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Chemical Parameters of Sewage Stabilization Ponds at Sewage Treatment Plant in Bikaner, Rajasthan

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Abstract -Bikaner district have four natural slopes according geographically, one towards the Vallabh garden area, where the three anaerobic and two aerobic stabilization ponds of sewage treatment plant are situated in the North –West part of the Rajasthan. The Thar desert lies which is characterized by typical arid conditions like scarcity of water, low rainfall, intense radiations, violent winds, high temperature fluctuations and dust storms. This paper is based on the chemical parameters of three anaerobic and two aerobic stabilization ponds of sewage treatment plant. The study was carried out for a period of 15 months from March 2010 to May 2011. The chemical parameters measured include Na, K, Ca & Mg. The chemical parameters of three anaerobic stabilization ponds of water was ranged Na (142.2 mg/l to 233.5 mg/l), K (11.70 mg/l to 40.0 mg/l), Ca (94.14 mg/l to 151.39 mg/l), Mg (0.60 mg/l to 19.340 mg/l) and two aerobic stabilization ponds of water was ranged Na (146.4 mg/l to 255.7 mg/lit), K (10.6 mg/l to 39.9 mg/l), Ca (79.05 mg/l to 151.39 mg/l) and Mg (0.84mg/l to 19.64 mg/l) were recorded.

Keywords- Sewage treatment plant, anaerobic and aerobic stabilization ponds, chemical parameters.

I. INTRODUCTION

Water is a basic need of every city and village. Importance of water for city like Bikaner is much more, because Bikaner is present at the North Western part of the Great Indian Desert in Thar Desert. This is used for agricultural purposes. The level of underground water is very much low. Their chemical composition varies from day to day and even from hour to hour and also from area to area because waste produced by different areas has different characters. Sewage treatment plant is important for Bikaner because it provide extra source of water, water obtained from plant are very useful irrigation so that city become independent for vegetables need and also help to make city clean because it provides a proper dumping site.

Heavy accumulation of sewage and other waste in water bodies because of uncontrolled dumping of wastes of rural areas, towns and cities into ponds, lakes, streams and in rivers cause loss of self-regulatory capability and failing of recycling mechanisms of these water bodies due to higher levels of pollution and low level of aerobic microbes. In the recent past, several studies [1],[2],[3],[4] have reported that receiving water bodies are becoming increasingly contaminated due to discharge of domestic (sewage) and industrial waste waters. Now a days combined sewage system is avoided because heavy rainfall reduced the sewage treatment plant efficiency.

II. DESCRIPTION OF THE STUDY AREA

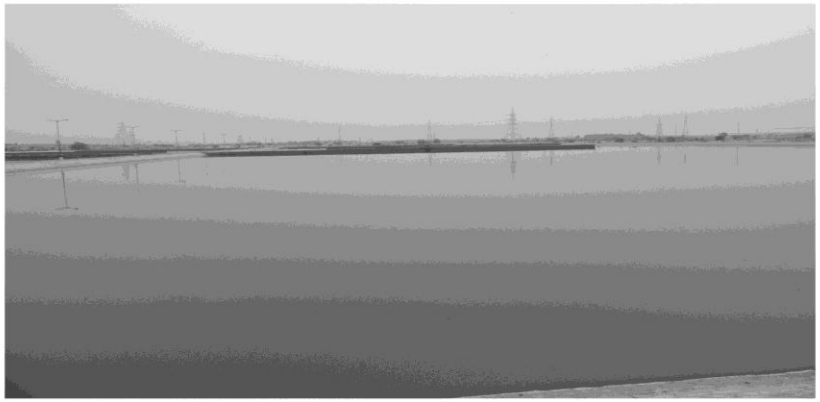
The study was carried at two types of water bodies situated about 6 Km. south of Bikaner district at sewage treatment plant of Vallabh Garden. The sewage stabilization ponds situated in sequence of deep anaerobic and shallow aerobic ponds hold the sewage water with the varying degree of pollution load, particularly the organic one. These included three anaerobic stabilization ponds (Plate 1) and two aerobic stabilization ponds (Plate 2).

FIRST ANAEROBIC STABILIZATION POND, BIKANER

SECOND ANAEROBIC STABILIZATION POND, BIKANER

THIRD ANAEROBIC STABILIZATION POND, BIKANER
PLATE : 1

FIRST AEROBIC STABILIZATION POND, BIKANER



SECOND AEROBIC STABILIZATION POND, BIKANER

PLATE : 2

III. COLLECTION AND ANALYSIS OF WATER SAMPLES FOR CHEMICAL PARAMETERS

The sewage water samples were collected from the pond with the help of plastic bucket. Calcium and magnesium were estimated by using 4% NaOH and murexide indicator titrating against EDTA. Sodium and potassium were estimated by flame photometer.

