Research Article CODEN: IJPRNK Impact Factor: 5.567 ISSN: 2277-8713
Ajit K. Sharma, IJPRBS, 2018; Volume 7(1): 1-10 IJPRBS

INTERNATIONAL JOURNAL OF PHARMACEUTICAL RESEARCH AND BIO-SCIENCE

PHYSICO-CHEMMICAL CHARACTERISTICS OF YAMUNA RIVER AT MATHURA DISTRICT UP

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Accepted Date: 13/10/2017; Published Date: 27/02/2018

Abstract: Physico-chemical analysis of Yamuna River water to assess the pollution load at three sampling sites was done in respect to pH, EC, TDS, alkalinity, total hardness, COD,BOD, DO, Calcium and Nitrates. The results showed that water quality at these sites was not within WHO permissible limits. However, significant differences were found in all the parameters studied at three sites of all the parameters studied only pH was observed to be maximum at Site 2, DO maximum at Site 3 and Nitrates at Site 2, otherwise remaining parameters were observed to be maximum at Site 1. Seeing overall results Site 1-Masani Nala was found to have the highest pollution load.

Keywords: Physico-chemical aspects, Yamuna River, Mathura City.

PAPER-QR CODE

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Access Online On:

www.ijprbs.com

How to Cite This Article:

Ajit K. Sharma, IJPRBS, 2018; Volume 7(1): 1-10

INTRODUCTION

Water is one of the essential commodities to sustain life and is considered to be an enigma. It is not only essential for mankind but also equally indispensable for agriculture and other industries. The quality of life depends upon the quality and quantity of the water available for various needs. Safe and adequate water is not only a public health necessity but also an important infrastructure for economic development. The 12th world health assembly held at Geneva in 1954.Declared water as "commodity, a social benefit and economic and industrial resource". As we know our life depends upon water and man needs water for his drinking and other domestic and industrial utilization. The demand for water is increasing tremendously day-by-day. Water is a major constituent of the environment around the mankind. Any change in the environment which leads to its deterioration causes pollution of the environment. There are a number of sources which are responsible for the acute problems of water pollution. The major ones are domestic, industrial, agricultural and microbiological.

Almost 75% of the water in India has become polluted due to discharge of domestic sewage, municipal waste, agricultural waste, industrial effluents make the river water contaminated (Arora*et.al*., 1985; Goesh*et.al*., 1986;Sangu and Sharma, 1987; Shahil and Pandey,1987).The important management of water system may cause serious problem in availability and quality of water (Kumar and Saha, 1991; Nag and Das, 1994; Subba Rao and Subba Rao, 1995; Sharma, 2004; Sharma, 2012).Rivers are major sources of water and their waste needs to be maintained for water to be as potable(Murthey and Ravanaidh, 2011; Jajawara and Shringi, 2012).It has to be complete with certain physico-chemical standards which are designed to ensure that the water is safe for drinking (APHA 1989; BIS, 1991).

Mathura situated on the right bank of the Yamuna River about 145 Kms South-east of Delhi and 58Kms North-west of Agra is rapidly emerging as a leading industrial and commercial city. The number of industries in the city limits have increased to more than 280 consisting of sari printing, dyes, chemical, nickel, silver polishing electroplating, supari industries, milk processing, crude oil, sugar factory etc. The development of city has caused directly a number of water quality problems (Khube and Durgpal, 1993; Kumar *etal*., 1994; WHO, 1993; Khanna, 2011; Sharma *et.al*., 2013).

The River Yamuna is relatively clean till it enters Delhi at the Wazirabad Barrage. By the time it leaves the city it is a sewer carrying the waste to downstream users. During most of its journey in the polluted strides the Yamuna has little flow to maintain its assimilative capacity, i.e., the ability to dilute waste. This is because firstly, cities take clean water from the river and return only waste. Secondly, the wastewater flow in to the river has increased phenomenally, widening the gap between the waste generated and treated. Urban density along Yamuna's

course is increasing along with the inflow of untreated sewage and industrial effluents. The River is not just polluted at its urban centers, Delhi, Mathura or Agra - it is increasingly dirty all along its full stretch. Thus, it is certain that the Yamuna is only a disposal medium for industrial and domestic waste. Nineteen drains crisscross Mathura before discharging into the river. The sewers connected 60% of the population before YAP. Part of the sewage was taken to a Sewage farm in the trans-Yamuna area. When there was no demand for treated water for irrigation it was discharged into the river untreated. In colonies where, sewage facilities were not available night soil and sullage flowed directly into open drains leading ultimately to Yamuna (Reference).In the present paper physico-chemical aspects of Yamuna River at Mathura City during pre-monsoon season at the three sampling sites viz., Site 1 MasaniNala, Site 2 VisramGhat and Site 3 Railway Bridge were performed in the year 2016.The parameter examined were pH, EC, alkalinity, total hardness, TDS, COD, BOD, DO, Calcium and Nitrates. The results showed that water quality at these sites was not found to be within permissible limits.

