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RESEARCH ARTICLE

COMPARATIVE STUDY OF PHYSICO-CHEMICAL PARAMETERS TO EVALUATE THE POLLUTION LEVEL OF NIZAMSAGAR CANAL, NIZAMABAD DISTRICT, INDIA

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ABSTRACT

The physico-chemical parameters of water samples from four locations of Nizamsagar irrigation canal that surrounds the Nizamabad city were comparatively studied. The sampling locations were selected on the basis of their possibility of pollution points. The physico-chemical parameter like, pH, dissolved oxygen (DO), total hardness (TH), calcium (Ca^{++}) magnesium (Mg^{++}), chloride (Cl^-), nitrite (NO_2^-), nitrate (NO_3^-), carbonates (CO_3^-), Bicarbonates (HCO_3^-) and phosphate (PO_4^-) of water samples was determined. The results were compared with standards prescribed by WHO (1973) and ISI (10500-91). The present study indicates that the location I and III were more polluted. The different parameters values in these two locations were very high compared to the other locations under study.

INTRODUCTION

Water is an essential factor for existence of life on earth that contains minerals, important for humans as well as for terrestrial and aquatic life (Agarwal and Manish, 2011). Lakes and surface water reservoirs are the planets freshwater resources that provide infinite benefits. They are used for domestic and irrigation purposes and provide ecosystems for aquatic life especially fish (Duran, 2006). Water bodies are considerable elements of the world's biological diversity and are important in socio-economic benefit as a result of tourism and recreation. However, the significant increase in population resulted in a substantial consumption of the water reserves globally (Fafioye *et al.,* 2005). The quality of surface water is largely affected by natural processes such as weathering and soil erosion, in addition to anthropogenic discharges like municipal and industrial wastewater discharge (Gopalkrushna, 2011). The anthropogenic discharges symbolize a steady polluting source, while surface runoff is a seasonal occurrence, mainly affected by climatic conditions (Hiware and Jadhav, 2001). There is a serious environmental crisis been faced in under developing and developed countries (Murthuzasab *et al.,* 2010). Contamination of aquatic ecosystems with heavy metals is a serious trouble, all over the globe (Ohimain *et al.,* 2008). One among the Nizamsagar irrigation canals that reaches the district head quarter was studied for the physico-chemical parameters such as pH, dissolved oxygen (DO), total hardness (TH), calcium (Ca^{++}) magnesium (Mg^{++}), chloride (Cl^-), nitrite (NO_2^-), nitrate (NO_3), carbonates (CO_3^-), Bicarbonates (HCO_3^-) and phosphate (PO_4^-).

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Study area

Nizamabad is located at 18°40′38″N 78°6′11″E18.67722°N 78.10306°E. It has an average elevation of 395 m (1,296 ft). Climate is Tropical Wet and Dry with most rainfall from June to October. Nizamabad district is the head quarter of 36 mandals surrounded by two states like Karnataka and Maharashtra, both in the west. This district receives water from the tributaries of river Godavari such as Manjira, Haridra and there are a few multipurpose projects like Nizamsagar, Sri Ramsagar and Singur. Nizamsagar project is constructed on the Manjira, a tributary of river Godavari (Fig 1). The Nizamsagar dam was constructed in the year 1923 across the Manjira River at the village of (Achampeta) Achampet. It irrigates 250,000 acres (1,000 km^2; 390 sq mi) of land in Nizamabad district. This Project was originally contemplated for utilization of 58.00 TMC of water to irrigate 2, 75,000 acres in Banswada, Bodhan, Nizamabad and Armoor Taluqs

irrigation and drinking water supply. There are three irrigation canals of this project that flow throughout the seven mandals of the Nizamabad district.