IV. RESULTS

During the study period, from sewage treatment plant, Na, K, Ca, Mg chemical cations were also recorded.

The value of Na cation fluctuates between 142.2 mg/l. to 233.5 mg/l. in three anaerobic stabilization ponds as lowest value noted in month of March 2010 and highest in June 2010. In aerobic stabilization ponds it varies between 146.4 mg/l. to 255.7 mg/l. as lower and higher value respectively.

The value of K cations was lower in compare to Na cations and table shows that the value of anaerobic stabilization ponds varies between 11.7 mg/l. to 40.0 mg/l. While in aerobic stabilization ponds it ranges from 10.6 mg/l. to 39.9 mg/l. From all the five stabilization ponds of sewage treatment plant, the highest value recorded from anaerobic while least were from aerobic stabilization ponds.

Among cations the second highest value were recorded for Ca ion from all the five stabilization ponds. Anaerobic stabilization ponds value ranges from 94.14 to 151.39 mg/l. While in aerobic stabilization ponds it was noted as 79.05 mg/l. (in month of July 2010) to 151.39 mg/l. (in month of Dec. 2010).

Mg cation were recorded lesser in compare to above three cations and noted lower 0.60 mg/l in month of March, 2010 and higher as 19.34 mg/l. in month of Aug. 2010 from anaerobic stabilization ponds. In aerobic stabilization ponds its value ranges from 0.84 mg/l. to 19.64 mg/l. in Nov, 2010 and in June 2010 respectively.

Table 1. Monthly average of chemical variables at first Anaerobic stabilizing pond of sewage treatment plant, Bikaner during March 2010 to May 2011. Values are expressed in mg/l. except otherwise mentioned.

Months / Variables	March 2010	April 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	March 2011	April 2011	May 2011	Total Average
Cations																
Na	142.2	198.9	177.4	224.5	219.5	214.5	198.5	125.2	193.5	165.5	176.2	183.5	144.3	198.0	175.5	182.5
K	37.5	38.0	38.5	37.1	35.5	29.3	27.5	11.7	25.4	30.7	38.7	38.9	37.2	38.8	38.2	33.5
Ca	113.54	99.24	96.72	95.04	105.97	95.88	114.38	120.27	137.93	134.57	142.98	149.70	116.06	98.40	95.88	114.4
Mg	0.60	10.43	15.44	18.78	14.65	19.06	16.50	13.60	5.38	7.66	9.03	9.83	0.47	10.15	16.62	11.2

Table 2. Monthly average of chemical variables at second Anaerobic stabilizing pond of sewage treatment plant, Bikaner during March 2010 to May 2011. Values are expressed in mg/l. except otherwise mentioned.

Months / Variables	March 2010	April 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	March 2011	April 2011	May 2011	Total Average
Cations																
Na	145.3	197.4	178.8	233.5	220.2	214.8	199.2	126.8	193.8	166.2	175.8	183.0	145.7	198.8	174.2	183.6
K	38.0	38.3	38.7	37.5	35.2	29.8	28.0	12.2	26.2	30.2	38.5	40.0	37.5	38.2	38.3	33.8
Ca	113.54	96.72	95.88	94.19	105.13	96.72	115.22	121.95	137.09	136.25	142.98	150.55	119.43	100.93	96.72	114.9
Mg	1.08	11.53	16.13	18.50	13.39	19.34	15.81	12.70	6.56	7.25	9.52	9.13	0.13	10.99	15.44	11.2

Table 3. Monthly average of chemical variables at third Anaerobic stabilizing pond of sewage treatment plant, Bikaner during March 2010 to May 2011. Values are expressed in mg/l. except otherwise mentioned.

