



# Assessment of Physico-Chemical and Microbiological Characteristics of Water Samples in Suttur Village, Nanjangud Taluk, Mysore, Karnataka, India

Sravani M., Divya L., Jessen George and Suriyanarayanan S. \*

Department of Water and Health, JSS University, SS Nagar, Mysore, Karnataka-570015, INDIA

Available online at: [www.isca.in](http://www.isca.in), [www.isca.me](http://www.isca.me)

Received 18<sup>th</sup> June 2014, revised 25<sup>th</sup> June 2014, accepted 17<sup>th</sup> July 2014

## Abstract

A study was conducted in Suttur village, Nanjangudtaluk of Mysore District, Karnataka to determine the physico-chemical, biological, and microbiological parameters of drinking water quality from surface water, bore wells and open wells. The water samples were collected from suttur village and analysed for a period of three months from January 2014 to March 2014. The results were compared with the BIS standard and they revealed that the most of the parameters are exceeding the permissible limit for drinking water. Higher values were observed for most of the parameters except pH, Alkalinity, DO, BOD, COD. Higher values of certain parameters indicate the unfitness of water for drinking purpose. Therefore, it is suggested more emphasis should be given to reduce microbial load, total hardness, conductivity, TDS, chloride etc contents wherever these parameters exceeding the limits of the standards.

**Keywords:** Coliforms, physico-chemical, microbiological, water quality.

## Introduction

Water is an essential and vital component of our life support system. In India, most of the population is dependent on surface water as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water<sup>1</sup>. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems<sup>2,3</sup>. The quality of water is to be determined for a locality of various purposes. Hence, safe and reliable drinking water is an essential need for a stable community. As water balances human life system in a positive way, its negative effect is attributed by consequence of various parameters beyond the permissible limits<sup>4</sup>. Water-quality monitoring is used to help water-resource managers to understand the potential negative effects of anthropogenic activities and natural stresses on water resources<sup>5</sup>.

This can be used as a measure of the suitability of water for a particular use based on selected physical, chemical, and biological characteristics. Hence the present study aims to determine the quality of drinking water in Suttur village, Mysore District.

## Material and Methods

**Study area:** The study was carried out in and around Suttur village (12°09'51.9" North and 76°47'52.3" East) situated 24 km south-east of Mysore city in Karnataka. The village has a total population of 4,365 (Census, 2011). About 90% of the populations in Suttur village are involved in agricultural works

and they are depending on three sources of water, such as borewell, communal tap water and open well water.

**Collection of Water samples:** A total of 24 water samples were collected from bore wells, communal tap water and well water across the Suttur village. The study includes collection of water samples during summer season of 2014. The samples were collected in pre-cleaned, sterilized polyethylene bottles. They were analysed by the following physico-chemical parameters and the microbiological analysis. All the measurements were done in triplicate and these averages were considered. The microbiological parameters were examined within 6 hours of sample collection.

**Physico-chemical Analysis of Water:** The physico-chemical characteristic includes pH, temperature, conductivity, alkalinity; chlorides, dissolved oxygen, total dissolved solids, and hardness were measured according to the standard methods<sup>6</sup>.

**Microbiological analysis:** The microbiological quality of water is commonly measured by indicators such as Total coli form count (TCC), faecal coliform count. The samples were analyzed the microbiological parameters such as total coliform count (TCC), Faecal coliform count were determined using standard methods<sup>7</sup>.

## Results and Discussion

The observed physico-chemical and microbiological parameters showed considerable variations in different samples. The observations are depicted in table 1, 2 and 3.