MATERIAL AND METHODS

Water samples were collected from 3 sites during pre-monsoon period (April-May) in the year 2016in polythene containers of 2 liter capacity from a site in morning hours between 8 am to 10 am and analyzed following standard methods (APHA 1989) the result were also compared with the Indian Standards.

OBSERVATIONS AND RESULTS

The various Physico-Chemical parameters of river water are presented in the Table-1 and Graphs 1-3 where the following observations were made with respect to various parameters at three sites:

The *pH values* ranged from 8.1 at Site 1 (MasaniNala), 8.2 at Site 3 (Railway Bridge) and 8.8 at the Site 2 (VishramGhat) showing an *alkaline* pH. The values from 8.1 to 8.8at the three sites were close to recommended values (6.8-8.5) of water for drinking purpose (Graphs 1-3).

Electrical conductivity values closely correlated with content of total dissolved solids. EC ranged from 1.045 dsm^{-1} at Site 3 (Railway Bridge), followed by 1.52 dsm^{-1} at Site 2 (VishramGhat) and highest of 3.965 dsm^{-1} at Site 1 (MasaniNala) (Graphs 1-3).

Total Dissolved Solids (TDS) content was *lowest* at Site 3 (Railway Bridge) with 1650 mg/l, followed by Site 2 (VishramGhat) 1820 mg/l and highest at the Site 1 (MasaniNala) as 1850 mg/l (Graphs 1-3).

Total alkalinity showed a high value at Site 1 (MasaniNala) as 320 mg/l followed by Site 2 (VishramGhat) with 305 mg/l) and the *lowest* was found to be at Site 3 (Railway Bridge) as 290 mg/l (Graphs 1-3).

Total hardness (TH) is caused by the presence of soluble salt of CaMg SrFe and Mn characterized by reduction of lather efficiency of water with soap. In the present investigation the hardness values ranged from 230-490 mg/l showing all the sites were found within the permissible limits (Graphs 1-3).

Dissolved oxygen (DO) content is an indicator of organic pollution the values were observed ranged (2.5-4.9mg/l).If DO valued lower than 4 mg/l as seen 2.5 mg/l at Site 2 (VishatamGhat) followed by 2.8 mg/l at Site 1 (MasaniNala) is not suitable for aquatic life (Graphs 1-3).

Biological Oxygen Demand (BOD) value indicates more organic waste present in the water source. The maximum BOD found (24.5 mg/l) at site 1 (MasaniNala) followed by 20.7 mg/l at Site2 (VishramGhat) and minimum (15.5 mg/l) at site3 (Railway Bridge) (Graphs 1-3).

Chemical Oxygen Demand (COD) value ranged between (105 -142 mg/l) where maximum value (142 mg/l) was observed at site-1 (MasaniNala) which may ascribe to high concentration of organic material source (Graphs 1-3).

Calcium (Ca) concentration ranged from (105-220 mg/l) and was found to be maximum (220mg/l) at site 1 (MasaniNala) followed by 109 mg/l recorded at Site 2 (VisharmaGhat) and minimum (105 mg/l) at Site 3 (Railway Bridge) (Graphs 1-3).

Nitrate (NO_3) concentrations ranged from (38.8-55 mg/l). Higher values of (55 mg/l) were observed at Site 1 (MasaniNala) followed by (45.8 mg/l) at Site2 (VishramGhat) because of mixing of various effluents from industries and other waste material (Graphs 1-3).

