blood cells, and over half of most other tissues. It is also an important component of the tissues of most other living things comprising upto two-third of the human body. Next to the air we breathe, water is mankind's most important substance. Dehradun, is the capital city of the Uttrakhand state, lies between latitudes 29° 55' and 30° 30' and longitudes 77° 35' and 78° 24'. It comprises townships of Vikasnagar, industrial area of Selaqui and townships of Rishikesh. The district head quarter lies in an intermountain Doon valley surrounded by the lesser Himalayan ranges in the north and Siwalik Hills in the south, the river Ganga in the east, and the river Yamuna in the west. The water divide of Ganga and Yamuna passes through the city. The study area has humid subtropical to tropical climate with heavy precipitation during July to September, moderate to high sunshine, humidity and evaporation. The average annual precipitation is about 205 cm in Dehradun district and about 150cm in

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Haridwar district. table. The quality of water has severely deteriorated at various places of Dehradun.

Key words:- Natural liquids, water, water vapor, Earth's surface, living matter, Dehradun, Uttrakhand state.

2. INTRODUCTION

Water in Dehradun Valley of India

The Himalayan Rivers have an important place in Indian culture and tradition. They are lifeline of majority of population in cities, towns and villages and are considered sacred (Semwal and Akolkar, 2006). Tons river is one of the most major perennial Indian Himalayan Rivers originating from Bandar Punch Mountain and an important tributary of Yamuna River. This river joins Yamuna at Kalsi in the North Western part of Dehradun valley, which is located 48 km away from Dehradun. In India, lot of religious activities take place all round the year. Most of the temples and ritual places are located near the aquatic resources like ponds, lakes and rivers etc. (Ujjania and Multani, 2011).

Present study was conducted to find out the impact of touristic activities on the water quality of Sahashtradhara Stream round the year. Some selected physiochemical parameters viz. temperature, pH, transparency, turbidity, total solids(TS), total dissolved solids(TDS), dissolved oxygen(DO), biochemical oxygen demand(BOD) and chlorides monitored during study period. Three study sites viz. Site-I (reference site), Site-II (main attraction of tourist) and site-III (dilution zone) were selected for the sampling. The relative differences for temperature was 8.05% higher, pH 1.06% higher, turbidity 52.24 higher, transparency 22.81% lower, total solids 18.31 higher, TDS 28.64% higher, DO 6.54% lower, BOD 21.78% higher, chlorides 22.29% higher at Site-II as compared to reference Site-I. The pH showed minimum (1.06%) relative difference while turbidity showed maximum (52.24%) relative

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

difference at site-I as compared to reference site (site-I). It was found that significant change in water quality of Sahashtradhara stream due to different touristic activities (Bhadula *et al*., 2014). Water quality of Tons river near Tapkeshwar temple in Dehradun was assessed in terms of their physicochemical parameters. Samples were collected on the monthly basis since January to March, 2011 from three sites viz confluence zone of temple, upstream and downstream river water. Total numbers of nine samples were analyzed and a correlation matrix among parameters was determined. River water was showing alkaline character throughout the study period. pH, alkalinity and chloride were found to be under the acceptable limit of BIS (2009), although turbidity and hardness were exceeding the limits at all three sites but total dissolved solid only on confluence zone and downstream river sites. Water samples from the confluence zone near the temple showed slightly higher concentration of all the parameters than other sites. The present study reveals the slight effects of various religious activities on confluence site of tons river water near the temple which were found to be under the prescribed permissible limits of BIS (2009) (Madan *et al* 2013).

27 genera belonging to seven orders of macro vertebrates were found which include *Ephemeroptera, Diptera, Coleoptera, Hemiptera, Plecoptera, Odonata and Trichoptera* indicating good quality of water in River Yamuna at Kalsi. Many genera were seasonally and monthly absent at different times in the river; however the overall diversity was found to be maximum in winter and summer. Correlation between the hydrological attributes showed good relationship and Transparency, dissolved oxygen and pH were found to be most important variables in shaping benthic faunal assemblage (Fouzia Ishaq and Amir Khan., 2013).