Months / Variables	March 2010	April 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	March 2011	April 2011	May 2011	Total Average
Cations																
Na	143.6	198.5	177.6	230.2	219.8	215.2	198.7	124.8	194.2	165.8	176.4	184.2	144.2	196.6	176.2	183.1
K	37.8	38.4	38.8	37.3	35.6	29.5	27.9	12.8	26.8	31.0	38.3	39.8	37.8	39.1	38.5	34.0
Ca	114.38	97.56	97.56	96.72	106.81	96.72	115.22	122.79	138.77	137.93	145.50	151.39	117.75	100.08	98.40	115.8
Mg	1.37	10.35	15.23	17.39	12.98	18.86	15.32	12.49	4.69	6.36	8.42	8.93	0.55	10.23	15.52	10.6

Table 4. Monthly average of chemical variables at first Aerobic stabilizing pond of sewage treatment plant, Bikaner during

March 2010 to May 2011. Values are expressed in mg/l. except otherwise mentioned.

Months / Variables	March 2010	April 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	March 2011	April 2011	May 2011	Total Average
Cations																
Na	157.6	194.4	206.6	255.3	250.2	226.9	202.9	146.4	174.9	207.1	186.7	170.4	157.5	201.9	206.8	196.4
K	35.7	39.9	34.6	35.7	37.8	37.0	31.7	10.6	25.8	34.5	37.4	37.8	35.9	39.5	34.7	33.9
Ca	92.51	87.46	94.19	87.46	79.05	82.00	113.54	118.59	137.51	151.38	149.28	144.65	90.82	91.67	92.93	107.5
Mg	3.04	8.42	16.3	19.64	16.82	19.27	11.33	12.78	0.84	0.88	1.15	4.23	2.23	6.91	17.09	9.4

Table 5. Monthly average of chemical variables at second Aerobic stabilizing pond of sewage treatment plant, Bikaner during March 2010 to May 2011. Values are expressed in mg/l. except otherwise mentioned.

Months / Variables	March 2010	April 2010	May 2010	June 2010	July 2010	Aug. 2010	Sep. 2010	Oct. 2010	Nov. 2010	Dec. 2010	Jan. 2011	Feb. 2011	March 2011	April 2011	May 2011	Total Average
Cations																
Na	158.8	194.3	206.7	255.7	250.4	226.7	202.1	147.8	175.2	206.8	188.3	170.6	158.7	195.3	206.1	196.2
K	36.1	39.0	34.8	35.9	37.8	36.6	31.9	10.9	26.1	34.5	37.6	38.0	35.9	39.6	35.0	34.0
Ca	94.19	88.96	95.45	88.72	79.47	83.68	113.54	119	135.83	148.02	150.54	146.3	92.51	92.09	93.77	108.1
Mg	3.12	7.69	16.00	19.10	17.20	19.35	12.06	13.66	0.84	0.88	1.32	4.31	2.55	6.80	17.62	9.5