**Table-1**  
**Physico-Chemical and Microbiological Parameters of Surface Water Sample**

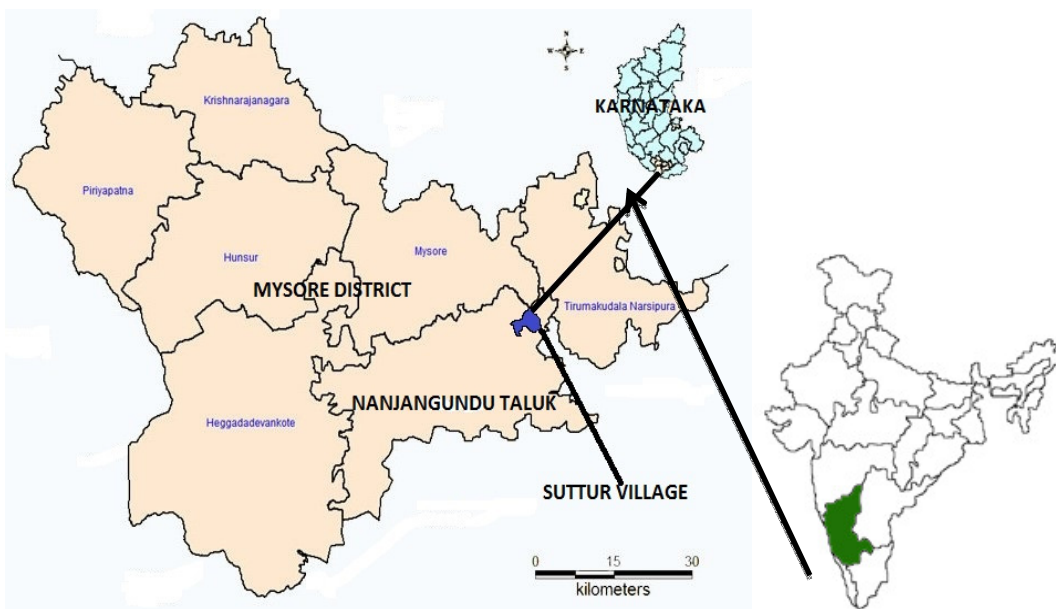
Parameters	Month	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	BIS
pH	January	7.7	7.4	8.1	7.9	8.2	7.6	7.3	7.6	7.8	7.6	7.5	7.6	6.5-8.5
	February	7.7	7.5	8	8	8.3	7.5	7.1	7.7	7.6	7.6	7.4	7.7	
	March	7.5	7.6	8.1	7.9	8.2	7.4	7.2	7.5	7.6	7.6	7.4	7.7	
	Mean value	7.633	7.5	8.066	7.933	8.233	7.5	7.2	7.6	7.66	7.6	7.43	7.66	
Conductivity (µmho)	January	680	570	480	448	670	712	780	540	412	482	418	610	-
	February	682	571	483	447	669	715	781	541	410	481	415	612	
	March	684	574	481	448	675	712	780	539	412	482	418	610	
	Mean value	682	571.6	481.3	447.6	671.3	713	780.3	540	411.3	481.6	417	610.3	
Chloride (mg/L)	January	39.9	29	31	28.8	38	50.2	33.2	29.4	39	31.3	38.5	40	250 mg/L
	February	37.6	28	30	27.8	39	49.2	30.2	29.4	38	30	37.5	39	
	March	38.9	29	32	28.8	37	50.2	30.2	30.1	39	31.3	36.5	35	
	Mean value	38.8	28.6	31	28.4	38	49.8	31.2	29.6	38.6	30.8	37.5	38	
Alkalinity (mg/L)	January	18	20	16	18	16	23	28	24	18	23	25	27	200 mg/L
	February	17	19	14	18	14	21	25	21	15	21	21	23	
	March	18	19	16	16	16	23	27	24	17	23	24	25	
	Mean value	17.6	19.3	15.3	17.3	15.3	22.3	26.6	23	16.6	22.3	23.3	25	
Total Dissolved solids (mg/L)	January	355	350	360	340	297	330	344.6	360	384	392	350	380	500 mg/L
	February	353	350	358	340	295	318	344.8	357	380	390	348	381	
	March	355	349	361	339	297	330	345	360	383	391	350	380	
	Mean value	354.3	349.6	359.6	339.6	354.3	326	344.8	359	382.3	391	349.3	380.3	
Total Hardness (mg/L)	January	210	285	254	230	270	233	245	212	230	296	230	278	200 mg/L
	February	213	288	251	233	273	236	242	209	233	293	233	281	
	March	207	282	257	227	267	230	248	215	227	299	227	275	
	Mean value	210	285	254	230	270	233	245	212	230	296	230	278	
Calcium (mg/L)	January	161	219	202	173	209	173	190	146	181	243	154	166	75 mg/L
	February	158	216	205	170	206	170	193	149	178	246	151	163	
	March	164	222	199	176	212	176	187	143	184	240	157	169	
	Mean value	161	219	202	173	209	173	190	146	181	243	154	166	
Magnesium (mg/L)	January	49	66	52	57	61	60	55	66	49	53	76	82	30 mg/L
	February	55	72	46	63	67	66	49	60	55	47	82	118	
	March	43	60	58	51	55	54	61	72	43	59	70	106	
	Mean value	49	66	52	57	61	60	55	66	49	53	76	82	
Dissolved Oxygen (mg/L)	January	4.4	4.7	5.3	5.1	4.9	5.5	5.4	4.8	5.1	4	5.4	5.2	-
	February	4.1	4.4	5.6	4.8	4.6	5.2	5.7	5.1	4.8	4.3	5.1	4.9	
	March	4.7	5	5	5.4	5.2	5.8	5.1	4.5	5.4	3.7	5.7	5.5	
	Mean value	4.4	4.7	5.3	5.1	4.9	5.5	5.4	4.8	5.1	4	5.4	5.2	
COD (mg/L)	January	7.7	5.6	6.1	5.4	6.4	7.3	8	8.9	4.7	6.1	9.5	5.8	250 mg/L
	February	7.2	5.1	6.6	4.9	5.9	6.8	8.5	9.4	4.2	6.6	9	5.3	
	March	8.2	6.1	5.6	5.9	6.9	7.8	7.5	8.4	5.2	5.6	10	6.3	
	Mean value	7.7	5.6	6.1	5.4	6.4	7.3	8	8.9	4.7	6.1	9.5	5.8	
BOD (mg/L)	January	0.8	0.4	0.6	0.4	0.5	0.5	0.7	0.4	0.8	0.8	0.8	0.4	-
	February	0.7	0.3	0.7	0.3	0.4	0.4	0.8	0.5	0.7	0.9	0.7	0.3	
	March	0.9	0.5	0.5	0.5	0.6	0.6	0.6	0.3	0.9	0.7	0.9	0.5	
	Mean value	0.8	0.4	0.6	0.4	0.5	0.5	0.7	0.4	0.8	0.8	0.8	0.4	
TCC (MPN/100ml)	January	4	4	0	0	4	>2400	9	11	0	0	3	4	10 MPN/100ml
	February	11	3	0	0	0	>2400	11	11	0	0	0	0	
	March	39	3	0	0	0	>2400	9	9	0	0	0	0	
	Mean value	18	3.33	0	0	4	>2400	9.6	10.3	0	0	3	4	