The study was undertaken to evaluate the water quality of Dehradun city the capital of Uttarakhand by an affable means the physiochemical and microbiological studies are most important regions by which we are able to test the portability of water. The isolation and characterisation of the pathogenic micro organism from the water sample collected was the main emphasized area of the study. The sample collected from three areas of Dehradun city

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Bullupur chowk, railway station and Doon hospital. The safest water sample was of the Doon hospital while the most contaminated sample was from the railway station. The bacterial isolates were *Escherichia coli, Pseudomonas aeroginosa, Staphylococcus aureus, Proteus sp.* The sample was inoculated at 37℃ for 24 hours or 48 hours for appropriate bacterial growth. Thus we can use this study for the assessment of the water sample and to resolve the hygienic problems of the water (Sapkota *et al*., 2012). An attempt has been made to understand to provide information on the physiochemicalcharacteristics of Golden Key Lake which is being used for aquaculture, were studied between 2008 to Feb 2009. All the parameters has been correlated with each other and each parameters has shown correlation matrix with different parameters at selected sites (Chauhan *et al*., 2012).

Doon valley forms part of Dehradun District, Uttarakhand in the Himalayan Mountain Belt. Doon valley area is drained by the mighty rivers, Ganga, Yamuna and their tributaries prominent of which are Asan, Tons, Rispana and Song rivers. Though the area is bestowed with plenty of surface water resource, the major drinking and irrigation requirements of the valley are met through groundwater. Therefore, it becomes imperative to know the scientific attributes of the ground water bearing formations so that the ground water may be developed and managed in an objective and controlled manner. There are two aquifers in the valley, shallow aquifer under unconfined conditions and deeper with confined conditions. Pumping tests are carried out, one in each of the aquifers, to estimate the aquifer parameters and well characteristics. These values infer that these aquifers are with high potential. Groundwater quality is also analyzed through hydro chemical data obtained from 20 samples covering the area. Ninety five percent of the samples fall in field 5 of the Richard's diagram where alkaline earths dominate over the alkalis and weak acids exceed the strong acids. The data suggests that the groundwater in Doon Valley is potable and suitable for domestic and irrigation purposes (Rawat *et al*., 2011).

3. MATERIAL AND METHODS

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

3.1. Collection of samples

The samples of drinking water for different examination were collected in clean, sterilized, narrow mouthed plastic bottles from four different places of Dehradun in the month of January 2014 and was kept in Refrigerator. These samples include drinking water of Doon Hospital, drinking of Kamla hostel (near clock tower), drinking water of Railway station and drinking water of Girls hostel of S.G.R.R (P.G.) College. The sample should be the representative of water to be tested and that should be collected with utmost care to ensure that no contamination occur at the time of collection. The volume the sample should be sufficient for carrying out the entire test required.

3.2. Basic Glassware and instruments used

Glass beakers, flasks, petri plates, measuring cylinder, test tubes, pipettes, dropper, spatula, culture flasks, burette, spreader, glass rods, glass slides, cover slips, Durham tubes, culture tube test tube racks, cotton plugs, muslin(cheese) cloth. Autoclave, Water bath, Thermometer, Laminar air flow(LAF),Colony counter ,Refrigerator, Incubator, Hot Air Oven, Digital Balance, hot plate, microscope, pH strip etc.

3.3.Basic chemicals used

Nutrient agar, Alcohol, Lactose broth, Potassium dichromate ,Sodium thiosulfate, Starch solution, Crystal violet, Iodine soln.,H_2SO_4, Safranin, MacConkey's agar, Distilled water etc.

3.4.Methods

Physiochemical examination of water

3.4.1.pH: The pH value determines whether water is hard or soft. The pH of pure water is 7, water with a pH lower than 7 is considered acidic and with pH greater than 7 is considered basic. The normal range for pH in surface water is 6.5 to 8.5 and for ground water it is 6 to

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

8.5. Alkalinity is a measure of capacity of water to resist a change in pH that would tend to make water more acidic. The measurement of alkalinity and pH was needed to determine the corrosiveness of water.

Procedure

The pH of water samples was determined by using pH strips. The pH strip was dipped in the water samples individually and allowed to dry and finally the color obtained was matched with the pH scale given which determines the pH of the water samples.

3.4.2. Microbial examination

Standard plate count (SPC) method

Standard plate count technique is useful in determining the efficiency of operations for removing or destroying organisms as during sedimentation, filtration or chlorination .A microbial count can be made before and after a specific treatment and results obtained indicate the degree to which the bacterial population has been reduced. A water sample containing less than 100 bacteria /ml is considered to be of good quality. The total bacterial count is made by calculating the number of colonies appearing on Agar plates after incubating at 20^0C and 37^0C for 72 and 24 hours respectively to which aliquots of water samples are added (Aneja, 2005).