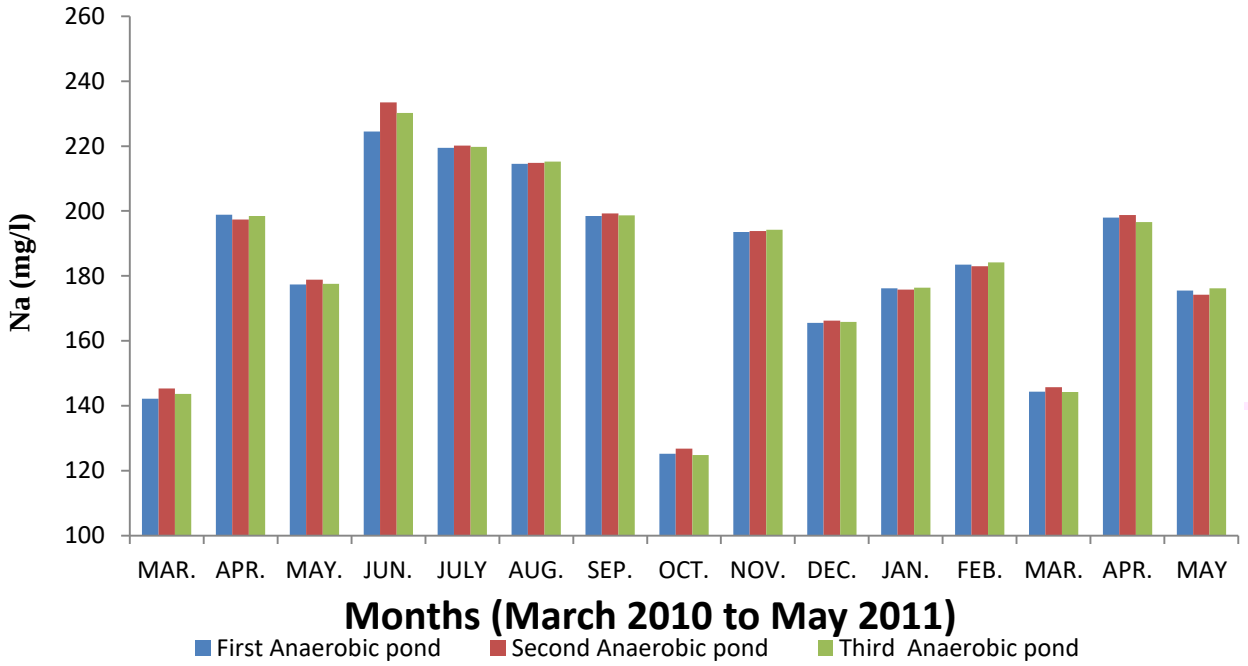


Fig. 1. Na of three anaerobic sewage stabilization ponds, Bikaner.

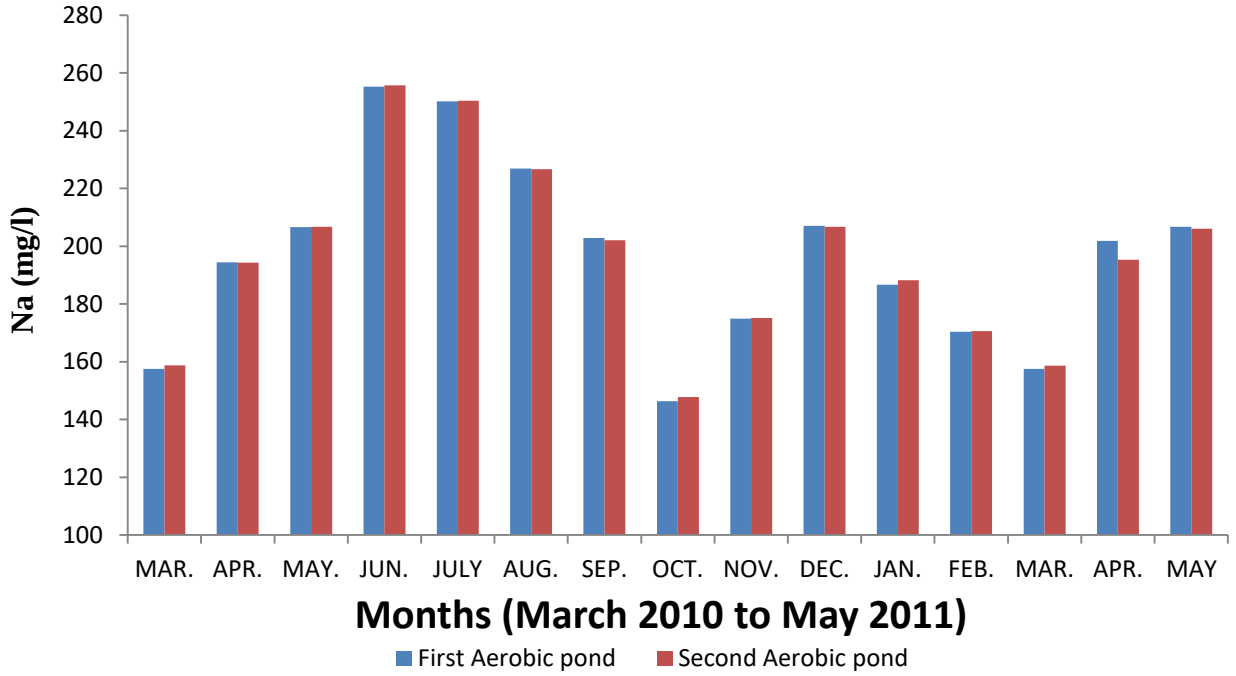


Fig. 2. Na (Sodium) in two aerobic sewage stabilization ponds, Bikaner.

