Current World Enviroment Vol. **3**(1), 83-92 (2008)

A study on correlation coefficient of some physico-chemical characteristics of Tumkur city sewage

K.S. KUMARA and S.L. BELAGALI

Department of Studies in Environmental Science, University of Mysore,
Mysore - 570 006 (India)

(Received: March 12, 2008; Accepted: May 05, 2008)

ABSTRACT

The Tumkur city sewage samples were collected and analysed from February 2007 to January 2008 for six sampling points - residential area (S_1), business centre (S_2), slum (S_3), converging point (S_4), open drain (S_5) and treated sewage water (S_6). The correlation coefficient 'r' of some physico-chemical parameters is derived. There is wide variation in the sewage quality, which is reflected by the results. The usefulness of this approach has been demonstrated to predict the quality of domestic waste. The result of the study is useful to predict the anthropogenic activities of the area. The present study reveals the significant correlation among pH-alkalinity, electrical conductivity-total dissolved solids, hardness- chloride, BOD-COD, although the quality of sewage varied significantly. The study of correlation coefficient facilitates the rapid monitoring process of sewage and gives an idea of treatment technique.

Key words: Sewage, EC, TDS, BOD, COD, Correlation coefficient.

INTRODUCTION

Sewage is a domestic waste enriched with nutrients and plays vital role in water pollution. Although, application of sewage were reported to be beneficial in increasing crop yield and reduce fertilizer requirement but leads to the accumulation of toxic metals in the soil and ultimately creates health problems[1]. The sewage comprises organic, inorganic and biological components. The chemistry of sewage is influenced by the inputs of materials containing minerals, their solubility and chemical equilibrium prevailing in the aqueous solutions. Based on anthropogenic activities, the composition of sewage greatly varies in different geographical regions[2].

Derivation of correlation coefficient 'r' among sewage parameters greatly facilitates the task of rapid monitoring process[3]. It is useful in identifying the appropriate methodology for treatment and to design the facility for disposal and reuse of sewage[4]. Since a definite correlation usually exists among the sewage quality parameters, a systematic calculation and interpretation of correlation coefficient gives an idea of treatment techniques[5].

Several researchers have attempted to determine the correlation coefficient of physico-chemical characteristics of water bodies and waste waters[6-15]. The literature revealed that, the correlation coefficient studies on sewage are limited. Hence, an attempt has been made to study the correlation coefficient of physico-chemical characteristics of Tumkur city sewage.

MATERIALS AND METHODS

Tumkur city is situated between 13°19'00"

to13°21'19" N latitude and 77° 05' 26" to 77° 07' 12" E longitude at 818.51m on MSL and 68 Km northwest of Bangalore city. The city spread area is about 102.6 Sq km. The 70 % of city area is covered by under ground drainage (UGD) facility.

City sewage samples were collected separately in 3 litre polythene cans from six sampling points - S_1,S_2,S_3(closed), S_4(converging), S_5(open) and S_6(treated) (Fig.1) between 7AM to 8AM on first week of every month and immediately