DISCUSSIONS

It was noticed that the pH value of the water appears to be dependent upon the relative quantities of calcium, carbonates and bicarbonates. The water tends to be more alkaline when it possessed carbonates (Suryanarayana 1995).EC values were as per US guidelines for potable water and irrigation water. The water sample having 0.7-3.0 dSm^{-1} values of EC are considered as moderately contaminated and those with EC higher than 3.0 dSm^{-1} are regarded as severely contaminated. Higher values of 3.965dSm^{-1} were recorded at Site 1 (MasaniNala). In the present study, the EC value falls in the moderate contaminated category as seen in Site 2 (VishramGhat) and Site 3 (Railway Bridge). Similar observations were observed by Krishna Murthy and Bharti (1994) for KaluRiver in North Karnataka. Total dissolved solids denote presence of different minerals in water, TDS is mainly on account of carbonates, bicarbonates,

chlorides, sulphates, phosphate nitrate, calcium, potassium, Iron. However, TDS levels tested at all sites were within the permissible limits. Alkalinity is a measure of the capacity of water to absorb hydrogen Ion. The higher value of alkalinity indicates presence of bicarbonates, carbonates and hydroxide in water body (Jain *et al*., 2000). Alkalinity levels tested at all sites within the permissible limits (290-320 mg/l) as recommended by BIS (1991). Hardness is caused by the presence of soluble salts of Ca, Mg, Sr, Fe and Mn and is characterized by reduction of lather efficiency of water with soap. In the present investigation the hardness values ranged from 230-490 mg/l at all the sites were found within the permissible limits by BIS 1991. Dissolved oxygen may be due to the microbial decomposition of organic component of sewage and industrial water in the river water which is used by micro-organism in the biological oxidation of organic matter is reflected in terms of DO. Dissolve oxygen at different sites fluctuated from(2.5-4.9 mg/l)being very low at Site 1 (MasaniNala) and Site2 (VishramGhat). The high BOD value indicates more organic waste present in the water source the ranged from 15.5-24.5 mg/l. The maximum BOD found at Site 1 (MasaniNala) showing more of sewage wastes with organic matter. The observed results are in close agreement with the study of Jangala and Vaishnav (2012) in Korba District but these values are above the standard limit for drinking water suggested by BIS 1991. During the study period, chemical oxygen demand (COD) values ranged between (105 -142 mg/l) of which the maximum value was observed at Site 1 (MasaniNala) which may be ascribed to high concentration of organic material source. These values are higher than the maximum permissible limit as per BIS (1991) suggesting that water sample is more severely affected with organic pollution. Desirable limit of calcium ions in drinking water is 75 mg/l and permissible limit is 200 mg/l (BIS 1991) however, its concentration ranged from (105-220 mg/l) with highest recorded at Site 1 (MasaniNala).Lastly, the nitrate concentrations ranged from (38.8-55 mg/l). Higher values were observed at Site 1 (MasaniNala) and Site 2 (VishramGhat) because of mixing of various effluents from industries and other waste material similar observations were made by Shridhar*et al*., (2006) in the Palk Basin of South-east Coast of India.

Conclusion

The present study revealed deterioration in the water quality of River Yamuna due to the high pollution level at all the three sites receiving city sewage and industrial wastes.

RECOMMENDATIONS

In view of the findings made in the present study following recommendations are made for better water quality management of the river.

- The local public has to be informed about proper waste disposal and the importance of clean water.

- The municipal waste, sanitary effluents, domestic sewage and industrial effluents should not be discharged into the river. Instead a central sewage system must be provided for first there while the industrial effluents should be treated properly before they are drained out.

- City garbage should be dumped into low lying areas and proper separation of the biodegradable and non-biodegradable materials should be done.

- Regular monitoring of river and drinking water sources should be done.