Procedure

1. Prepare nutrient agar medium (5.6gm in 200ml distilled water), heat for some time till it dissolves completely.
2. Autoclave it for 15 minutes and cool it, then pour it equally in eight pre sterilized plates labeled as 1,2,3,4 & A, B, C, D with two different sample amounts i.e. 1ml & 0.1ml.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

3. Now mix the water samples thoroughly by shaking vigorously and pour/inoculate four different samples at two different amounts i.e. four plates with 0.1ml and other four with 1ml of sample water with the help of micro pipettes.
4. Now mix the inoculums by rotating the plates for the uniform distribution of organisms and incubate one set of plates i.e with 0.1ml sample water at 37^0C for 24 hrs. & second set i.e with 1ml water sample at 20^0 -22^0C for 72 hrs.
5. Finally after incubation count the microbial colonies grown on the eight respective plates with the help of colony counter.

3.4.3. Gram staining method

This technique was used to differentiate two types of bacteria as Gram positive and Gram negative bacteria. The composition of bacterial cell wall is the bases of Gram staining. The cell wall of Gram negative bacteria contains alcohol soluble lipids while as Gram positive bacteria lack lipids and therefore resist with decolorizing agent (alcohol) and retain the color of primary stain (crystal violet), while after decolorizing of Gram negative it takes the color of counter stain (safranin) (Aneja, 2005).

Procedure

1. Take the mixed culture of eight different microbial colonies obtained from the standard plate count method (both 0.1ml&1ml plates) and spread/streak them on eight different slides namely A,B,C,D and E,F,G,H.
2. Apply crystal violet on these slides for 30 seconds and rinse with water for 2-5 times (all cells will lack primary stain).
3. Now apply iodine solution or fixing agent for 1 minute and rinse with water for 2-5 times (violet color will completely fix with the cell surface).
4. Wash the slides with 95% alcohol solution or decolorizing agent and rinse with water.
5. Now apply safranin dye or counter stain on the slides and wash with water to remove excess stain and observe the slides keenly under microscope (gram positive retain violet color and gram negative retain pink/red color).

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

3.4.4. Chemical oxygen demand (COD) Method

COD is a better estimate of the organic matter, which leads no sophistication and is time saving. However COD does not differentiate the stable organic matter from the unstable form. The amount of organic matter in water is estimated by their oxidability by chemical oxidant such as potassium dichromate (the constituent carbon and hydrogen are oxidized and not the nitrogen).In this method the organic matter is first oxidized with a known volume of $K_2Cr_2O_7$ and then the excess of oxygen is allowed to react with potassium iodide to liberate iodine in amounts equal to the excess oxygen, which is estimated titrimetrically with sodium thiosulfate solution using starch as an indicator (Aneja, 2005).

Procedure

1. Take 300ml flask and pour 50ml of water sample in each (i.e in triplicate).
2. Simultaneously run distilled water blanks standards (also in triplicate).
3. Add 5ml of $K_2Cr_2O_7$ solution in each of the six flasks.
4. Keep the flasks in water bath at 100^0C for 1 hr.
5. Allow the samples to cool for 10 minutes then add 5ml of potassium iodide in each flask.
6. Now add 10ml of H_2SO_4 in each flask.
7. Titrate the contents of each flask with 0.1M sodium thiosulfate until the appearance of pale yellow color.
8. Add 1ml of starch solution to each flask (solution turns blue).
9. Titrate it again with 0.1M sodium thiosulfate until the blue color disappears completely.

3.4.5. Multiple –tube fermentation (MTF) test or Multiple tube test

Multiple- tube fermentation test is the most oftenly used technique for the sanitary analysis of water. The test is used to detect coliform that make up approximately 10% of the intestinal

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

microorganisms of humans and other animals and also have found widespread use as indicator organisms of faecal contamination.

The test is performed sequentially in three stages: Presumptive, Confirmed and Complete test.

3.4.6. Presumptive coliform test

The presumptive coliform test is used to detect coliforms in a water sample in this test lactose fermentation tubes are inoculated with different water volumes and production of acid and gas from the fermentation of lactose in any of the tubes is a presumptive evidence of coliforms in the water sample (Aneja, 2005).