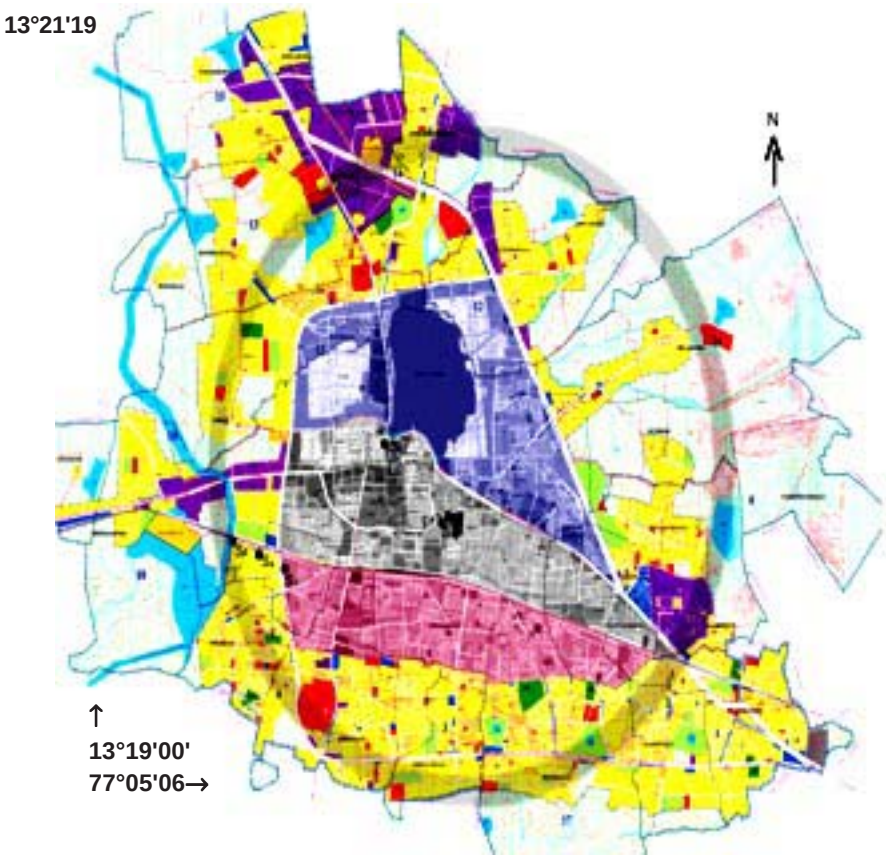

Fig. 1: Tumkur city map showing sewage sampling points

brought to the laboratory for analysis. The Temperature, pH, EC, TDS, DO, CO_2, H_2S, BOD, COD, Acidity, Alkalinity, Hardness, Chloride, Nitrate and Phosphates were estimated following the standard methods[16, 17]. The Pearson correlation coefficient 'r' was calculated using Pentium-IV Windows EXCEL statistical package.

RESULTS AND DISCUSSION

The physico-chemical characteristics of sewage in different areas of Tumkur city are presented in Table 1 to 6 and their Pearson correlation coefficient 'r' values are shown in the Table 1a to 6a. The sewage quality parameters revealed variations, which depend upon the anthropogenic activities, geochemical composition, climatic conditions and biological activities of microbes.

The temperature variation attributed to the active biological processes and decomposition of

organic matter [18, 19]. Sewage temperature positively correlates with DO in sample-1 (0.63), 2(0.12), 3(0.32) and 4(0.14), H_2S in sample-1to 6 (0.48, 0.45, 0.42, 0.32, 0.58 and 0.18), acidity (0.28, 0.40, 0.60, 0.47 and 0.46 in sample-1 to 5 correspondingly), BOD (0.49, 0.26 and 0.32 in 2, 5 and 6 samples) and COD(0.60, 0.11 and 0.41 in sewage samples 2, 5 and 6). The variation in the correlation coefficient values are attributed due to the sewage quality and the anthropogenic activities.

Table 1: Variation in Pysico-Chemical Parameters of Sample Station1

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.4	2.0	830	1.4	42	3.40	360	760	522	1367	466	383	0.26	0.46
Mar-07	31	7.8	2.3	960	2.8	56	0.85	102	280	322	1409	490	360	0.31	0.59
Apr-07	32	7.3	1.9	860	5.4	62	3.34	64	140	463	1351	404	382	0.16	1.20
May-07	32	7.2	1.7	620	3.0	59	1.70	120	210	415	1211	382	293	0.40	1.80
Jun-07	34	7.7	2.1	920	0.6	124	0.21	570	1180	178	1433	436	312	0.06	2.20
Jul-07	27	7.2	2.1	1008	0.2	181	0.00	760	1690	296	1276	420	323	0.08	2.80
Aug-07	25	7.7	1.9	1012	0.6	55	0.21	340	720	163	1450	448	332	0.18	0.56
Sep-07	27	7.2	2.0	989	1.4	64	0.23	381	738	305	1339	456	325	0.20	1.40
Oct-07	27	7.6	2.1	980	0.2	58	0.00	624	1120	236	1411	490	358	3.20	3.90
Nov-07	27	7.8	2.2	1100	0.0	64	0.23	780	1350	241	1495	518	368	3.00	4.20
Dec-07	26	7.7	2.4	1350	0.2	58	0.00	640	1246	228	1380	560	395	4.00	3.85
Jan-08	27	7.1	2.0	890	0.0	64	0.00	770	1424	447	1172	540	335	6.00	3.80