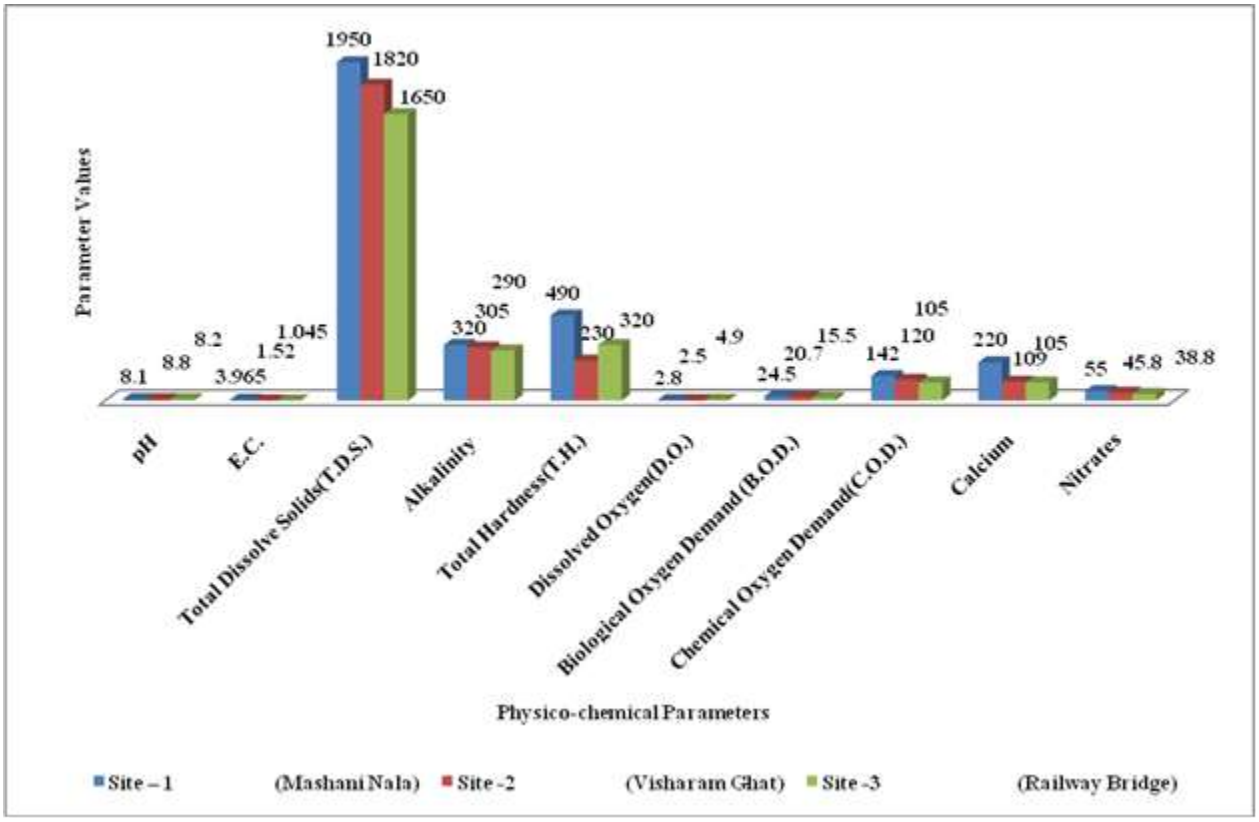
ACKNOWLEDGMENTS

Authors are thankful to Dr. RaghavaPrakash, Director, Parishkar College of Global Excellence, Jaipur for providing necessary facilities and to Rajasthan State Pollution Control Board for their help in wastewater analysis and for invaluable suggestions. Authors are also thankful to the Principal Dr. Alok Chaturvedi and Dr. Savita Paiwal for their patronage and support.

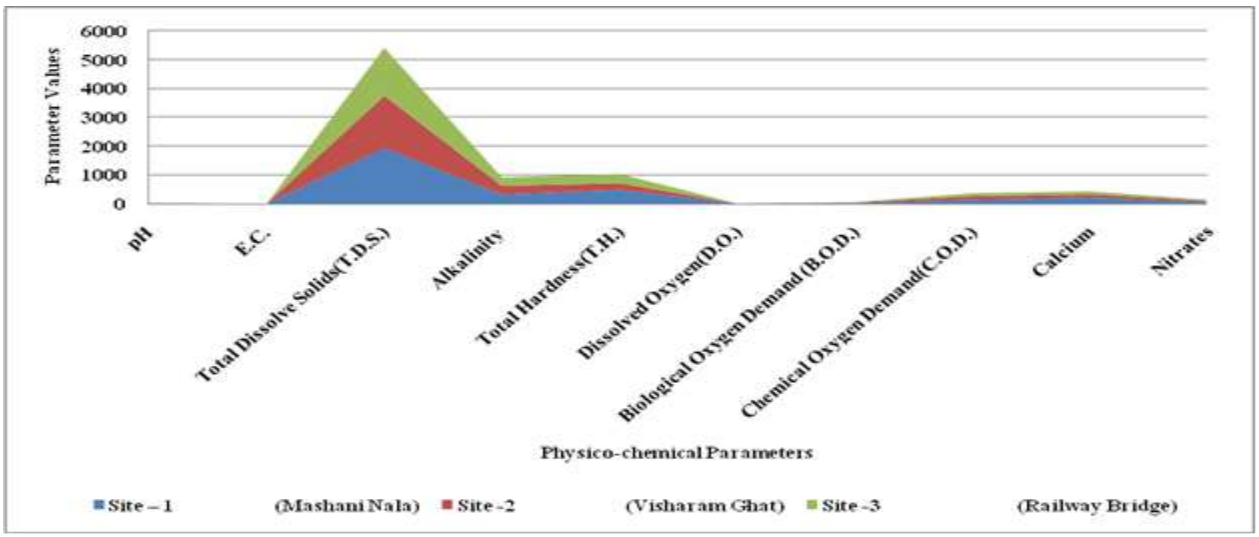
Table-1: Physico-Chemical Characteristics of Yamuna River water at Mathura Pre-Manson 2016