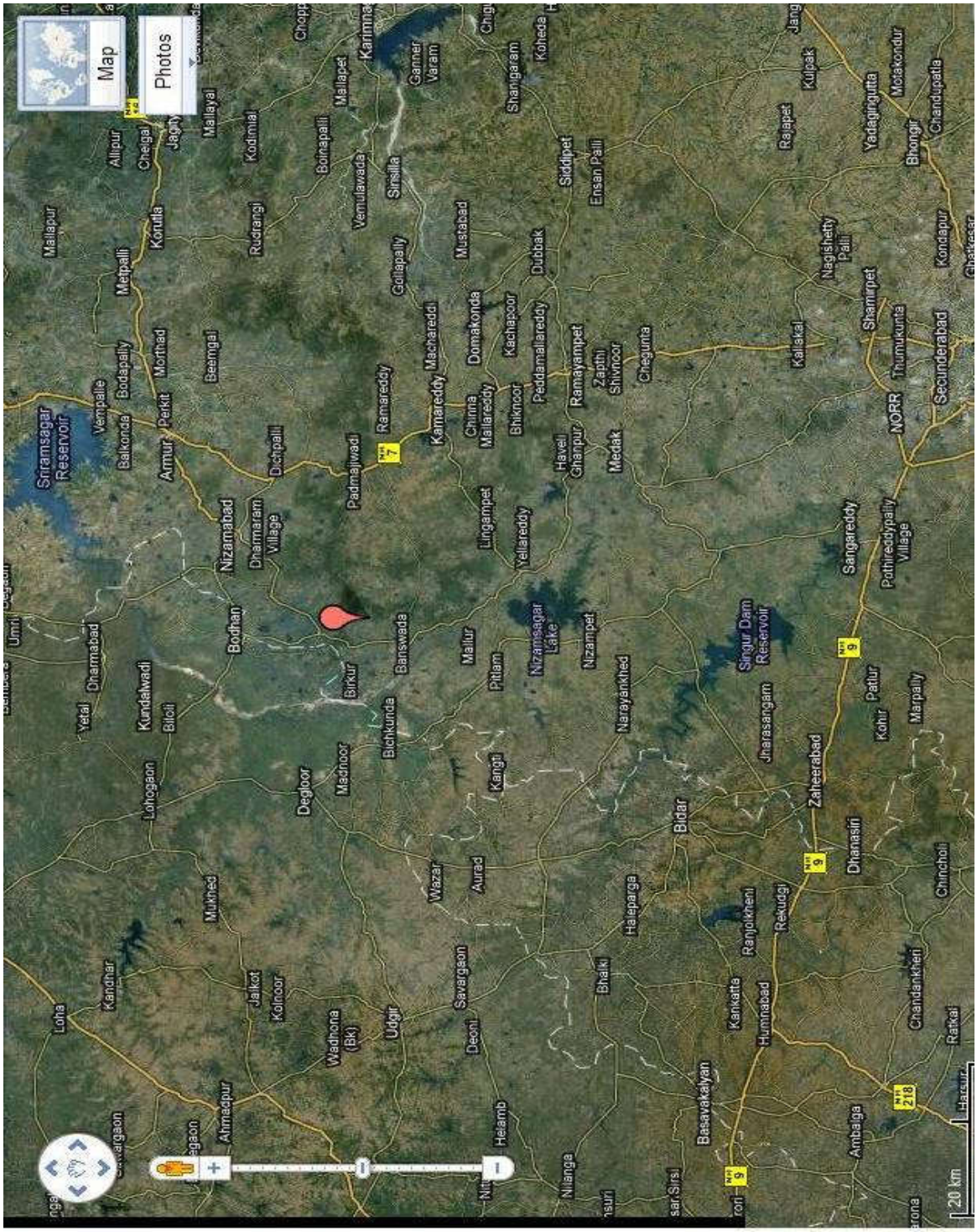

Fig. 1: Flow map of Nizamsagar canal

MATERIALS AND METHODS

Samples were collected from four locations for six times in a year according to three major seasons. In India, seasons are summer (May-Jun), rainy (Aug-Sept) and winter (Nov-Dec). 2010. The physico-chemical parameters were estimated as per the Standard Methods (APHA, 1998). Water samples were collected for the purpose of estimation of various parameters were brought to the laboratory and subjected to analysis immediately as far as possible. Standard Methods for Estimation of Water and Wastewater 20th edition, 1998 were referred for estimation of parameters such as pH, dissolved oxygen (DO), total hardness (TH), calcium (Ca^{++}) magnesium

RESULTS AND DISCUSSION

The physico-chemical parameters for location-I, II, III and IV in the different months (2008-2010) are given in the Tables 1, 2, 3 and 4.

Phosphates

The Phosphate content of water samples were found in the range of 6 to 9 mg/L in location I, 3 to 8.5 mg/L in location II, 8.1 to 8.6 mg/L in location III and 6.4 to 7.9 mg/L in location IV. Phosphates lead to eutrophication which could also lead to