Table 1a: Correlation of Physico-chemical parameters of Sampling Station 1

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0	-0.02	-0.24	-0.59	0.63	0.11	0.48	-0.53	-0.50	0.28	-0.07	-0.54	-0.23	-0.45	-0.35
pH		1.0	0.61	0.52	-0.22	-0.19	-0.25	0.05	0.02	-0.65	0.88	0.37	0.37	-0.00	0.05
EC			1.0	0.82	-0.42	0.09	-0.43	0.43	0.44	-0.42	0.46	0.74	0.55	0.34	0.39
TDS				1.0	-0.52	0.06	-0.54	0.52	0.52	-0.60	0.49	0.70	0.60	0.38	0.45
DO					1.0	-0.27	0.75	-0.88	-0.88	0.53	-0.14	-0.57	0.09	-0.49	-0.59
CO_2						1.0	-0.34	0.42	0.54	-0.27	-0.15	-0.32	-0.42	-0.25	0.19
H_2S							1.0	-0.66	-0.65	0.76	-0.10	-0.45	0.33	-0.42	-0.58
BOD								1.0	0.98	-0.37	0.02	0.56	0.02	0.62	0.81
COD									1.0	-0.38	0.00	0.49	-0.01	0.52	0.73
Aci										1.0	-0.61	-0.19	0.17	-0.00	-0.28
Alk											1.0	0.18	0.41	-0.22	-0.07
TH												1.0	0.54	0.80	0.56
Cl^-													1.0	0.28	0.10
NO_3^{-1}														1.0	0.79
PO_4^{-3}															1.0

It was observed that sewage was alkaline in nature during the study period. The results are possibly due to photosynthetic assimilation of inorganic carbon[20]. pH determination is essential for assessing the suitability of sewage for biota and treatment measures. The results showed positive relationship with conductivity (0.61, 0.77, 0.42, 0.52, 0.21 and 0.03), total alkalinity (0.88, 0.70, 0.60, 0.40, 0.50 and 0.75) and dissolved solids (0.82, 0.83, 0.91, 0.75, 0.91 and 0.78) for all the samples. The significant value indicates that the ions responsible for pH also contribute to the conductivity,

Table 2: Variation in physico-chemical parameters of Sample Station 2

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.4	1.8	850	1.8	62	1.20	440	750	398	1129	418	281	0.38	0.42
Mar-07	31	8.2	2.0	1330	3.2	75	2.30	306	612	150	1343	452	340	0.16	0.57
Apr-07	32	7.3	1.5	885	2.2	82	1.86	416	860	330	1116	388	225	0.28	1.68
May-07	32	7.2	1.6	635	1.8	94	0.00	512	824	346	1108	396	251	0.58	2.64
Jun-07	34	7.9	1.7	890	2.6	51	0.42	360	958	162	1272	412	290	0.08	3.46
Jul-07	27	7.3	1.7	844	1.2	53	0.23	256	340	161	1087	390	262	0.28	2.78
Aug-07	25	7.5	1.6	832	1.0	90	0.23	496	920	171	1182	464	246	0.46	1.88
Sep-07	27	7.1	1.6	825	2.4	36	0.46	172	430	202	1050	484	238	0.08	2.16
Oct-07	27	7.8	2.0	1229	2.2	106	0.23	190	546	113	1128	512	305	0.06	3.22
Nov-07	27	7.9	2.0	1028	2.4	97	0.23	119	210	110	1144	498	298	0.08	1.84
Dec-07	26	7.8	2.0	1154	3.2	93	0.23	98	342	106	1028	506	274	0.02	1.18
Jan-08	27	7.2	1.7	960	3.8	143	0.00	76	324	262	970	468	248	0.04	0.68

