PHYSIOCHEMICAL ESTIMATION POTABLE WATER QUALITY ANALYSIS OF DISTRICT MORADABAD, UP

Dr. Alka Rani

Associate Professor, Department of Chemistry, Hindu College Moradabad, UP

ABSTRACT

Moradabad like industrial area, supply of safe drinking water of international standard is very limited. Only around 30% population has access to piped drinking water, which has rarely been completely tested for health safety. About 70% population is drinking water of unknown quality. The only testing comes through human consumption and getting sick. This study is designed to investigate the water quality problems of Moradabad district of uttar pradesh. Samples were collected from the subject area on continuous basis for a period of 5–6 months. Nearly 240 samples were collected. Analysis of physicochemical parameters has been carried out that includes temperature, pH, electrical conductivity, total dissolved solids, total suspended solids, chloride content, total coliform bacteria, total dissolved solids, nitrates, sulfates and arsenic. The area is adversely affected by the concentration of nitrates and total coliform. The maximum concentration of nitrates was observed at point "D" equal to 112 mg/L. And the same point has a maximum microbial pollution, i.e., 4 MPN/100 mL. The turbidity, TDS and arsenic concentration at all the points were observed to be within the permissible values of WHO guidelines. The point "A" is found to have higher concentration of TDS, i.e., 1240 mg/L, owing to which these samples were found to have bitter taste. Moreover, the concentration of sulfates was also found to be more, i.e., 632 mg/L at point 'A". Hence it is recommended that preventive measures must be taken at all points to remove the excess microbial and nitrates contamination and cost-effective methodology should be designed for monitoring of drinking water of the subject area. In this regard, low-cost measures must be applied at a household level for provision of safe drinking water free from any contamination.

Keywords: *Total dissolved solids, concentration, total coliform, physiochemical parameters*

INTRODUCTION

World comprises of 70% water. Of all the water available, 97% is salty which is found in oceans and seas. It is not fit for drinking, irrigation, industrial use or other uses of water consumption. Only 3% of the total water supply on Earth does not contain salt. Only less than 1% of the total Earth's water is available for drinking, household use and other purposes. In most of the region which were nor in industrially revolution area, supply of safe drinking water of international standard is very limited and only around 30% population has access to piped drinking water, which has rarely been completely tested for health safety. About 70%

population is drinking water of unknown quality. All of the human beings on the Earth depend on this meager supply of clean water which is also depleting fast with the rise in world's population yearly [1]. Water being the largest consumable substance in the human life, access to safe drinking water has been declared one of the basic human rights much alike as the right to clean air [2]. Thus, presence of a safe and reliable source of water is an essential prerequisite for the establishment of a stable community. In the absence of such a source, a nomadic lifestyle becomes necessary [3]. Despite the availability of cleaner water from tap, tank problems are often experienced with accessibility to and available of the supply water. This leads to the inevitable practices of using container to collect and store water. Another problem is the maintenance which influences sustainability of such services [4].

Due to industrialization, overpopulation and some other related factors, water pollution has been extensively documented as a contributor to health problems in humans and marine animal ecosystems. Water-borne diseases contribute a significant share to the human illness particularly in the developing countries where access to safe drinking water is getting scarce. According to WHO, in Pakistan infant mortality rate is around 12.5% since 35% population has access to safe drinking water. So, in order to provide an ample amount of clean water to the community, different methods are being used for water treatment as boiling/pasteurization is the oldest and cheapest known traditional method to make water safe from microbial contamination but it is not suitable when heavy metal ions and other toxic chemicals are present in water and in that case filters are being employed to retain undesirable contaminants to pass through the filter media and treated water is expected to meet drinking water quality standards and recommended as safe for drinking [5, 6].