**Table-2**  
**Physico-Chemical and Microbiological Parameters of bore well water**

Parameters	Month	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	BIS(2012)
pH	January	7.2	7.6	7.4	7.5	7.1	7.1	7.3	7.5	7.3	7.5	6.5-7.5
	February	7.3	7.8	7.4	7.5	7.2	7.1	7.4	7.6	7.7	7.5	
	March	7.1	7.7	7.3	7.4	7.3	7.2	7.4	7.6	8.1	7.9	
	Mean value	7.2	7.6	7.4	7.5	7.1	7.1	7.3	7.5	7.3	7.5	
Conductivity (µmho)	January	1435	1126	1309	1249	1217	1469	1210	1452	1255	1169	-
	February	1438	1123	1306	1252	1220	1466	1213	1449	1252	1166	
	March	1432	1129	1312	1246	1214	1472	1267	1455	1258	1172	
	Mean value	1435	1126	1309	1249	1217	1469	1210	1452	1255	1169	
Chloride (mg/L)	January	650	530	680	550	630	650	560	570	630	545	250mg/L
	February	67	533	683	547	627	653	557	573	633	548	
	March	653	527	677	553	633	647	563	567	627	542	
	Mean value	650	530	680	550	630	650	560	570	630	545	
Alkalinity (mg/L)	January	190	184	173	154	160	194	142	136	122	194	200 mg/L
	February	187	187	176	151	197	139	139	125	197	127	
	March	193	181	170	157	103	191	145	133	119	119	
	Mean value	190	184	173	154	160	194	142	136	122	194	
Total Dissolved solids (mg/L)	January	960	755	876	836	815	980	810	972	840	780	500mg/L
	February	963	752	873	839	818	977	813	969	837	777	
	March	957	758	879	833	812	983	807	975	843	783	
	Mean value	960	755	876	836	815	980	810	972	840	780	
Total Hardness (mg/L)	January	240	260	256	275	250	210	264	286	23	298	250 mg/L
	February	243	257	253	278	253	207	267	283	231	295	
	March	237	263	259	272	247	213	261	289	237	301	
	Mean value	240	260	256	275	250	210	264	286	23	298	
Calcium (mg/L)	January	175	205	207	217	181	170	209	227	188	228	75 mg/L
	February	172	208	210	214	178	173	206	230	191	231	
	March	178	202	204	220	184	167	212	224	185	225	
	Mean value	175	205	207	217	181	170	209	227	188	228	
Magnesium (mg/L)	January	65	55	49	58	69	40	55	59	46	70	30 mg/L
	February	71	49	43	64	75	34	61	53	40	64	
	March	59	61	55	52	63	46	49	65	52	76	
	Mean value	65	55	49	58	69	40	55	59	46	70	
Dissolved Oxygen (mg/L)	January	5	4.8	5.2	5.6	5.2	5.6	5.2	5.3	5.2	5	-
	February	4.7	5.1	5.5	5.3	4.9	5.9	4.9	5.6	5.5	5.3	
	March	5.3	4.5	4.9	5.9	5.5	5.3	5.5	5	4.9	4.7	
	Mean value	5	4.8	5.2	5.6	5.2	5.6	5.2	5.3	5.2	5	
COD (mg/L)	January	8.3	10	9.4	9	6.8	10	5.14	5.17	5.13	10	250 mg/L
	February	7.8	10.5	9.9	8.5	6.3	10.5	4.64	5.67	5.63	10.5	
	March	8.8	9.5	8.9	9.5	7.3	9.5	5.64	4.67	4.63	9.5	
	Mean value	8.3	10	9.4	9	6.8	10	5.14	5.17	5.13	10	
BOD (mg/L)	January	0.4	0.6	0.8	0.5	0.8	0.8	0.4	0.4	0.8	0.8	-
	February	0.3	0.7	0.9	0.4	0.7	0.9	0.3	0.5	0.9	0.9	
	March	0.5	0.5	0.7	0.6	0.9	0.7	0.5	0.3	0.7	0.7	
	Mean value	0.4	0.6	0.8	0.5	0.8	0.8	0.4	0.4	0.8	0.8	
TCC (MPN/100mL)	January	0	0	3	4	210	7	0	0	0	0	10 MPN/100ml
	February	0	0	0	3	39	4	0	0	0	0	
	March	0	0	3	0	21	3	0	0	0	0	
	Mean value	0	0	3	2.3	90	4.6	0	0	0	0	