Table 2a: Correlation of physico-chemical parameters of Sampling Station 2

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0.	0.14	-0.26	-0.17	0.12	-0.27	0.45	0.49	0.60	0.40	0.52	-0.65	0.13	0.19	0.20
pH		1.0	0.77	0.78	0.31	0.03	0.30	-0.16	-0.02	-0.63	0.70	0.36	0.88	-0.40	-0.02
EC			1.0	0.83	0.40	0.22	0.05	-0.53	-0.51	-0.58	0.21	0.64	0.84	0.57	-0.19
TDS				1.0	0.55	0.25	0.36	-0.52	-0.36	-0.61	0.30	0.59	0.74	-0.65	-0.26
DO					1.0	0.39	0.14	-0.64	-0.39	0.17	-0.11	0.40	0.29	-0.72	-0.41
CO_2						1.0	-0.27	-0.29	-0.24	-0.01	-0.36	0.36	-0.00	-0.11	-0.27
H_2S							1.0	0.29	0.30	0.24	0.55	-0.29	0.29	0.05	-0.46
BOD								1.0	0.88	0.57	0.45	-0.68	-0.19	-0.87	0.12
COD									1.0	0.44	0.51	-0.54	-0.14	0.59	0.20
Aci										1.0	-0.20	-0.63	-0.47	0.61	-0.31
Alk											1.0	-0.19	0.64	0.13	0.11
TH												1.0	0.31	-0.62	-0.13
Cl^-													1.0	-0.33	-0.07
NO_3^{-1}														1.0	0.02
PO_4^{-3}															1.0

alkalinity and dissolved solids. Such a relationship was also reported[21].

The conductivity is an index of total number of ions in sewage. High conductivity is usually the indication of chloride, dissolved solids and total hardness. Nevertheless the concentration of cationic and anionic contents in sewage had profound impact on electrical conductivity[22]. The EC showed positive relationship with total dissolved solids (0.82, 0.83, 0.91, 0.75, 0.91 and 0.78), hardness (0.74, 0.64, 0.80, 0.61 and 0.78) and chlorides (0.55, 0.84, 0.43, 0.65 and 0.70). The relation of EC could be explained on the basis of solubility of minerals and

Table 3: Variation in physico-chemical parameters of Sample Station 3

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.4	2.0	1260	0.0	46	0.4	428	820	301	1364	432	279	0.3	0.7
Mar-07	31	7.2	2.1	1330	5.9	50	0.4	96	210	330	1256	444	323	0.4	0.7
Apr-07	32	7.3	2.0	1128	3.8	39	0.5	124	220	316	1280	418	285	0.2	1.4
May-07	32	7.1	1.0	630	2.1	16	0.0	264	620	324	1054	322	168	0.4	1.9
Jun-07	34	7.7	1.7	870	2.2	62	1.3	380	710	272	1402	386	327	0.1	2.4
Jul-07	27	7.3	1.8	862	2.3	88	1.2	111	260	268	1362	374	316	0.2	2.7
Aug-07	25	7.6	1.7	852	2.9	50	0.4	108	224	135	1324	482	352	0.2	1.1
Sep-07	27	7.3	1.3	780	1.6	83	0.0	331	630	287	1184	360	248	0.2	1.5
Oct-07	27	7.7	2.1	1288	2.4	130	0.0	380	800	136	1304	468	207	2.2	3.6
Nov-07	27	8.0	1.9	1040	1.7	119	0.0	676	1234	110	1468	400	237	2.0	3.9
Dec-07	26	7.9	2.2	1280	0.9	117	0.0	394	820	123	1258	480	348	2.0	2.3
Jan-08	27	7.4	2.0	1240	2.1	296	0.0	431	950	337	1234	458	259	3.8	2.2