METHODOLOGY

Moradabad is a city of Uttar Pradesh, India, famous for Brass Metal Handicrafts not only in India but also in abroad since ancient times. This city is situated in western U.P. between 28°-21´ to 28°-16´ Latitude North and 78°- 4´ to 79 Longitude East. Ram Ganga River flows in the north east and Gagan River is there in south west of the city. The physicochemical characteristics of ground water of five selected points in Moradabad Town viz. PA campus Mandi chowk, Lajpat nagar, Katghar, Majhola, Moradabad and railway station were studied. Samples were collected from the subject area on continuous basis for a period of 5–6 months. The sampling points were designated as mentioned in Table 1. These points are also shown in Figure 2. Nearly 240 samples were collected. These samples were then tested in the nearest available public health engineering laboratory, using standard methods. The various physio-chemical parameters tested are shown in Table 2.

Table 1: *Description of Sampling Codes.*

Sample Codes	***Sampling Stations***
A	PA campus Mandi chowk
B	Lajpat nagar
C	Katghar
D	Majhola
E	Moradabad
F	Main railway station

Physio-chemical parameters used in this research have been given in Table 2 along with method/technique used.

RESULTS AND DISCUSSION

After conducting extensive laboratory testing on the samples collected from different points, values of different parameters are recorded as below. The average pH concentration observed at points A, B, C, D, E and F was 8.2, 8.35, 8.25, 8.10, 8.40 and 8.30, respectively. The maximum pH was noticed at Point B, which is still within the permissible limits of WHO of 6.5–8.5. If the pH of water before water distribution in pipes is not maintained, it can result in corrosion of pipes and contamination of drinking water and cause bad taste, odor and color [7]. Comparison of pH values of understudy points is shown in Figure 3.

Table 2: *Description of Physio-Chemical Parameters Along with Techniques Used.*

Parameter	***Technique***
pH	pH Meter
Turbidity	Turbidity meter
Electric Conductivity	EC Meter
Chlorides	Argentrometric
Sulfates	Spectrophotometer
Nitrates	Spectrophotometer
Total Solids (TS)	Gravimetric
Total Suspended Solids (TSS)	Gravimetric
Arsenic	Atomic Spectroscopy
Total Coliform	Membrane Filtration Technique

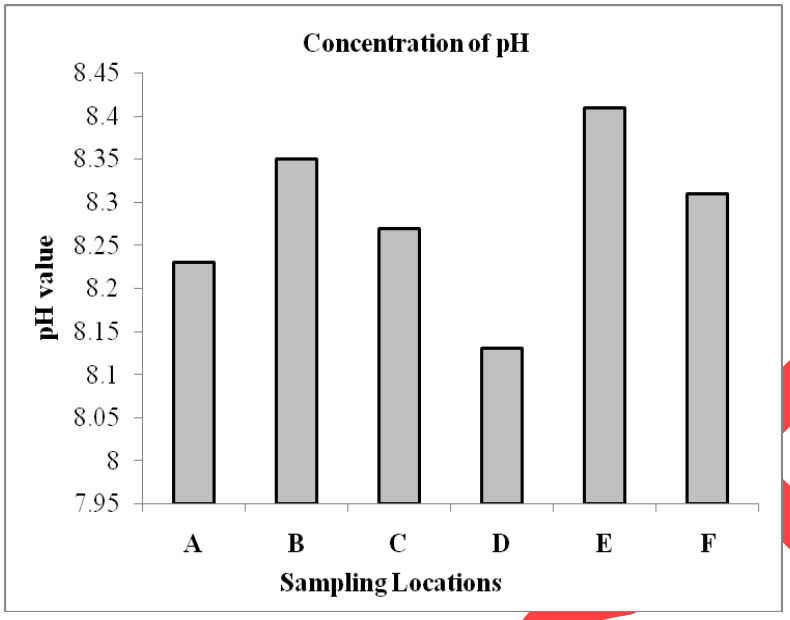

Fig. 3: *Concentration of pH at Different Points.*

Electrical Conductivity (EC) is a rapid and most convenient method for the estimation of concentration of salts in water samples. The electrical conductivity of the water depends on the water temperature, the higher the temperature, the higher the electrical conductivity would be. It is a good indicator of the total salinity [8]. The values of average EC observed at A, B, C, D, E and F was 2600 µ-S/cm, 2500 µ-S/cm, 2510 µ-S/cm, 2550 µ-S/cm, 2300 µ-S/cm and 1520 µ-S/cm, respectively. As shown in Figure 4, it was observed that the EC of all drinking water samples were within the recommended range advocated by World Health Organization (WHO) guideline standards for drinking water.