**Table-3**  
**Physico-Chemical and Microbiological Parameters of Open Well Water Sample**

Parameters	Months	O1	O2	WHO
pH	January	8.1	7.9	6.5-8.5
	February	8	8.1	
	March	8.2	8.3	
	Mean value	8.1	7.9	
Conductivity (µmho)	January	1179	1303	-
	February	1176	1306	
	March	1182	1300	
	Mean value	1179	1303	
Chloride (mg/L)	January	520	540	250mg/L
	February	523	537	
	March	517	543	
	Mean value	520	540	
Alkalinity (mg/L)	January	152	140	200mg/L
	February	155	137	
	March	149	143	
	Mean value	152	140	
Total Dissolved solids (mg/L)	January	788	872	500mg/L
	February	785	875	
	March	791	869	
	Mean value	788	872	
Total Hardness (mg/L)	January	260	254	200mg/L
	February	257	257	
	March	263	251	
	Mean value	260	254	
Calcium(mg/L)	January	202	191	75mg/L
	February	205	188	
	March	199	194	
	Mean value	202	191	
Magnesium (mg/L)	January	58	63	30mg/L
	February	52	69	
	March	64	57	
	Mean value	58	63	
Dissolved Oxygen(mg/L)	January	4.4	5.4	
	February	4.7	5.1	
	March	4.1	5.7	
	Mean value	4.4	5.4	
COD (mg/L)	January	5.6	9.3	250mg/L
	February	6.1	8.8	
	March	5.1	9.8	
	Mean value	5.6	9.3	
BOD (mg/L)	January	0.8	0.8	-
	February	0.9	0.7	
	March	0.7	0.9	
	Mean value	0.8	0.8	
TCC(MPN/100mg/L)	January	240	210	10(MPN/100ml)
	February	210	210	
	March	240	214	
	Mean value	230	634	



**Figure-1**  
**Map showing the study area in Suttur village, Mysore district, Karnataka**

**pH:** In this present study all the water samples are within the permissible limit as per the BIS (BIS 2012)<sup>8</sup>. The hydrogen ion concentration (pH) ranged from 7.6 to 7.7 for surface water, 7.1 to 7.6 for borewell water and 7.9 to 8.1 for open well. Sample S3, S5 and O1 are showing alkaline range of pH. The permissible level of pH in drinking water is 6.5 to 8.5, according to the BIS (2012). Presence of alkalinity in surface water might be due to addition of lime during neutralization of the effluent higher pH might be due to mixing of alkali contained effluents or microbial activities<sup>9</sup>.