Table 3a: Correlation of Physico-chemical parameters of Sampling Station 3

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0	-0.42	-0.25	-0.15	0.32	-0.44	0.42	-0.17	-0.20	0.60	-0.14	-0.48	-0.12	-0.44	-0.23
pH		1.0	0.42	0.23	-0.39	0.28	-0.16	0.65	0.62	-0.88	0.60	0.43	0.18	0.44	0.64
EC			1.0	0.91	0.15	0.41	0.02	0.13	0.12	-0.29	0.53	0.80	0.43	0.46	0.14
TDS				1.0	0.13	0.39	-0.22	0.18	0.19	-0.10	0.26	0.75	0.21	0.49	-0.02
DO					1.0	-0.17	0.17	-0.63	-0.65	0.26	-0.13	0.10	0.18	-0.19	0.25
CO_2						1.0	-0.32	0.44	0.52	-0.06	0.06	0.37	-0.09	0.91	0.40
H_2S							1.0	-0.40	-0.46	0.24	0.45	-0.19	0.54	-0.55	-0.11
BOD								1.0	0.98	-0.36	0.33	-0.00	-0.37	0.57	0.57
COD									1.0	-0.33	0.22	0.01	-0.42	0.66	0.58
Aci										1.0	-0.45	-0.44	-0.15	-0.26	-0.55
Alk											1.0	0.29	0.42	0.01	0.34
TH												1.0	0.48	0.44	-0.07
Cl^-													1.0	-0.25	-0.35
NO_3^{-1}														1.0	0.52
PO_4^{-3}															1.0

other inorganic matter. The results are harmony with the earlier findings[23].

DO level in sewage is confined with respiratory activities of microbes and also the chemosynthetic processes of phytoplankton. It varies according to the density and metabolic activities of micro flora and fauna. As the amount of salt increase in sewage the amount of dissolved oxygen decreases[24]. Hence DO negatively correlate with BOD (- 0.88, - 0.64, - 0.63, - 0.44, -0.63 and - 0.52) and COD (- 0.88, -0.39, -0.65, -0.30 and - 0.51). The results are in agreement with the previous findings[14, 22].

Table 4: Variation in physico-chemical parameters of Sample Station 4

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.9	2.0	945	4.4	42	0.9	428	820	158	1129	428	259	0.2	0.7
Mar-07	31	7.8	2.2	1010	3.2	36	3.8	356	730	210	1178	454	299	0.3	0.7
Apr-07	32	7.2	1.8	854	1.8	32	0.5	121	270	294	1170	394	228	0.2	1.3
May-07	32	6.8	1.5	640	2.2	81	0.0	328	680	392	490	322	144	0.5	1.8
Jun-07	34	7.6	1.9	960	1.4	124	0.0	550	980	153	1110	362	276	0.1	2.0
Jul-07	27	7.1	2.0	988	0.2	148	0.0	610	1120	158	1214	348	275	0.3	2.0
Aug-07	25	7.4	2.0	978	1.0	78	0.0	530	910	110	430	432	364	0.3	1.0
Sep-07	27	7.8	1.7	946	1.8	62	0.0	347	720	264	1050	340	303	0.2	1.3
Oct-07	27	7.8	1.9	1075	2.4	126	0.0	350	750	128	1027	372	324	2.4	2.9
Nov-07	27	7.7	1.9	998	2.4	91	0.0	375	768	103	920	378	198	2.0	2.8
Dec-07	26	7.6	2.3	1013	1.4	89	0.0	610	1124	101	1089	426	350	5.0	1.2
Jan-08	27	7.3	1.8	939	3.4	251	0.0	341	880	286	1058	376	268	4.8	1.4

Table 4a. Correlation of physico-chemical parameters of Sampling Station 4

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0	-0.20	-0.32	-0.50	0.14	-0.26	0.31	-0.34	-0.42	0.47	0.16	-0.17	-0.53	-0.47	-0.07
pH		1.0	0.52	0.72	0.41	-0.26	0.32	0.07	0.08	-0.58	0.40	0.47	0.48	0.05	-0.06
EC			1.0	0.75	0.03	-0.09	0.44	0.53	0.49	-0.75	0.40	0.80	0.65	0.27	-0.28
TDS				1.0	-0.03	0.14	0.15	0.39	0.41	-0.83	0.47	0.46	0.74	0.27	0.14
DO					1.0	-0.06	0.41	-0.44	-0.30	0.19	0.15	0.32	-0.23	0.15	-0.27
CO_2						1.0	-0.41	0.23	0.45	0.01	0.06	-0.36	0.05	0.58	0.36
H_2S							1.0	-0.19	-0.20	0.05	0.29	0.59	0.08	-0.25	-0.49
BOD								1.0	0.95	-0.63	-0.03	0.11	0.48	0.14	0.00
COD									1.0	-0.55	0.02	0.04	0.45	0.34	0.05
Aci										1.0	-0.16	-0.47	-0.61	-0.17	-0.20
Alk											1.0	0.13	0.14	0.11	-0.03
TH												1.0	0.51	0.11	-0.58
Cl^-													1.0	0.22	-0.25
NO_3^{-1}														1.0	0.15
PO_4^{-3}															1.0