Turbidity may notify the presence of disease causing organisms. The APHA specifies drinking water turbidity shall not exceed 5 NTU. The values of turbidity values observed are shown in Figure 5. It was observed that the turbidity concentration at A, B, C, D, E and F was 0, 3.5, 4.4, 4.6, 2.3 and 1.8 NTU, respectively. Turbidity in the water samples is within the WHO permissible.

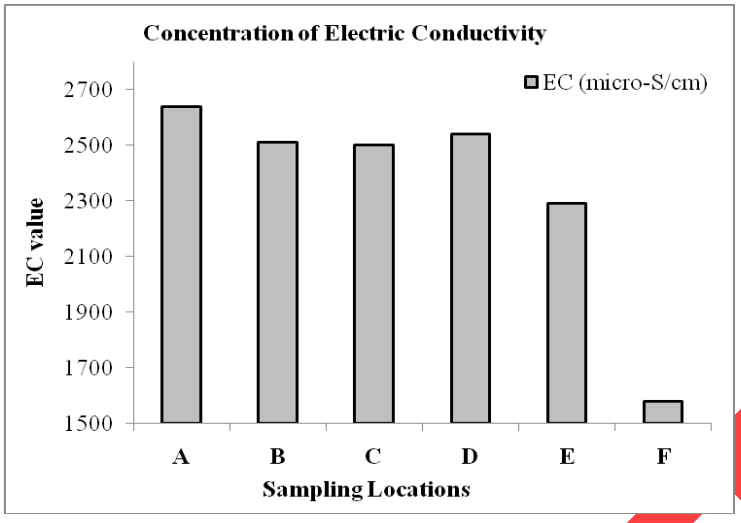

Fig. 4: *Concentration of EC at Different Points.*

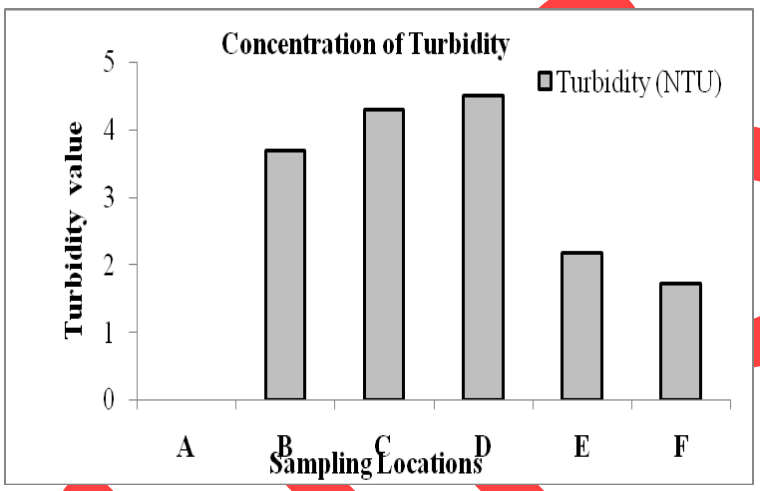

Fig. 5: *Concentration of Turbidity at Different Points.*

Chlorides are usually related to the "salt" content of the water. Water with a high chloride concentration may have a salty taste and will increase the corrosion of plumbing and home appliances. The maximum concentration of 250 mg/L is recommended by WHO. The concentration of chlorides at point A, B, C, D, E and F was observed as 156 mg/L, 148 mg/L, 150 mg/L, 74 mg/L, 138 mg/L and 58 mg/L, respectively as shown in Figure 6. It was observed that the chloride values of all drinking water samples were within the recommended range as advocated by World Health Organization (WHO) guideline standards for drinking water [9].