Procedure

1. Prepare a single strength lactose broth (2.5gm in 200ml distilled water).
2. Label twelve single strength lactose broth tubes (i.e with 10ml, 1ml and 0.1ml of sample water) and fill all these tubes with inverted Durham tube to observe the gas production.
3. Mix the water sample thoroughly by shaking.
4. Aseptically inoculate four tubes with 10ml of water sample using 10ml sterile pipette.
5. Using 1ml pipette, aseptically inoculate another four tubes with 1ml of water sample.
6. Again using 0.1ml pipette aseptically inoculate the other four tubes with 0.1ml of water sample.
7. Label all these tubes according to their sample name.
8. Incubate all the twelve inoculated tubes aerobically at 35^0C for 48 hrs.
9. Observe all the lactose fermentation tubes for the production of acid (yellow color) and gas after 24 and 48 hrs of incubation.

3.4.7. Confirmed coliform test

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

This test is used to confirm the presence of coliforms and to determine the most probable number (MPN) value in water samples showing positive or doubtful presumptive test. In the confirmed test, water samples from all the positive presumptive lactose broth tubes or inoculated into tubes of brilliant lactose bile broth and incubated at 35^0C for 48 hrs and positive confirmed tubes are used to determine MPN (Aneja, 2005).

Procedure

1. Again in confirmed test inoculate lactose bile broth tubes containing Durham tube with inoculum from all lactose broth positive presumptive tubes.
2. Now again incubate all the inoculated tubes at 35^0C for 48 hrs.
3. Examine all the broth tubes for the gas production.

3.4.8. Completed coliform test

Completed test is used to establish the presence of coliform bacteria and as a confirmatory test for the presence of E.coli in a water sample. In this test the samples from the positive brilliant lactose broth from the confirmed test are streaked on a nutrient agar or MacConkey's agar plate and If there appear silver color colonies on the MacConkey's agar plate then the presence of coliform in the water sample is confirmed and is considered a positive completed test (Aneja, 2005).

Procedure

1. Streak twelve preprepared MacConkey's agar (11.0 in 200ml d/w) plates by the mixed samples of four different places (containing different concentration of water samples) obtained from confirmed test in a series of steps with sterile inoculating needle or by Micropipette.
2. Now Incubate all the plates for 24 hrs at 35^0C in an inverted position.
3. Observe the plates after 24 hrs of incubation for coliform colonies.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

3.4.9. Membrane filter (MFT) Technique/method

In membrane filter method a water sample is passed through a thin sterile membrane filter which is kept in a special filter apparatus contained in a suction flask. The filter disc that contains the trapped microorganisms is aseptically transferred to sterile petri dish having an absorbent pad saturated with a selective, differential liquid medium, and the colonies which develop, following incubation are counted. This method enables a large volume of water to be tested more economically, results obtained are more accurate and are obtained more quickly than multiple-tube technique (Aneja, 2005).

Procedure

1. Aseptically assemble the filter apparatus and insert membrane filter (muslin cloth) by placing it on sterile beakers or buchner flask and name these beakers according to the sample name.
2. Shake the water samples and pour 100ml of each water sample into the beaker through this filter membrane.
3. When the entire sample has been filtered carefully remove the filter from the filter holder (beakers) using sterile forceps.
4. Aseptically add, using sterile pipette few drops of distilled water to saturate the pre prepared nutrient agar medium (making four saturated plates and four unsaturated plates).
5. Now transfer the membrane filter on the medium (nutrient agar) saturated in the petri dish and also on the unsaturated petri dishes.
6. Now incubate all the eight plates in an inverted position at 37^0C for 24 hrs.
7. Remove the filter disc from the petri dish and allow it to dry on absorbent paper for 1 hr.
8. Examine the filter disc under a microscope for the presence of coliforms.

4. RESULT AND DISCUSSION

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Result of pH

Table 4.1:- pH of four different samples

S.NO.	Sample name	pH detected
1.	SGRR girls hostel	8.0
2.	Railway station	8.0
3.	Doon hospital	7.2
4.	Kamla hostel	7.5

Table 4.1 shows that there is slight increase in the pH of drinking water of SGRR Girls hostel & Railway station but it lies within the permissible limit.

Result of SPC

Formula used

Number of colonies/ml=colony count × Df.

Where…. Df = dilution factor (sample size).

Table 4.2:- Result of standard plate count (SPC) with 0.1ml water sample after incubation of 24hrs at 37^0C.

S.NO.	Sample name	No. of colonies calculated using above formula	Amount of sample used in ml at 37^0C.
1.	SGRR girls hostel	1520×0.1=152	0.1ml

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

2.	Kamla hostel	2080×0.1=208	0.1ml
3.	Railway station	TNC	0.1ml
4.	Doon hospital	TNC	0.1ml

TNC:-Too numerous to count.