The higher values of total alkalinity indicate low photosynthetic rate. It implies a large reserve of carbon dioxide, which provides inorganic carbon for the support of phytoplankton[25]. The high alkalinity attributed to increased rate of organic decomposition, during which carbon dioxide is liberated and reacts with sewage to form bicarbonate thereby increasing the total alkalinity. It relates positively with pH, EC, TDS, H_2S, BOD and COD (Table 1a to 6a). The relation supports the hypothesis of the dependence of alkalinity on sewage ionic density.

Table 5: Variation in physico-chemical parameters of Sample Station 5

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.4	1.7	849	3.2	62	0.0	389	690	250	1136	592	335	0.3	0.5
Mar-07	31	7.7	1.9	946	4.4	49	0.0	362	680	350	1356	600	344	0.3	0.5
Apr-07	32	7.8	1.5	820	2.2	56	0.0	326	550	224	1444	572	330	0.1	1.3
May-07	32	7.5	0.7	610	1.2	62	0.0	297	510	9	1342	324	84	0.3	1.7
Jun-07	34	8.0	1.8	880	0.8	113	0.9	620	1120	103	1480	472	316	0.0	2.1
Jul-07	27	7.7	1.8	866	0.4	139	0.0	652	1234	100	1285	488	312	0.3	2.6
Aug-07	25	7.8	1.7	854	1.6	57	0.0	320	560	72	1303	438	262	0.2	0.7
Sep-07	27	7.5	1.7	845	1.6	88	0.0	401	740	206	1036	446	247	0.2	1.1
Oct-07	27	8.1	1.5	860	2.8	114	0.0	360	724	64	1234	352	155	5.8	1.0
Nov-07	27	8.1	1.4	792	4.6	59	0.0	288	590	67	1324	446	156	6.0	0.9
Dec-07	26	8.0	1.8	968	3.0	63	0.0	319	720	71	1412	496	197	3.0	3.4
Jan-08	27	7.7	1.7	960	4.2	299	0.0	287	640	340	1326	450	202	2.8	3.6

Table 5a: Correlation of physico-chemical parameters of Sampling Station 5

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0	-0.16	-0.26	-0.32	-0.21	-0.18	0.58	0.26	0.11	0.13	0.46	0.19	0.26	-0.44	-0.13
pH		1.0	0.21	0.31	0.26	-0.01	0.25	-0.04	0.07	-0.35	0.50	-0.18	-0.21	0.70	0.13
EC			1.0	0.91	0.16	0.21	0.19	0.39	0.47	0.49	-0.03	0.61	0.70	-0.08	0.11
TDS				1.0	0.36	0.36	0.08	0.14	0.29	0.52	0.08	0.51	0.47	0.10	0.34
DO					1.0	0.11	-0.37	-0.63	-0.51	0.49	-0.00	0.29	-0.11	0.56	-0.11
CO_2						1.0	0.07	0.10	0.23	0.35	-0.00	-0.20	-0.11	0.17	0.66
H_2S							1.0	0.60	0.55	-0.14	0.43	-0.00	0.26	-0.21	0.14
BOD								1.0	0.96	-0.11	0.05	0.14	0.50	-0.37	0.16
COD									1.0	-0.10	0.07	0.10	0.41	-0.20	0.34
Aci										1.0	-0.15	0.66	0.55	-0.26	-0.04
Alk											1.0	0.09	0.04	0.00	0.37
TH												1.0	0.85	-0.39	-0.16
Cl^-													1.0	-0.60	-0.21
NO_3^{-1}														1.0	0.10
PO_4^{-3}															1.0

Total hardness of sewage is due to concentration of salts especially of divalent metallic salts of calcium and magnesium. The higher values are due to the excessive dumping of domestic waste, detergents and carbonate minerals. Calcium, magnesium and total hardness in sewage are interrelated. And hardness correlates with EC, chloride and TDS (Table 1a to 6a).