Table: 1 Physico-chemical parameters: location-I

Parameters		PO4-	NO3-	NO2-	DO	CO3-	HCO3-	Cl-	TH	Ca+	Mg+	pH	TEMP	EC
Months	Year					mg/l							°C	µs/cm
JAN-FEB	2008	7.3	12.1	0.8	3.6	Nil	230	163	470	104	138.5	8	21	780
	2009	7	12.3	0.9	3.6	Nil	235	165	465	103	140.6	9	19	798
	2010	7.4	12.2	0.1	3.6	Nil	233	167	472	105	141.4	9	15	750
MAR-APR	2008	7.3	12	1	3.2	Nil	200	150	370	110	138.5	9	34	740
	2009	8.5	12.3	0.9	3.6	Nil	235	165	465	103	140.6	9	35	780
	2010	7.4	12.2	0.1	3.6	Nil	233	167	472	105	141.4	9	34	774
MAY-JUN	2008	8.5	12.1	2	4.6	Nil	280	170	500	110	146.5	6	36	775
	2009	9	13.2	2.5	5	Nil	285	172	490	109	150.6	6	39	770
	2010	8.9	12.2	2.8	4.5	Nil	283	170	492	111	149.4	6	37	650
JUL-AUG	2008	6.3	10.1	0.6	2.9	Nil	190	156	356	99	120.4	8	28	665
	2009	6	11.3	0.7	3.3	Nil	200	158	350	98	130.6	9	30	775
	2010	6.4	10.9	0.6	3	Nil	211	160	360	101	125.4	9	28	780
SEP-OCT	2008	7.3	12.1	0.8	3.6	Nil	230	163	470	104	138.5	8	26	790
	2009	7	12.3	0.9	3.6	Nil	235	165	465	103	140.6	9	28	800
	2010	7.4	12.2	0.1	3.6	Nil	233	167	472	105	141.4	9	26	890
NOV-DEC	2008	8.3	12.4	0.8	3.5	Nil	230	162	472	106	138.5	8	20	773
	2009	7.9	12.6	1	3.6	Nil	238	164	468	108	140.6	9	21	779
	2010	8	12.8	0.9	3.6	Nil	235	166	470	106	141.4	9	22	790

Table 2. Physico-chemical parameters: location-II

Parameters		PO4-	NO3-	NO2-	DO	CO3-	HCO3-	Cl-	TH	Ca+	Mg+	pH	TEMP	EC
Months	year					mg/l							°C	µs/cm
JAN-FEB	2008	3.3	14.4	6	2.02	Nil	260	177.5	60	120.24	193.83	6.5	21	501
	2009	4.2	15	8	2.9	Nil	268	180	90	125.25	200	6.9	19	499
	2010	4	14.8	7	2.5	Nil	270	178.5	100	122.5	196.44	6.2	15	485
MAR-APR	2008	7.9	13.7	4	2	Nil	220	165.5	100	120.9	199.9	6	34	492
	2009	7.2	14	6	2.5	Nil	215	168.7	109	125.6	220	6.2	35	490
	2010	7.4	13.8	4.9	2	Nil	223	167.9	106	122.9	215	6.5	34	492
MAY-JUN	2008	8.5	15.6	8	2.9	Nil	250	177	120	126.5	233.6	6.1	36	472
	2009	8.4	15.7	9	3.1	Nil	260	176	115	128.6	240.5	6.4	39	490
	2010	7.9	15	8.5	3.2	Nil	255	172	118	127	238.6	6.2	37	503
JUL-AUG	2008	3.3	14.4	6	2.02	Nil	260	177.5	60	120.24	193.83	6.5	28	550
	2009	4.2	15	8	2.9	Nil	268	180	90	125.25	200	6.9	30	560
	2010	4	14.8	7	2.5	Nil	270	178.5	100	122.5	196.44	6.2	28	557
SEP-OCT	2008	3.8	14.8	6.5	3.2	Nil	268	179.6	80	122.6	196	6.8	26	559
	2009	4.7	15.5	8.5	3.9	Nil	270	182.3	100	127.8	208.22	6.7	28	556
	2010	4.9	15.2	7.7	3.7	Nil	272	180.3	115	125.4	199.7	6.2	26	563
NOV-DEC	2008	3	14	6.2	2.5	Nil	255	170.5	86	120	190.83	6.5	20	589
	2009	4	14.5	7.8	2.6	Nil	260	178	93	125	196	6.9	21	598
	2010	3.7	14.8	6.9	2.9	Nil	268	174.5	105	122	198.44	6.2	22	596