Table 4.2 shows that there are too numerous bacterial colonies present in the drinking water of Railway station & Doon hospital and is highly contaminated

Table 4.3:-Result of SPC with 1ml water sample after incubation of 72 hrs at 20^0C.

S.NO.	Sample name	No. of colonies	Amount of sample used in ml at 20^0C.
1.	SGRR girls hostel	76×1=76	1ml
2.	Doon hospital	TNC	1ml
3.	Kamla hostel	No colonies found	1ml
4.	Railway station	TNC	1ml

Table 4.3 shows that drinking water of Doon hospital & Railway station is highly contaminated and is unsafe for drinking hence need to be cured and tested properly.

Table 4.4:-Result of Gram staining

S.No.	Name of sample	Color observed
1.	Kamla hostel	Red color(minimum&violet color(max.)
2.	Doon hospital	Red & violet(max)color

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

3.	SGRR girls hostel	Purple color
4.	Railway station	Red color

Table 4.4:- shows that in drinking water of kamla hostel, Doon hospital & Railway station gram negative bacteria are mostly present and is not fit for use.

Result of COD

Formula used

COD of sample mg/l=8×C× (B-A)/S

Where-------C=concentration of titrant in mmol/l,A=volume of titrant used for blank in ml.

B=volume of titrant used for sample in ml, S=volume of water sample in ml.

Table 4.5:- Result of COD of four different samples.

S.No.	Name of sample	COD calculated by using above formula
1.	Doon hospital	$8\times0.1\times(50-35)\times10^3/50=204$
2.	Railway station	$8\times0.1\times(45-35)\times10^3/50=160$
3.	SGRR girls hostel	$80\times0.1(42-35)\times10^3/50=112$
4.	Kamla hostel	$8\times0.1\times(40-35)\times10^3/50=80$

Table 4.5 shows that COD of drinking water of Railway station & Doon hospital is high hence confirms the presence of organic matter in the water samples and that needs to be cured.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Result of Multiple tube test (MTT)

Table 4.6:-Result of MTT of four different samples with sample size 10ml.

S.No.	Sample name	Sample size	Presumptive test	Confirmed test	Completed test
1	Kamla hostel	10 ml	+	+	+
2	Railway station	10ml	+	+	_
3	Girls hostel	10ml	+	+	_
4	Doon hospital	10ml	+	+	+

Table 4.6 shows positive presumptive &confirmatory test for all samples and negative completed test for sample water of Railway station and Girls hostel.

Table 4.7:-Result of MTT of four different samples with sample size 1.0ml

S.No.	Sample name	Sample size	Presumptive test	Confirmed test	Completed test
1	Kamla hostel	1 ml	+	+	+
2	Railway station	1ml	+	+	_
3	Girls hostel	1ml	_	+	_
4	Doon hospital	1ml	+	+	+

Table 4.7 shows positive confirmed test for all samples**.**

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Table 4.8:-Results of MTT of four different samples with sample size 0.1ml

S.No.	Sample name	Sample size	Presumptive test	Confirmed test	Completed test
1	Kamla hostel	0.1 ml	+	+	+
2	Railway station	0.1ml	+	+	–
3	Girls hostel	0.1ml	–	+	–
4	Doon hospital	0.1ml	+	+	+

Table 4.8 shows negative completed test for Railway station and Girls hostel and positive test for Kamla hostel and Doon hospital.

1. FIGURE'S OF SPC

Fig.4.1:-showing bacterial colonies on nutrient agar media after incubation of 24 hours.

Fig. 4.2:-showing bacterial colonies on nutrient agar media after incubation period of 72 hrs.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