Chloride content is an indication of eutrophication caused by animal and domestic waste [26]. The higher concentration of chloride content in the sewage is possibly due to large scale chemical fertilizers and animal waste, which may have percolated from surface to sewage. Chloride showed relationship with TDS (0.60, 0.74, 0.21,

Table 6: Variation in physico-chemical parameters of Sample Station 6

	Temp	pH	EC	TDS	DO	CO_2	H_2S	BOD	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Feb-07	29	7.9	1.5	710	3.8	11.0	0.0	110	268	19	620	460	260	0.05	0.55
Mar-07	31	8.1	1.4	630	3.6	16.0	1.2	135	298	16	748	380	249	0.03	0.64
Apr-07	32	7.9	1.4	640	4.0	15.0	0.0	120	292	21	720	410	227	0.09	0.66
May-07	32	8.0	1.4	590	4.2	0.0	0.0	123	242	33	703	452	297	0.06	0.96
Jun-07	34	8.8	1.3	675	3.4	0.0	0.0	280	576	0	847	338	251	0.02	0.86
Jul-07	27	8.4	1.3	665	3.9	14.0	0.2	88	158	16	748	342	262	0.06	1.10
Aug-07	25	7.7	1.2	650	3.2	0.0	0.0	180	362	41	549	342	246	0.08	0.46
Sep-07	27	7.7	1.0	540	2.7	55.0	0.2	190	374	59	683	266	156	0.04	0.76
Oct-07	27	8.1	1.3	739	3.0	67.6	0.0	168	340	48	828	384	175	5.40	2.40
Nov-07	27	8.1	1.6	832	4.7	48.5	0.0	168	328	55	843	404	278	5.00	2.25
Dec-07	26	8.1	1.6	724	3.9	45.0	0.0	98	210	51	798	402	263	4.00	2.60
Jan-08	27	7.5	1.6	853	5.9	85.6	0.0	88	190	211	605	462	290	4.20	2.00

Table 6a: Correlation of physico-chemical parameters of Sampling Station 6

	Temp	pH	EC	TDS	DO	CO_2	H_2S	B0D	COD	Aci	Alk	TH	Cl^-	NO_3^{-1}	PO_4^{-3}
Temp	1.0	0.48	-0.02	-0.33	-0.02	-0.51	0.18	0.32	0.41	-0.41	-0.29	0.15	0.16	-0.48	-0.44
pH		1.0	0.03	-0.06	-0.27	-0.42	0.07	0.46	0.45	-0.62	0.75	-0.24	0.07	-0.12	0.01
EC			1.0	0.78	0.74	0.24	-0.11	-0.43	-0.40	0.30	0.26	0.78	0.70	0.60	0.60
TDS				1.0	0.69	0.56	-0.30	-0.21	-0.21	0.58	0.14	0.53	0.41	0.79	0.70
DO					1.0	0.34	-0.17	-0.52	-0.51	0.69	-0.14	0.71	0.74	0.39	0.37
CO_2						1.0	-0.12	-0.21	-0.25	0.76	0.09	0.08	-0.26	0.79	0.73
H_2S							1.0	-0.07	-0.05	-0.20	0.06	-0.20	-0.08	-0.29	-0.29
BOD								1.0	0.98	-0.33	0.33	-0.56	-0.37	-0.14	-0.20
COD									1.0	-0.36	0.29	-0.48	-0.37	-0.19	-0.26
Aci										1.0	-0.36	0.33	0.19	0.53	0.45
Alk											1.0	-0.15	-0.11	0.37	0.49
TH												1.0	0.66	0.30	0.25
Cl^-													1.0	0.02	0.08
NO_3^{-1}														1.0	0.95
PO_4^{-3}															1.0

Note: All values are expressed in mg/L except EC ($mScm^{-1}$) and temperature (°C).

0.74, 0.47 and 0.79), EC (0.55, 0.84, 0.43, 0.65, 0.70 and 0.70) and pH (0.37, 0.88, 0.18, 0.48, -0.21 and 0.07).

The decomposition of organic matter and the slow oxidation process in sewage leads to increase in nutrient level. The higher phosphate levels may interfere in treatment plants. The correlation coefficient 'r' values with sewage quality parameters are presented in Table 1a to 6a.