According to Figure 7, the sulfates of various location A, B, C, D, E and F was observed to be 640 mg/L, 340 mg/L, 345 mg/L, 450 mg/L, 60 mg/L and 180 mg/L, respectively. Sulphates concentration at Points E, F is with in permissible limit set by WHO which is 250 mg/L. While at Points A, B, C, D the concentration of sulfates has exceeded the permissible limit which may be due to the inclusion of fertilizers or due to reaction of water with sulphate containing rocks.

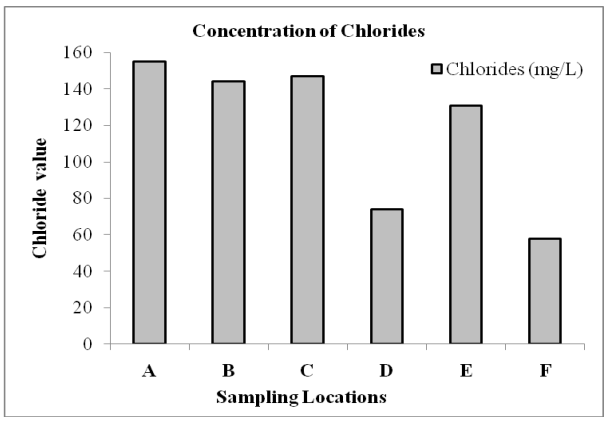

Fig. 6: *Concentration of Chlorides at Different Points.*

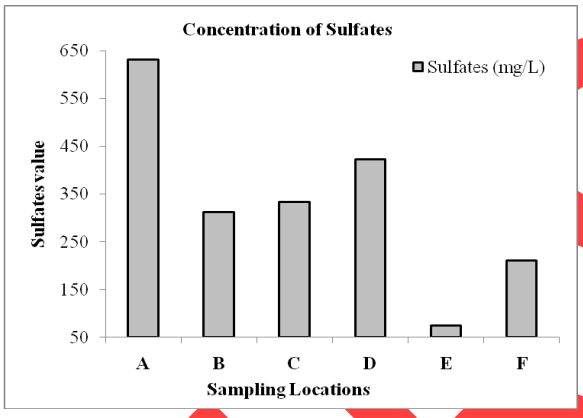

Fig. 7: *Concentration of Sulfates at Different Points.*

The concentration of nitrates are shwon in Figure 8. The concentration of nitrates at point A, B, C, D, E and F are observed to be 70 mg/L, 55 mg/L, 04 mg/L, 08 mg/L, 88 mg/L and 116 mg/L, respectively. Total dissolved solids (TDS) represent the total concentration of dissolved substances in water. The values of TDS obtained at A, B, C, D, E and F are 1120 mg/L, 1215 mg/L, 1100 mg/L, 890 mg/L, 1180 mg/L and 585 mg/L, respectively. Values of the most of drinking water samples were not within the recommended range (1000 mg/L) advocated by World Health Organization (WHO) guideline standards for drinking water. Figure 9 shows different values of TDS at various points.[13-16]

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. The concentration of TSS is shown in Figure 10. The observed values at Points A, B, C, D, E and F were found to be 154 mg/L, 225 mg/L, 230 mg/L, 115 mg/L, 265 mg/L and 195 mg/L, respectively. High concentrations of suspended solids can cause many problems for stream health and aquatic life. Changes in the pH will cause some of the solutes to precipitate or will affect the solubility of the suspended mater [5, 8-12].