S.No.	*Parameter*	*Site 1(MasaniNala)*	*Site 2(VisharamGhat)*	*Site 3(Railway Bridge)*
1	**pH**	8.1	8.8	8.2
2	**E.C.**	3.965	1.520	1.045
3	**Total Dissolve Solids(T.D.S.)**	1950	1820	1650
4	**Alkalinity**	320	305	290
5	**Total Hardness(T.H.)**	490	230	320
6	**Dissolved Oxygen(D.O.)**	2.8	2.5	4.9
7	**Biological Oxygen Demand (B.O.D.)**	24.5	20.7	15.5
8	**Chemical Oxygen Demand(C.O.D.)**	142	120	105
9	**Calcium**	220	109	105
10	**Nitrates**	55	45.8	38.8

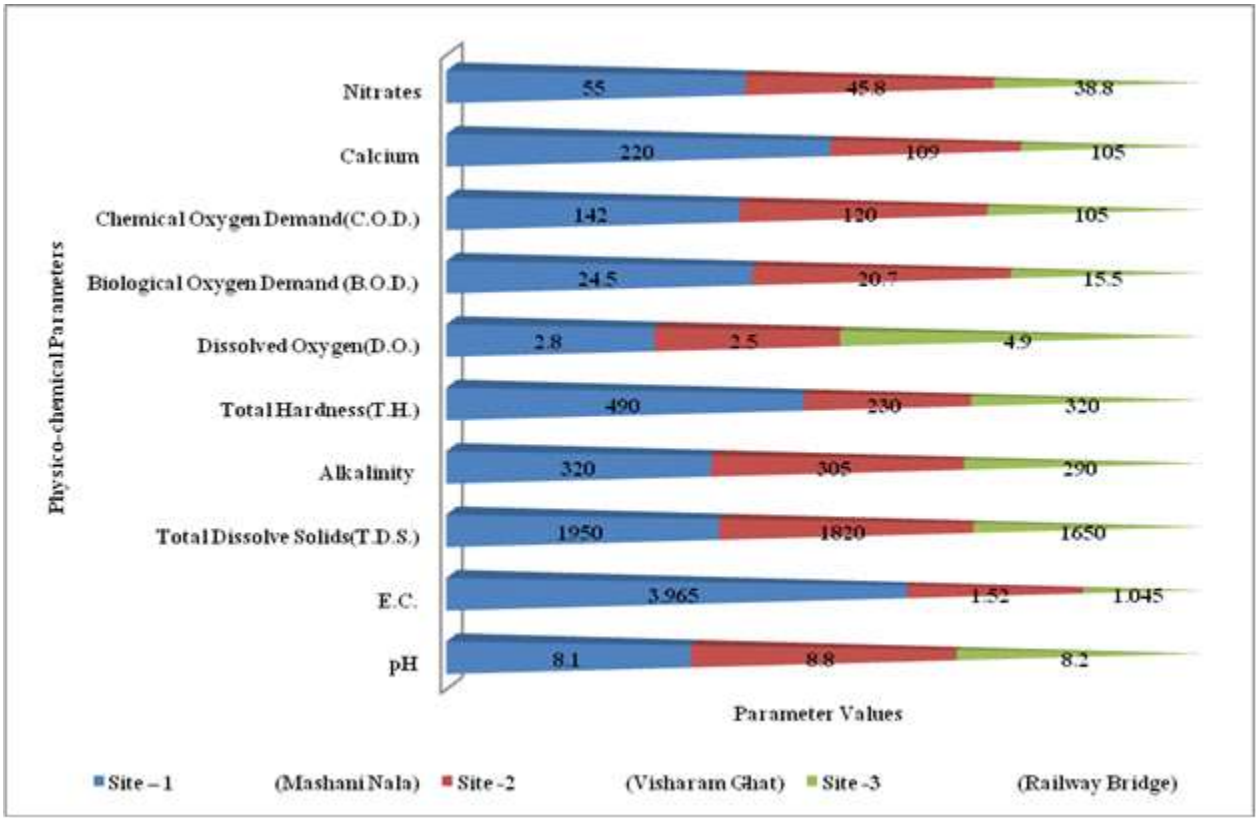
Graph-1: Physico-Chemical Characteristics of Yamuna River water at Mathura Pre-Manson 2016