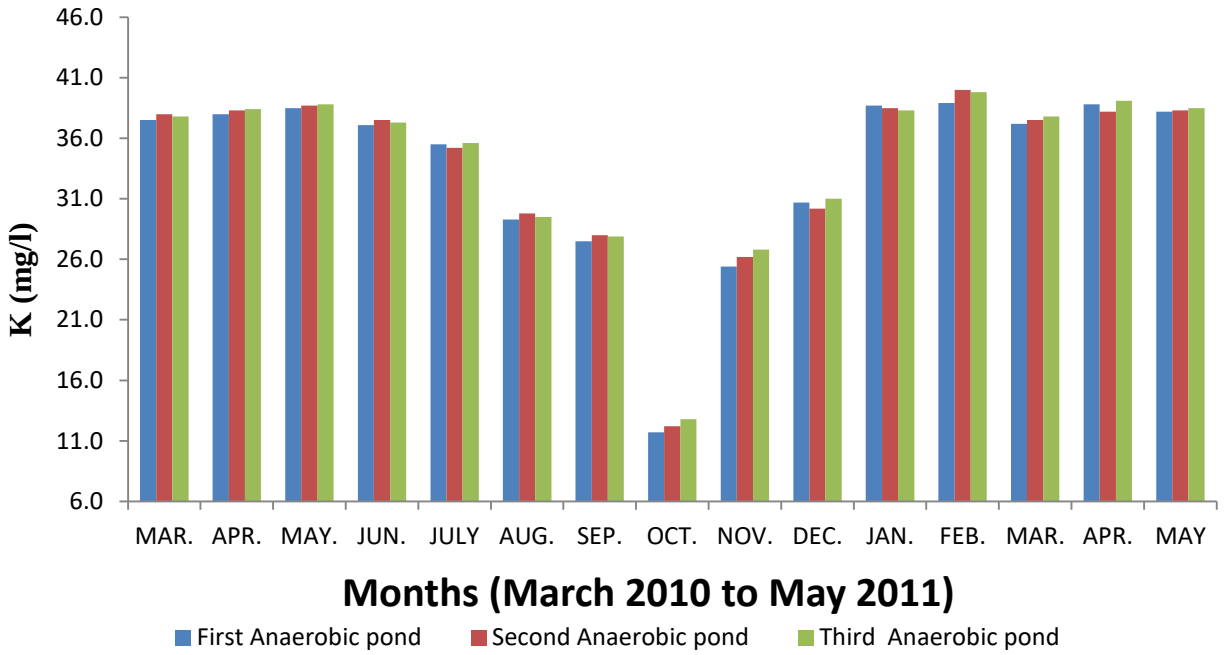


Fig. 3. K (Potassium) in three anaerobic sewage stabilization ponds, Bikaner.

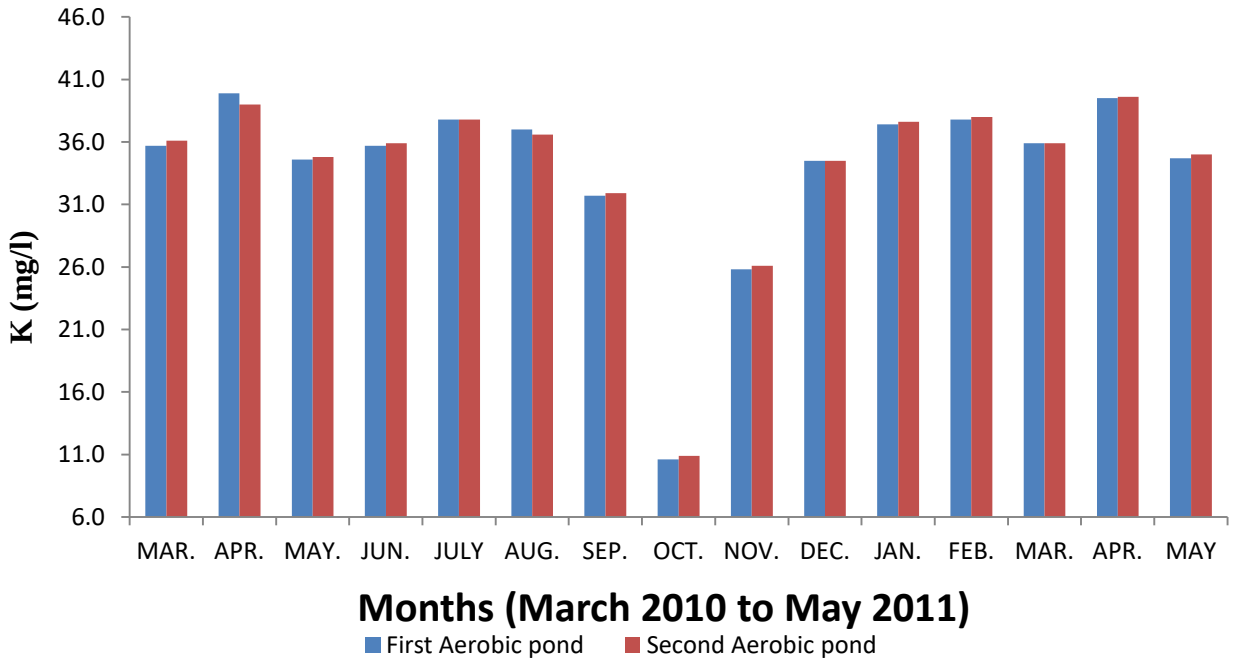


Fig. 4. K (Potassium) in two aerobic sewage stabilization ponds, Bikaner.