**Electrical Conductivity:** The Electrical conductivity values ranged from 412 to 712  $\mu\text{mhos/cm}$  for surface water are 1126 to 1469  $\mu\text{mhos/cm}$  for bore water and 1179 to 1303  $\mu\text{mhos/cm}$  for open well samples during assessment period of January-March 2014. From total number of 24 water samples, higher value was noticed for bore well sample B1, B6 and B8 which may be due to high concentration of cations such as sodium, calcium and magnesium or anions like chloride, phosphate and nitrate. The higher concentration of ions in water may also be due to the leaching of ions from the soils and pick up of organic materials from biota and debris<sup>10</sup>.

**Chloride:** Chlorides are common constituents of all natural waters. Chloride content in the present study ranges from 28.8 to 39.8 mg/L for surface water and 530 to 680 mg/L for bore well water and 520 to 540 mg/L for open well water samples respectively. As per BIS the desirable limit of chloride for drinking water is 250 mg/L. In this present study the surface water sample are within the limits of prescribed BIS standards. Whereas the bore well and open well water samples are higher in concentration.

**Alkalinity:** The range of total alkalinity in the present study is from 15.3 to 26.6 mg/L for surface water, 122 to 190 mg/L for Bore well water and 140 to 152 mg/L for open wells respectively. BIS recommends 200 mg/L of alkalinity for drinking water samples. According to BIS standards all the samples are within the limits.

**Total Dissolved Solids (TDS):** Total Dissolved solids are an important parameter in drinking water and other water quality standards. In the present study, TDS ranges from 297 to 391 mg/L for surface water and 755 to 980 mg/L for bore well water and 788 to 872 mg/L respectively. BIS recommends 500 mg/L. The presence of high concentration of solids reduces the clarity of the water, rises the temperature and in turn leads to the decrease in the content of oxygen level. The TDS values of surface water are with the standard limits of BIS (2012). Whereas the bore well and open well sample are higher in concentration exceeding the BIS limits.

**Total hardness:** In the present study, total hardness was found to range from 210 to 296 mg/L for surface water and to 210 to 298 mg/L for bore well and 254 to 260 mg/L for open well respectively. BIS recommends 500 mg/L. It is observed that the samples are within the limits of BIS standards.

**Calcium and Magnesium hardness:** Water is hard mainly due to the dissolved minerals specifically calcium and magnesium. Calcium ( $\text{Ca}^{2+}$ ) and magnesium ( $\text{Mg}^{2+}$ ) ions are both common in natural waters and both are essential elements for all organisms. The calcium content in the present study varied from 161 to 243mg/L for surface water and 170 to 227mg/L for bore well and 191 to 202 mg/L for open well water respectively. BIS recommends 75 mg/L. The samples are not within the limits of

BIS standards. Magnesium content in the present study ranges from 49 to 66mg/L for surface water and 40 to 70mg/L for Bore well water samples and 58 to 63mg/L for open well respectively. BIS recommends 30 mg/L. The samples are not within the limits of BIS standards.

**Dissolved Oxygen:** Dissolved Oxygen values ranged from 4 to 5.4 mg/L for surface water, for bore water ranges from 4.8 to 5.6 mg/L and for open well 4.4 to 5.4 mg/L. The lower DO values indicate the presence of high organic pollutants the high value of DO in riverine system may be due to prominence of plankton density<sup>11</sup>.

**Biochemical Oxygen Demand:** BOD test provides an estimate of how much biodegradable waste is present in water. The nutrient like nitrates and phosphates are discarded into the surface water from the discharge of domestic effluent which intern stimulate the growth of microorganisms leading to water pollution which is directly proportional to the BOD<sup>10</sup>. In this present study, BOD values varied from 0.4 to 0.8mg/L for surface water samples, whereas, for bore water 0.4 to 0.8 mg/L and for open well are 0.8 mg/L. Highest values may be due to higher organic load. All the samples are within the limits.

**Chemical Oxygen Demand:** In this present study, COD varied from 6.1 to 9.5mg/L for surface water, for bore water varied from 5.13 to 10, for open well varied from 5.6 to 9.3. Highest value indicates the presence of organics, due to effluent runoff to river water from the nearby industries. BIS recommended limit for COD is 250mg/L. It was observed that all the samples are within the limits of BIS (2012).