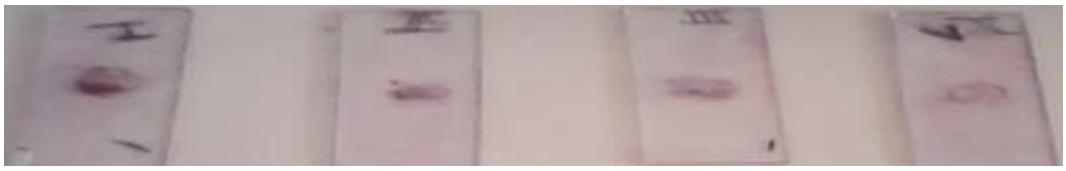

Fig. 4.3:-showing gram staining of bacterial colonies obtained from SPC**.**

2. Figure's COD test

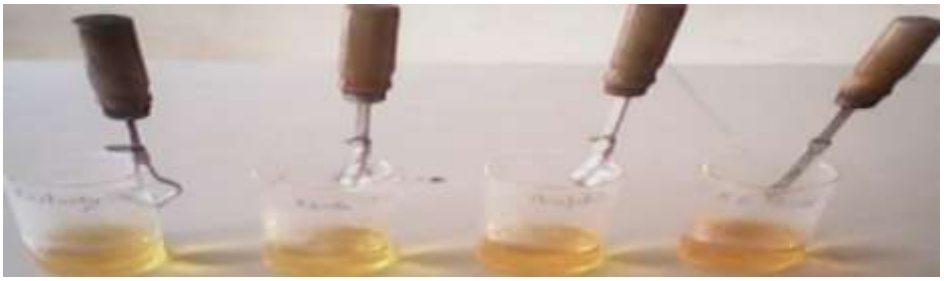

Fig. 4.4:-showing four different water samples containing $K_2Cr_2O_7$ when kept in water bath.

Fig. 4.5:-showing four different water samples when titrated with sodium thiosulfate.

Fig. 4.6:-showing disappearing of yellow color when starch soln. was added.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Fig. 4.7:-showing titration of distilled water or blank**.**

2. FIGURE'S OF MTT

Fig. 4.8:-showing fermentation tubes containing lactose broth +water samples and inverted Durham tubes.

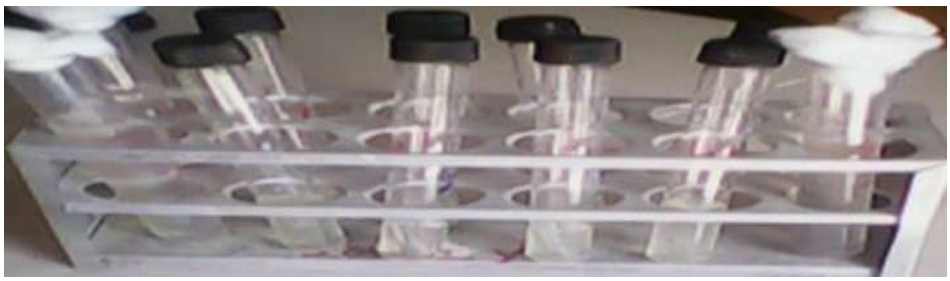

Fig. 4.9:-showing presumptive test after Incubation of 24hrs

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Fig. 4.10:- showing confirmed test for coliforms after incubation of 48 hrs.

Fig. 4.11:-showing bacterial colonies on MacConkey's agar media in completed coliform test containing sample water of Doon hospital in a series of 10ml, 1ml&0.1ml.

Fig. 4.12:-showing bacterial colonies on MacConkey's agar media containing water sample of kamla hostel in a series of 10ml, 1ml &0.1ml.

Fig. 4.13:-showing bacterial colonies on MacConkey's agar media containing water sample of S.G.R.R Girls hostel in a series of 10ml, 1ml &0.1ml.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

Fig. 4.14:-showing bacterial colonies on MacConkey's agar media containing water sample of Railway station in a series of 10ml, 1ml &0.1ml.

3. FIGURE'S OF MFT

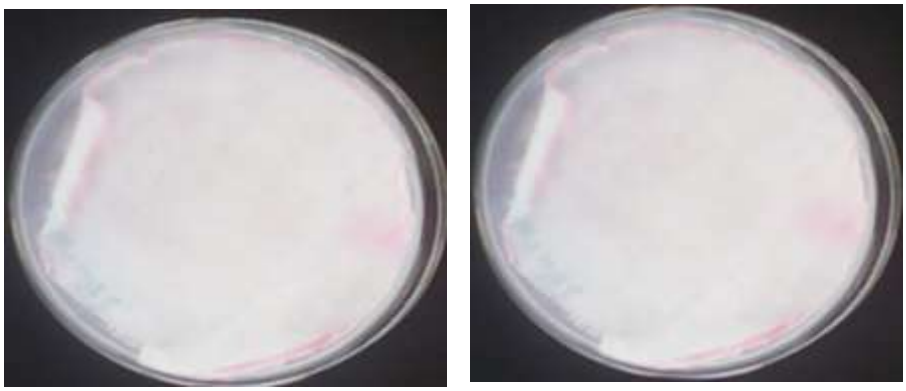

Fig. 4.15:- showing microbial colonies on filter membrane of sample taken from S.G.R.R Girls hostel on both saturated & unsaturated media**.**