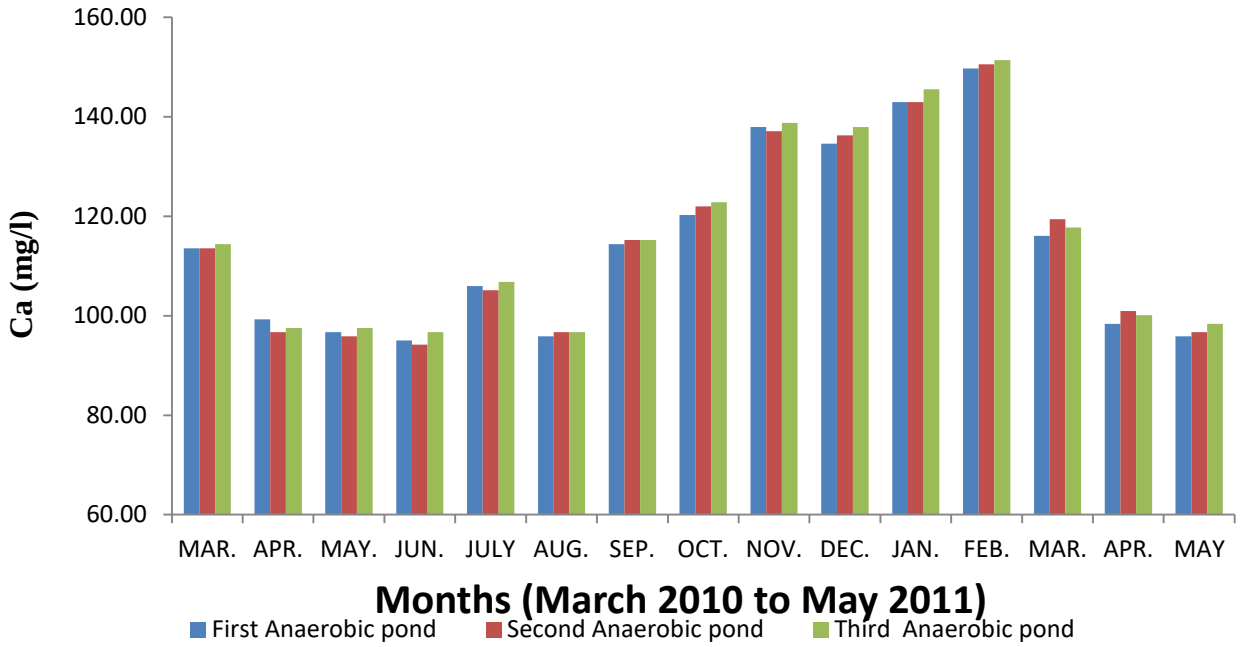


Fig. 5. Ca (Calcium) in three anaerobic sewage stabilization ponds, Bikaner.