Graph-2: Physico-Chemical Characteristics of Yamuna River water at Mathura Pre-Manson 2016



Graph-3: Physico-Chemical Characteristics of Yamuna River water at Mathura Pre-Manson 2016



REFERENCES

1. APHA 1989 – Standard methods for the examination of water and waste water, 17th Ed. Washington DC.

2. Arora, B.R., A.S.Azad, B.Singh and G.S.Sarkar 1985 – Pollution potential of municipal waste water in Punjab. Indian Journal of Agriculture Science 45:80-8

3. BIS 1991 – Drinking water specification IS No. 10500. Bureau of Indian Standards. New Delhi, PP 1-5.

4. Ghose, N.C., C.B. Sharma and S.N. Sinha 1986 – Anappraiseal of the quality of drinking water resource in Bihar. A case study from India. Indian Journal of landscape system and ecology studies 9(1):53:63.

5. Jain, CK, K.K.S. Bhatia and V. Kumar 2000 – Ground water quality in Sager District, Madhya Pradesh, Indian Journal of Environment Health 42(4):151-158.

6. Jajawara, Seema and Surendra Kumar Shringi 2012 – Studies on quality assessment of Chanraloiriver water near Kota, Rajasthan, India.Indian Journal of Environmental Science 16(1):43-46.

7. Khube R. D. and A. Durgpal 1993 – Evalution of drinking water at Bhimtal nainital (U.P). Pollution research 12(1):109-111.

8. Krishnamurthy, S. R. and S. G. Bharti1994-Studies of river Kaluaround Dandeli (North Karnataka District).Pollution Research 13(2):131-136.

9. Kumar S. and L. C. Saha 1999 – Composition of water quality and the chemical nature of the sediments and river water and wells at Bhagalpur. India Aeta, Hydrochom, Hydrobiology 19(4); 411-417.

10. Murthy Narsimha C. V. and G. Ravanaidh 2011 – Impact of Industrial pollution on the change of physic – chemical characteristics of the water of the nelapatte bird sanctuary, Nellore District A.P. Indian Journal of Environmental Science 15(1):39-42.

11. Nag J.K. and A.K.Das 1994 – Quality of drinking water in the Bibhum District of West Bengal. Indian Journal of Environment 14(7):516-519.

12. PragyaKhanna 2011 – Evolution of water quality of river tawi, Jammu (J&K) with reference to physic chemical parameters. Indian Journal of Environmental Science 15(1):1-5.

13. *Sahal, L.C. and B. K. Pandey 1987. Quality of hand pump water at* Bhagalpur Aeta Ecology 7(1):44-48.

14. Sangu, R. P. S. and S.K.Sharma 1987 – An assessment of water quality of river Ganga at GamukteShwarr. Indian Jounal of Ecology 14(29):278:287.

15. Sharma Ajit Kumar 2004 – Water quality problem in Mathura and its effect on the physicology of major crop in the region. Ph.D. Thesis. Dr. B. R. University Agra.

16. Sharma Ajit Kumar and Nidhi Parashar (Sharma) 2012 – Assessment of drinking water quality in mathura city physic chemical characteristics. National Conference EMSE S. S. Jain Subodh (P.G.) Jaipur. 20-22 Dec Abstract 34 PP.

17. Shridhar, R.T. Thangaradjou, S. Senthi Kumar and L. Kanna 2006 – Water quality and phytoplankton characteristics in the palk bay southern coast of India. Journal of Environmental Biology 27(3):561-566.

18. Subba Rao, C. And N. V. Subba Rao1995 – Ground water quality in residential colony. Indian Journal of Environmental Health 37(4):295-300.

19. Suryanarayan 1995 – Effect of ground water quality on health hazards in parts of Eastern Ghats. Indian Journal Protection 15(7):497-500.

20. WHO 1993 – Guideline for drinking water quality in Health Criteria and other supporting information Vol-2 336 PPC Geneva.