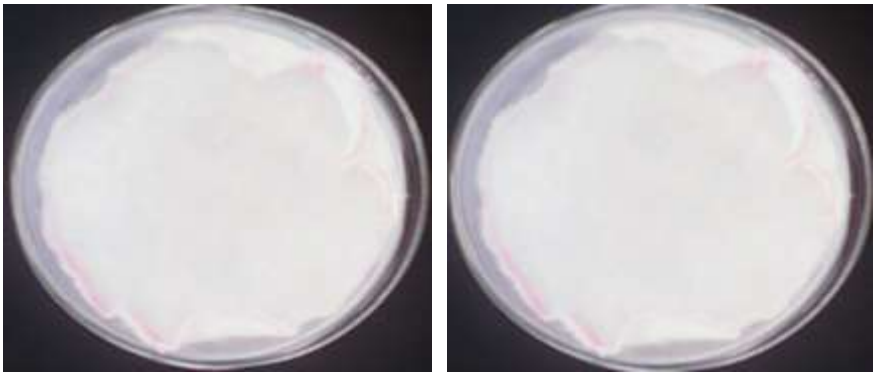

Fig. 4.16:-showing microbial colonies on filter membrane of sample taken from Doon hospital on both saturated & unsaturated media.

iJCEM International Journal of Core Engineering & Management
ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

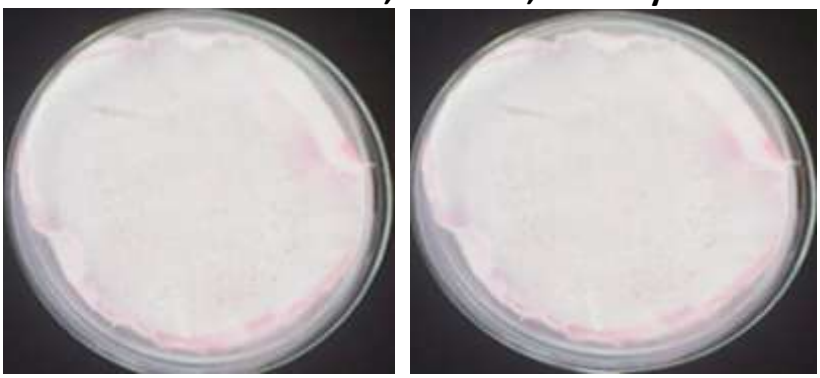

Fig. 4.17:-showing microbial colonies on filter membrane of sample taken from kamla hostel on both saturated & unsaturated media**.**

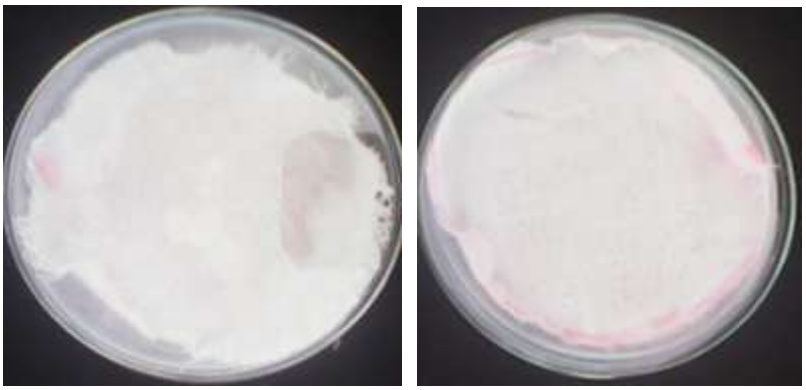

Fig. 4.18:-showing microbial colonies on membrane filter of sample taken from Railway station on both saturated & unsaturated media.

The results obtained for the study of water quality made from January 2015-June 2015, at four selected places namely Kamla hostel, Doon hospital, Railway station and Girls hostel of SGRR (PG) college, A total of seven tests were monitored. The findings of water quality are represented from table 4.1-4.5 and described above. The pH detected was in the range of 7.2 to 8.0, which remained neutral throughout the study period and was in permissible range.