The concentration of Arsenic in the various samples obtained is shown in Figure 11. The average values obtained at Points A, B, C, D, E and F are 0, 0.01 ppb, 0, 0.01 ppb, 0 and 0.01 ppb, respectively. [17,18]

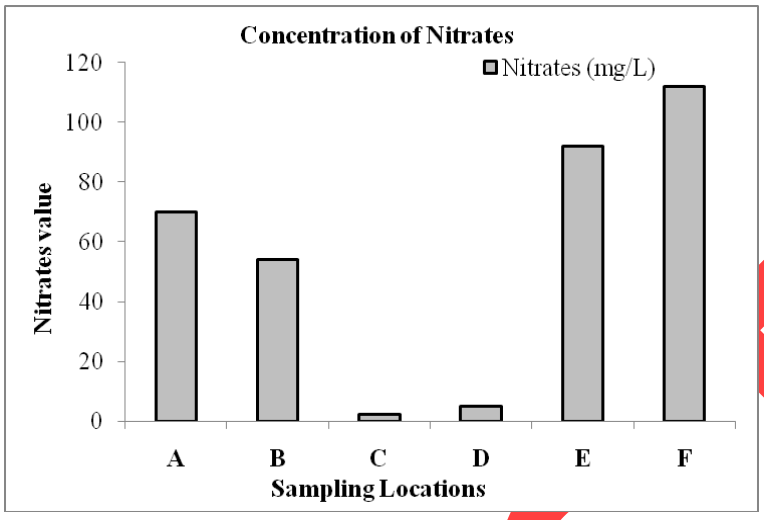

Fig. 8: *Concentration of Nitrates at Different Points.*

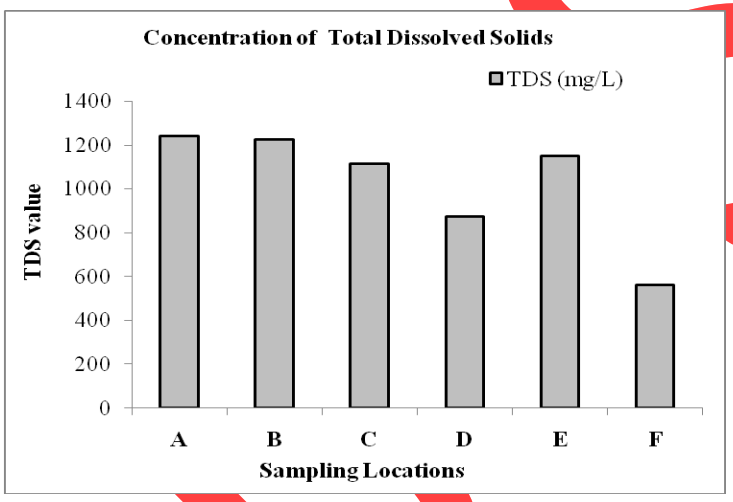

Fig. 9: *Concentration of TDS at Different Points.*

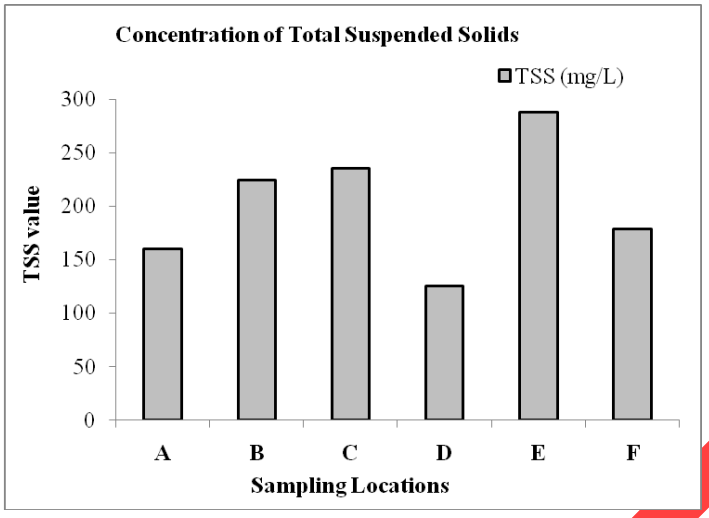

Fig. 10: *Concentration of TSS at Different Points.*

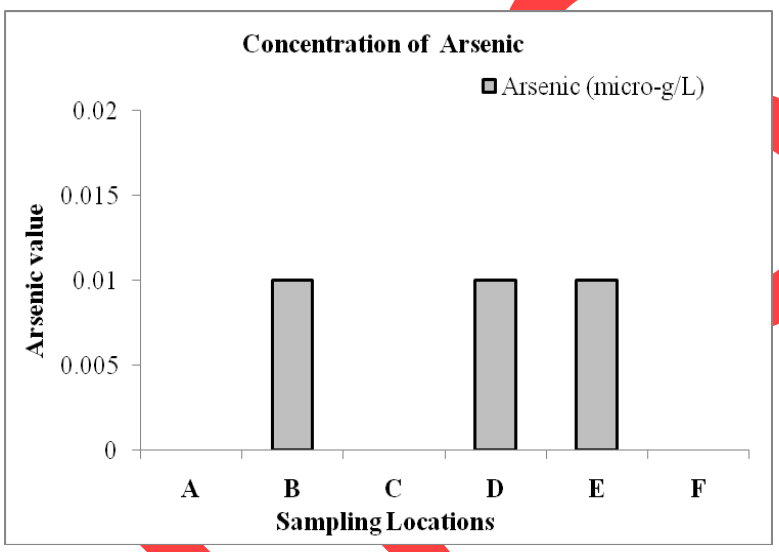

Fig. 11: *Concentration of Arsenic at Different Points.*

The values obtained at Points A, B, C, D, E and F are 2 MPN/100 mL, 3 MPN/100 mL, 1 MPN/100 mL, 3 MPN/100 mL, 3 MPN/ 100 mL and 4 MPN/100 mL, respectively. According to WHO, the *E coli* and *fecal coliform* bacteria must not be detectable in any 100 ml sample of all water intended for drinking [19-24]. Analysis shows that all the tap water samples have coliform bacteria ranging from 20 colonies till 80 colonies to the maximum per 100 ml sample and water samples from filtration plants have no bacterial colonies. As shown in Figure 12.[25,26]

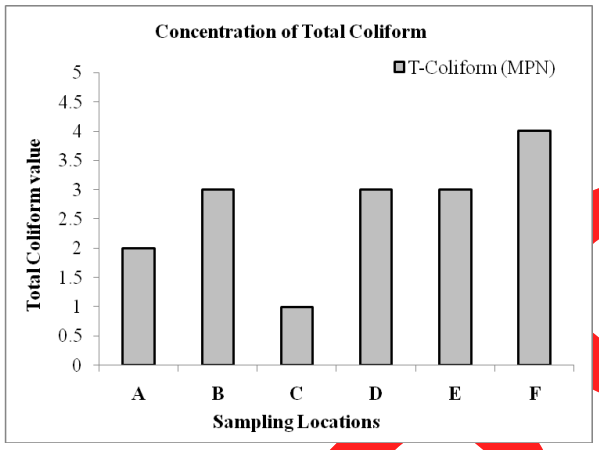

Fig. 12: *Concentration of Total Coliform at Different Points.*

CONCLUSION

Analysis of physio-chemical parameters that includes temperature, pH, electrical conductivity, total dissolved solids, total suspended solids, chloride content, total coliform bacteria, total dissolved solids, nitrates, sulfates, arsenic, etc., has been done. It is concluded that the area is adversely affected by the concentration of nitrates and total coliform. The maximum concentration of nitrates was observed at Point "D" equal to 112 mg/L. And the same point has a maximum microbial pollution, i.e., 4 MPN/100 mL. The turbidity, TDS and arsenic concentration at all the points were observed to be within the permissible values of WHO guidelines. While the point "A" is found to have higher concentration of TDS, i.e., 1240 mg/L, owing to which these samples were found to have bitter taste. Moreover, the concentration of sulfates were also found to be more, i.e., 632 mg at Point 'A". It is highly desired that preventive measures must be taken at all points to remove the excess microbial and nitrates contamination in the drinking water of the subject area. Upgrade and installation of water treatment plants and water distribution systems to control water contamination is very necessary to effectively implement quality standards for drinking water.