Table 3. Physico-chemical parameters: location-III

Parameters		PO4-	NO3-	NO2-	DO	CO3-	HCO3-	Cl-	TH	Ca+	Mg+	pH	TEMP	EC
Months	Year					mg/l							°C	µs/cm
JAN-FEB	2008	8.5	7.2	1.6	6.46	Nil	230	265	96	120.24	181.2	9	21	403
	2009	8.6	7.8	2.6	6.06	Nil	235	270.5	90	122.3	190.2	9.2	19	450
	2010	8.4	7.9	2.1	6.3	Nil	233	273.6	85	123	195.6	9.5	15	412
MAR-APR	2008	8.4	6.8	2.1	6.46	Nil	236.2	300.2	59	122.3	190.3	9.3	34	470
	2009	8.2	7	1.8	6.2	Nil	234.4	296.5	70	119.5	196.3	9.4	35	498
	2010	8.6	7.2	2	6.3	Nil	232.6	299.3	75	121.6	188.3	9.2	34	480
MAY-JUN	2008	8.6	7.8	2.6	5.46	Nil	232	265	96	120.24	181.2	9	36	487
	2009	8.5	7.8	3.6	7.06	Nil	231	274.5	94	132.3	195.2	9.2	39	489
	2010	8.4	8.9	3.1	7.3	Nil	233	273.6	85	123	195.6	9.5	37	483
JUL-AUG	2008	8.5	6.8	2.1	7.46	Nil	236.2	304.2	59	122.3	190.3	9.3	28	471
	2009	8.7	7	1.8	6.2	Nil	234.4	296.5	74	129.5	194.3	9.4	30	425
	2010	8.1	8.2	2	6.3	Nil	232.6	299.3	75	121.6	198.3	9.2	28	438
SEP-OCT	2008	8.2	7.2	3.6	5.46	Nil	234	264	96	120.24	191.2	9	26	389
	2009	8.3	8.8	3.6	6.06	Nil	234	270.5	95	122.3	190.2	9.2	28	399
	2010	8.2	8.9	2.1	6.3	Nil	233	274.6	85	133	195.6	9.5	26	390
NOV-DEC	2008	8.2	7.8	2.1	6.46	Nil	236.2	300.2	99	122.3	194.3	9.3	20	391
	2009	8.5	8	1.8	7.2	Nil	234.4	296.5	80	129.5	192.3	9.4	21	396
	2010	8.6	7.2	3	7.3	Nil	235.6	299.9	75	121.6	188.3	9.2	22	406

in the months of Jan-Feb and higher in the months of Nov

Table 4. Physico-Chemical Parameters: Location-IV

Parameters		PO4-	NO3-	NO2-	DO	CO3-	HCO3-	Cl-	TH	Ca+	Mg+	pH	TEMP	EC
Months	year	mg/l											°C	µs/cm
JAN-FEB	2008	7.5	4.4	0.6	2.02	Nil	240	157.5	460	112.24	336.23	7.5	21	280
	2009	6.8	5	0.8	2.09	Nil	248	158	490	115.25	300	7.9	19	275
	2010	7	4.8	0.7	2.05	Nil	247	158.5	400	120.5	360.44	7.2	15	260
MAR-APR	2008	6.9	3.7	0.4	2.07	Nil	250	155.5	400	120.9	339.9	7	34	255
	2009	6.7	4	0.6	2.05	Nil	255	158.7	409	120.6	340	7.2	35	265
	2010	6.4	3.8	0.9	2	Nil	253	160.9	406	120.9	325	7.5	34	263
MAY-JUN	2008	6.5	4.6	0.8	2.09	Nil	250	150	400	110.9	329.9	7	36	302
	2009	6.4	4.7	0.9	3.01	Nil	260	156	409	115.6	320	7.2	39	300
	2010	6.9	5	0.5	3.02	Nil	255	152	406	112.9	315	7.5	37	360
JUL-AUG	2008	6.5	4.8	0.6	2.09	Nil	250	157.5	461	113.24	330.23	7.2	28	366
	2009	6.6	5.2	0.8	2.07	Nil	245	158	494	125.25	320	6.9	30	352
	2010	7.8	5.8	0.7	2.04	Nil	249	156.5	460	123.5	330.44	7.8	28	320
SEP-OCT	2008	7.9	4.7	0.4	2.05	Nil	259	157.5	409	127.9	329.9	7	26	330
	2009	7.7	4.5	0.6	2	Nil	250	158.7	404	123.6	320	7.4	28	336
	2010	7.4	4.8	0.9	2.03	Nil	259	168.9	403	123.9	315	7.6	26	339
NOV-DEC	2008	6.9	4.6	0.8	2.05	Nil	258	154	404	120.9	319.9	7	20	321
	2009	6.7	4.7	0.9	2.01	Nil	266	152	401	135.6	323	7.2	21	356
	2010	6.4	5	0.5	2.02	Nil	265	151	408	122.9	325	7.3	22	324

unpleasant taste and odour of the water. The high concentration of Phosphate after rainy season is due to discharge of Phosphate fertilizer.