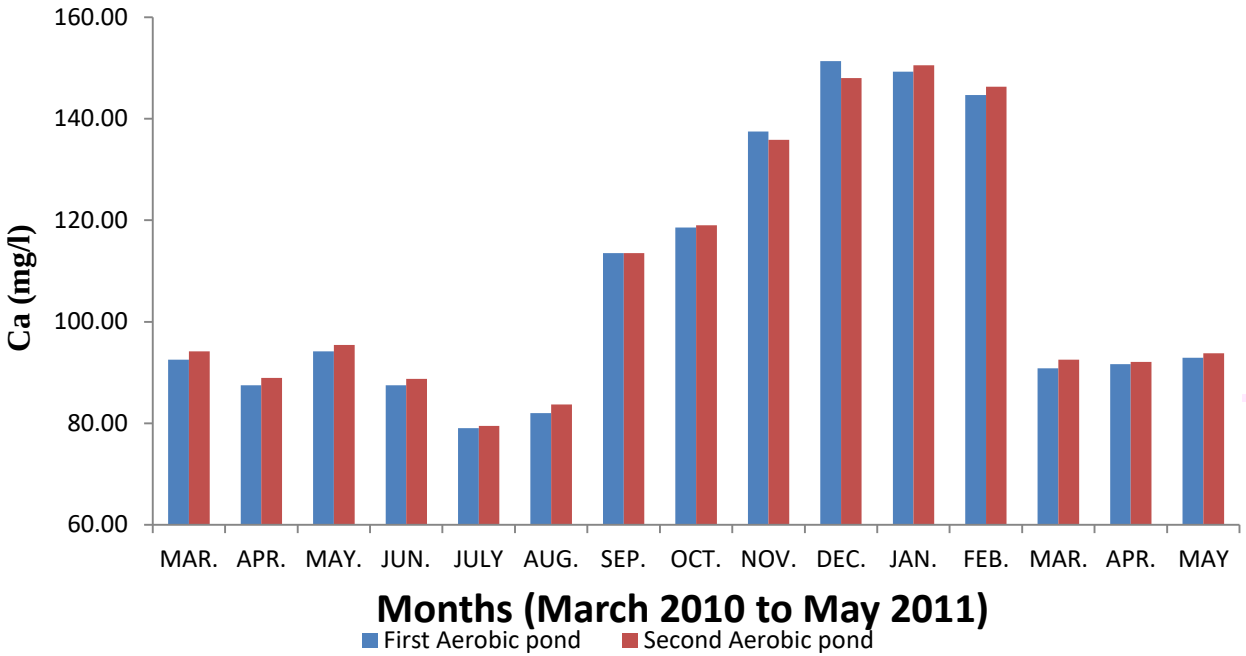


Fig. 6. Ca (Calcium) in two aerobic sewage stabilization ponds, Bikaner.

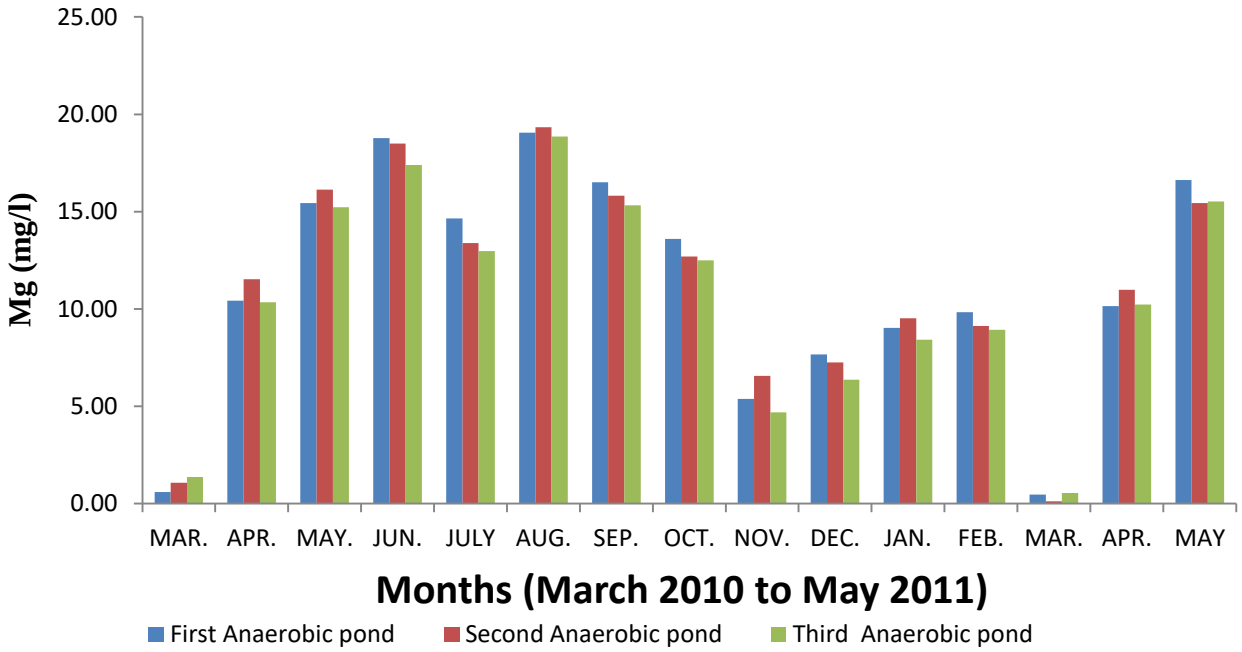


Fig. 7. Mg (Magnesium) in three anaerobic sewage stabilization ponds, Bikaner.