The microbial analysis of water is shown from Table 4.2-4.5 in which the SPC indicates (Table 4.2&4.3) the microbial load after the incubation of 24 and 72 hours having a value which is more than the recommended value and also more than the permissible limit. The

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

SPC for all water samples was generally high, extending the limit of water, hence needs to be cured for the wellbeing of public, added to this the identification of bacteria through gram staining (Table 4.4) also indicates that the drinking water of these places is not fit for use (i.e to drink) due the presence of mostly gram negative bacteria which are very harmful for living organisms especially for human beings. The COD of given water samples which is calculated in Table 4.5 also indicates the presence of most organic matter and is above than the maximum permissible limit. The presence of coliform group in the given water samples generally suggests that a certain selection of water may have been contaminated with faeces either of human or animal origin, hence these drinking water sources must be protected from these coliforms to prevent contamination and made this water fit for use. The other more dangerously Microorganisms could be also present in the water samples. The completed coliform test showed a positively completely confirmed test for Railway station and Doon hospital water samples. In membrane filtration method (MFT) the microbial growth was observed in samples containing drinking water of Doon Hospital and Railway Station which suggests that there is an urgent need to protect these water sources from pollution in order to prevent public from diseases which are caused due to this drinking water.

5. CONCLUSION

The water pollution has a special interest Now-a-days. It take place by pathogenic organisms, which may cause intestinal infection like enteric fever, cholera, dysentery and food poisoning. The result of bacteriological studies and analysis of drinking water showed that the most drinking water sources are contaminated with coliform and pathogenic bacteria. The microbes detected were mostly Gram negative. The description of water analysis fits very well with the appearance of colonies that were observed. The infection/diseases may attack to those humans whose local or general defense mechanism would be significantly low. The people likely to be at risk would be the very old or very young as well as patients undergoing immunosuppressive therapy. Also the polluted water than permitted to contaminated food

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

which would lead to the multiplication of pathogens to very high doses. The variations of different physiochemical and microbial characteristics have been shown from Table 4.1 to 4.5. On the basis of current investigation we can conclude that the drinking water of sample of Railway station and Doon hospital are not under the permissible limit while the other two achieves the given limit ,so far there we can follow the safety. Thus the study of different experimental features revealed that the intensity of pollution increases as these drinking water sources are subjected to pollution (faecal contamination).In the growing awareness of relationships between human health and water pollution and for the sustainability of the system it is essential to undertake regular monitoring and proper testing of these water sources.

REFERENCES

[1] Aneja K R. (2005) Experment in microbiology plant pathology and biotechnology.4th ed chapter XV.pp.274-275.

[2] Bhadula Sushil, Vijay Sharma and B.D. Joshi (2014), Impact of Touristic Activities on Water Quality of Sahashtradhara Stream, Dehradun, International Journal of ChemTech Research Vol.6(1): 213-221.

[3] Chauhan Avnish, Mayank Pawar and Showkat Ahmad Lone (2012) Water quality status of Golden Key Lake in Clement Town, Dehradun, Uttarakhand International Journal of Agr. [01] ISSN 2307-265.

[4] Fouzia Ishaq and Amir Khan (2013), Seasonal limnological variation and macro benthic diversity of river Yamuna at Kalsi Dehradun of Uttarakhand, Asian Journal of Plant Science and Research, 3(2):133-144.

[5] Madan Sangeeta, Shilpika Dutta and Chanchal, (2013) Water quality assessment of river Tons, Dehradun (Uttarakhand), India Journal of Applied and Natural Science 5(1): 76-81.

ISSN: 2348 9510
International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 10, January 2016

[6] N. Semwal N. and P. Akolkar (2006), Water quality assessment of sacred Himalayan rivers of Uttaranchal, Current Science, Vol. 91(4), 25.

[7] Rawat Meenakshi, Hemanti Sharma, Manali Singh, U.Kedareswarudu and R. P. Singh (2011)Evaluation of aquifer parameters and groundwater quality in Doon Valley, Uttarkhand Ind. Geophys. Union Vol.15(3): 125-136.

[8] Sapkota Rajendra, Dusgupta rubin and malik abhishek (2012) microbial quality of partable water in dehradun research article ISSN2230-8407 Vol.3(6).

[9] Ujjania N. C, Azhar A. Multani (2011), Impact of Ganesh Idol Immersion Activities on The Water Quality of Tapi River, Surat (Gujrat) India, Research Journal of Biology Vol. 01(01).

ACKNOWLEDGEMENT. We thank Sri Guru Ram Rai PG College, Dehradun for providing technical support and guidance.