Nitrates and Nitrites

The results of the Nitrate from 10.1 to 13.2 mg/L in location I, 13.7 to 15.7 mg/L in location II, 6.8 to 8.9 mg/L in location III and 3.7 to 5 mg/L in location IV. The Nitrite concentration in the water were 0.6 to 2.8 mg/L in location I, 4 to 9 mg/L in location II, 1.6 to 3.6 mg/L in location III and 0.4 to 0.9mg/L in location IV. This may be characteristic of the oxidation of ammonia by nitrifying bacteria and biological nitrification (Pawar et al., 2009). The nitrate concentration could be due to surface run-off of nitro phosphate fertilizer from nearby farmlands into the water.

DO

DO is one of the significant parameter in water quality evaluation. It reproduces the physical and biological processes existing in the water. Non polluted surface water is normally saturated with DO. The DO varies from 2.93 to 5 mg/L in location I, 2 to 3.9 mg/L in location II, 6.2 to 7.4 mg/L in location III and 2 to 3.02 mg/L in location IV. These values indicate relatively large organic pollution. The high temperature and low DO create favorable conditions for growth of blue-green algae (Pradhan *et al.,* 2009).

Alkalinity (Carbonates and Bicarbonates)

Carbonates were not found in the locations during the period of study. Bicarbonates ranges from 190 to 285 mg/L in location I, 215 to 272 mg/L in location II, 230 to 236.2 mg/L in location III and 240 to 265 mg/L in location IV. Bicarbonates values were lower in location I in the months of Jul-Aug, and higher in the months of May-Jun. The Bicarbonates values were lower in location II in the months of Mar-Apr and higher in the months of Sept-Oct. The Bicarbonates values were lower in location III in the months of Jan-Feb, and higher in the months of Mar-Apr, Jul-Aug and Nov-Dec. the Bicarbonates values were lower in location IV

Chloride

Chlorides are found in almost all the natural waters. This is most frequent inorganic anion present in water. Man and animals excrete high quantities of chlorides as a result it signifies sewage contamination. In our study the chloride value ranges from 156.3 to 169.5 mg/L in location I, 165.5 to 183.3 mg/L in location II, 265 to 300.2 mg/L in location III and 150 to 168.9 mg/L in location IV.

Total hardness

In most of the water samples from the studied locations TH is imparted majority by the calcium and magnesium ions that apart from Chloride, Nitrites and Nitrates are found in combination with bicarbonates. In our study of Total hardness we found 356 to 500 mg/L in location I, 60 to 118 mg/L in location II, 59 to 99 mg/L in location III and 400 to 494 mg/L in location IV. These results suggest that the water is very hard.

pH

The PH ranges from 6.0 to 9.3 in location I, 6.0 to 6.9 in location II, 9.0 to 9.5 in location III and 6.9 to 7.0 in location IV. In general the pH values were lower in location I in the months of May-Jun and higher in the months of Jan-Feb, Mar-Apr, Jul-Aug, Sept-Oct and Nov-Dec. in most of the months in the year the location I water was found to alkaline. The pH values were lower in location II in the months of Mar-Apr and higher in the months of Jan-Feb, Jul-Aug and Nov-Dec. The pH values were higher in location III in the months of Jan-Feb, May-Jun, and Sept-Oct. the pH values were lower in location IV in the months of Jul-Aug and higher in the months of Jan-Feb. The fluctuation in the pH values may due to the exposure of water to atmosphere, biological activities and temperature changes. (Arain *et al.,* 2008).

Temperature & Electrical conductivity

in aquatic environment. Temperatures ranges from 15 to 39°C in location I, 20 to 39°C in location II, 19 to 39°C in location III and IV. The difference is mainly related with the temperature of atmosphere and weather conditions. In present study the EC varies from ranges from 650 to 890µs/cm in location I, 472 to 598µs/cm in location II, 389 to 498µs/cm in location III and 255 to 366µs/cm in location IV. High EC signifies a large quantity of dissolved minerals. The present study indicates that the location I and III were more polluted. The different parameters values in these two locations were very high compared to the other locations under study. Water quality monitoring has a high priority for the determination of current conditions and long-term trends for effective management. The supply of safe water has a significant impact on the anticipation of water transmissible diseases (Prasanna and Chitta Ranjan 2010; Vasanthkumar and Vijaykumar, 2011). The abundance of organic compounds, radionuclide's, toxic chemicals, nitrites and nitrates in water may cause unfavorable effects on the human health especially cancer, other human body malfunctions and chronic illnesses (Sultan and Sharief, 2004).

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