The study revealed that, the highest Pearson correlation coefficient was observed between BOD and COD. The significant correlation coefficient exists between pH-alkalinity, EC-TDS, nitrate-phosphate, nitrate-BOD, EC-chloride and EC-TH (Table1a to 6a). The study aims to establish a systematic correlation between the physico-chemical parameters of sewage. It gives useful indication of sewage quality and also facilitates the rapid monitoring status of treatment measures.

ACKNOWLEDGEMENT

The authors are grateful to the management of Sri Siddhartha First Grade College, Tumkur and Prof H.N.Vijayendra, Principal for the encouragement. First author is also thankful to Dr. M.B.Nadoni, Prof C.Vijayabhaskar, Prof. M.S. Jayaprakash for their valuable suggestions and to Dr.M.K.Veeraiah, Prof.B.Manjunath and Prof. B. Mallesh of SSIT, Tumkur, for the laboratory facility.

REFERENCES

1. Sharma, O P, Bangar K.S and Sharma P.K., *Res. J. Chem. Environ* **8**(2): 62 (2004).
2. Abdul Jameel A and Zahir Hussain., *Ind.J. Env. Prot.,* **23**(6): 660 (2003).
3. Tiwari T N and Ali N., *Ind.J. Env.Prot.,* **8**(1): 44 (1988).
4. Tchobanoglous G., Waste water engineering-treatment, disposal and reuse (2nd Edition) Metcolf-Eddy, Inc, Tata McGraw Hill Pub Co., New Delhi. (1979).
5. Aravinda H B., *Poll. Res*. **17**(4): 371 (1998).
6. Thergaonkar V P and Kulkarni D N., *Ind.J. Env. Health,* **13**: 149 (1971).
7. Gajghate D G and Reddy P J., *Ind.J. Env. Prot.*, **9**(11): 805 (1980).
8. Kannan N, Rajashekaran N and Vallinayagam P., *Ind.J. Env.Prot.,* **11**(11): 85(1991).
9. Reddy P J, Krishna D and Gajghate D J ., *Poll. Res.* **11**(2): 69(1992).
10. Sanjay Kumar, Nikhil Garg and Krishna Gopal., *Ind.J. Env.Prot.,* **14**(8): 595(1994).
11. Somashekara Rao and Someshwara Rao B., *Ind.J. Env.Prot.,* **14**(7): 528(1994).
12. Singanan and Somashekar Rao K., *Ind. J. Env. Prot.,* **15**(3): 213(1995).
13. Sulochana N, Stephan Inbaraj B, Selvarani K and Thirumuragan., *Ind.J. Env.Prot.,* **19**(4): 290 (1999).
14. Mahuya Dasgupta Adak and Purohith., *Ind.J. Env. Prot.,* **21**(4): 295(2000).
15. Mohapatra, B. Das and Chakravorthy., *Poll Res.* **20**(3): 401(2001).
16. APHA AWWA WEF ., Standard methods for examination of water and waste water, 19th edition, Washington DC (1995).
17. Trivedy and Goel ., Chemical and biological methods of water pollution studies. Environmental Publication, Karad (1986).
18. Selvam V, Hariprasad V, Mohan R and Ramasubramanyan R ., *Ind.J of Mari Sciences.,* **23**: 94(1994).

19. Guruprasad B., *Nat. Env. Poll. Tech.,* **4**(4): 521(2005).
20. King D L., The role of carbon in eutrophication. *Ecology.* **42**: 2035 (1970).
21. Bharadwaj, K and Sharma, L.L ., *J.Env.Poll.,* **6**(4): 255 (1989).
22. Nayak B.K, Acharya B C, and Panda, U C ., *Ind. JMari. Sciences.* **33**(2), 164 (2004).
23. Kataria H C, Iqbal S A anddd Shandlya A K., *Ind. J. Env.Prot.*, **16**(11): 841(1995).
24. Milind Hujare ., *Nature Env. Poll. Tech.* **7**(1): 43 (2008).
25. Sinada F and Abdel Karim, *Hydrobiologia,* **110**: 21(1984).
26. Munavar M., The biotope, *Hydobiologia,* **35**(1): 1.