REFERENCES

1. Srivastava Shubha, M Kumar, Singh J., Srivastava K. K. and Singh G. (1999). Indian J. Environmental Protection, 19(9), 641.
2. Narsimhan T. N. (2005) Current Science, 89(5), 787.
3. Patel S. and Quadri S.H. (2011). Der Chemica Sinica, 2(5),194.
4. De A. K. (1994). Environmental Chemistry, 3rd Ed, New Age International (p) Limited, Publishers, New Delhi.
5. Sayyed J. A. and Bhosle A.B. (2010). Der Chemica Sinica, 1 (2), 104.
6. Ogbonna] O., Jimoh W.L., Awagu E. F. and Bamishaiye E.I. (2011). Advances in Applied Science Research, 2 (2), 62.
7. Dhake R. B., Phalak R. P. and Waghulde G. P. (2008). AJCER, 1(1), 54.
8. Moscow S., Jothivenkatachalam K., and Subramani P. (2011), Der Chemica Sinica, 2 (2),199.
9. Mehta K. A. and. Patil C. L. (2008). J. Chemtracks 10 (1&2), 345.
10. Yadav S.S and Rajesh Kumar. (2011). Advances in Applied Science Research, 2 (2), 197.
11. Kudesia V. P. (1980). Water pollution, 1st Ed., Pragati Prakashan, Meerut.
12. Shah D.G. and. Patel P.S. (2011) Der Chemica Sinica, 2(5), 8.
13. Kannan Krishnan, (1991). Fundamentals of Environmental Pollution, S. Chand and Co. Ltd., New Delhi.
14. Kamble P. N., Gaikwad V. B. and Kuchekar S. R. 2011. Der Chemica Sinica, 2 (4),229.
15. Sing Rakesh Kumar, Sharma R. D. and Sharma K. D. (2005). Current Science, 89(5), 794.
16. APHA,AWWA,WPCF,Standards methods for examination of water and waste water , (19^{th} edn.),Washington D.C.
17. Sinha, D.K. and Saxena Ritesh, Statistical Assessment of Underground Drinking Water Contamination and Effect of Monsoon at Hasanpur, J.P nagar (Uttar Pradesh, India), Journal of Environ. Science & Engg., 48(3), 157-164 July (2006).
18. Pathak J.K, Alam Mohd,and Sharma Shikha, Interpretation of Ground water Quality Using Multivariate Statistical Techniques in Moradabad City, western uttar Pradesh State, India, E-Journal of Chemistry , 5(3), 607-619, July (2008).
19. Sinha, D. K., Saxena, Shilpi and Saxena, Ritesh, Water Quality Index for Ram Ganga river at Moradabad, Poll. Res., 23(3), 527-531 (2004).
20. Mohan A, singh R.K, pandey Kirti, Kumar V and Jain V ., Assessment of Water Quality in Industrial zone of Moradabad: Physico-chemical Parameters and Water Quality Index, Ind. J. Env. Protection, 27 (11), 1031-1035 (2007).
21. Sinha, D. K. and Kumar Navneet., Level of gagan River water Pollution in and around Moradabad, Poll Res. , 27(4), 743-746 (2008).
22. Sinha, D. K. and Kumar Navneet., Monitoring of Trace Metals in Gagan River water at Moradabad, Ind. J. Env. Protection, 26 (5), 516-520 (2006).

23. Saraswat Shweta,Tewari Saumyata and Rai J.P.N, Impact of Brass and Electroplating Industry Effluents on some Physico-chemical and Biological properties of soil, Journal of Sci. & Ind. Research 66,957-962 (November 2007).
24. Agarwal A, Saxena M. Assessment of pollution by Physicochemical India. *Advances in Applied Science Research*. 2011; 2(2): 185–9p.
25. APHA. *Standard Methods for Examination of Water and Wastewater*, (20th Ed.). American Public Health Association: Washington D C., 1985.
26. Das D, Dorner SM. *Waterborne Diseases*: Linking public health and watershed Health services Academy, 2007. *Quality Drinking Water*: Guidelines and Standards for Pakistan, Islamabad, 2008.