**Total Coliform Count (TCC):** Total coliform is one of the most important microbiological parameter for drinking water quality. In this present study TCC ranges from 0 to 39 MPN/100ml for treated surface water. Among 12 sampling sites two places (S-1 and S-8) values are exceeded the BIS (2012) and WHO (2011)<sup>12</sup> limit. The sampling sites (S-2, S-5, S-7, S-11, S-12) which are exceeded the WHO (2011) guidelines and lower than the BIS, (2012) limit. In ground water samples it ranges from 0 to 210 MPN/100 ml. The values slightly exceeded the WHO, (2011) and BIS, (2012) limit in sampling station (B-5). In sampling stations (B-4 and B-6) the values are exceeded WHO, (2011) and lower than BIS, (2012). In open well water TCC ranges 210 to 240 MPN/100ml. For all two sampling points the values are exceeded the WHO, (2011) and BIS, (2012) limit. Hence the overall few of sampling points the water not microbiologically fit for consumption. In case of raw water from river Kabani shows >2400 MPN/100 ml. It shows that the raw water seems to be moderately polluted due to various anthropogenic activities. Hence pre-treatment is required for drinking purposes. The Faecal coliform count (FCC) was also reported for (S-1, B-5, O-1 and O-2) samples. The presence of FCC indicates that the water not suitable for drinking purposes.

## Conclusion

As a whole, this study concluded that, the most of the parameters are exceeding the permissible limit of BIS standard for drinking water. Higher values were observed for most of the parameters except pH, Alkalinity, DO, BOD, COD. Higher values of certain parameters indicate the unfitness of water for drinking purpose. From this present study also concluded that open well water was not microbiologically fit for consumption. Therefore, it is suggested more emphasis should be given to reduce microbial load, total hardness, conductivity, TDS, chloride etc contents wherever these parameters exceeding the limits of the standards.

## References

1. Patil V.T. and Patil P.R., Physicochemical Analysis of Selected Groundwater Samples of Amalner Town in Jalgaon District, Maharashtra, India, *E-Journal of Chemistry*, **7(1)**, 111-116 (2010)
2. Suriyanarayanan S., Jayakumar D., Devi M.P. and Balasubramanian S., Monitoring of ground water in and around waste paper based paper mill in Kanchipuram, *Indian Journal of Environmental Protection*, **23(9)**, (2003)
3. Nithulal K.P., Karthikeyan K., Praveesh V., Devi., Suriyanarayanan S. and Vijay Kumar, Drinking Water Quality Assessment of Ground Waters of Bhachau - Kachchh, Gujarat, India with special reference to major Anions and Cations, *International Research Journal of Environment Sciences*, **3(5)**, 67-72 (2014)
4. Raja R.E., Lydia Sharmila, Princy Merlin, Christopher G., Physico-Chemical analysis of some groundwater samples of Kotputli Town Jaipur, Rajasthan, *Indian J Environ Prot*, **22(2)**, 137 (2002)
5. Suriyanarayanan S., Jayakumar D., Balasubramanian S., Physico-chemical characteristics of paper industry effluents--a case study, *J Environ Sci Eng.*, **47(2)**, 155-6 (2005)
6. APHA, Standard Methods for the Examination of Water and Wastewaters, 20th Edn American public health association, Washington DC, (1998)
7. Bureau of Indian Standards, Indian standard Method of sampling and Microbiological examination of water, Fourth Reprint (2003)
8. Bureau of Indian Standards, Drinking water specification Second revision (2012)
9. Rajanna A H, Belagali SL., Assessment of seasonal variations of physico-chemical profile of Kabaniriver, Nanjangud, Mysore, Karnataka, *The Ecoscan*, **5(3&4)**, 147-151 (2011)
10. Parihar S.S., Kumar Ajit, Kumar Ajay, Gupta R.N., Pathak Manoj, Shrivastav Archana and Pandey A.C., Physico-

Chemical and Microbiological Analysis of Underground Water in and Around Gwalior City, MP, India, *Research Journal of Recent Sciences*, 1(6), 62-65 (2012)

Coastal Site of Natural Reserve "Lake of Tarsia-Mouth of River Crati"-Northern Ionian Sea, Calabria (Italy), *Journal of Water Resource and Protection*, 5, 1087-1096 (2013)

11. Alessandra Giulia Chiara Marincola, Luisa Ruffolo, Davide Cozza., Radiana Cozza, Phytoplankton Communities in a

12. WHO Guidelines for drinking water Quality Fourth Edition, Geneva: World Health Organization (2011)