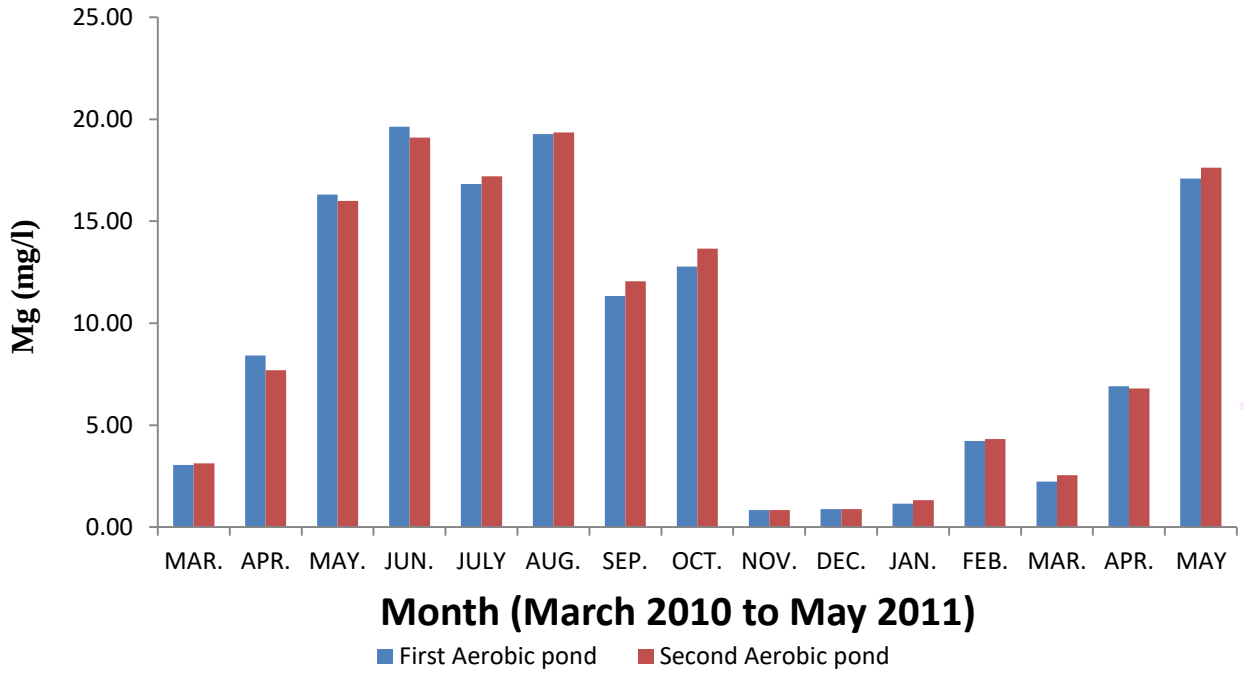


Fig. 8. Mg (Magnesium) in two aerobic sewage stabilization ponds, Bikaner.

V. CONCLUSION

In present study Na, K, Ca, and Mg were also recorded as cations from sewage treatment plant (both anaerobic and aerobic stabilization ponds). The average value of Na (Sodium) recorded as 182.7 mg/l and 196.3 mg/l in anaerobic and aerobic stabilization ponds respectively. The values of Na of greywater was recorded as 109.5-184.5 mg/l. (bathroom, shower), 302.1-667 mg/l. (laundry), 70.1-148.9 (Kitchen sink) and 641 mg/l. (dishwater). The average values of K(Potassium) recorded as 33.34 mg/l. in both anaerobic and aerobic stabilization ponds.

The average values of Ca (Calcium) recorded as 115 mg/l. in anaerobic and 107.5 mg/l. in aerobic stabilization ponds of sewage treatment plant. Calcium is essential for the organism as it regulates various physico-chemical functions. Calcium is required as micronutrient for algae also, though it as known to be essential nutrient for the metabolisms of plants. Water bodies Categorized as "Calcium rich" having calcium values >25 mg/l. The present studies corroborate the finding of Ohle (1934). Similar observations were

made by Krishnan *et al*. (2007) in sewage water of Sivakasi, where about 192.3 mg/l. (highest) value was noticed. In a study of sewage water of Suawn Nala near industrial area of Balrampur Ca value fluctuates between 142-167 mg/l. (Soni *et al*., 2010).

Krishnan *et al*. (2007) make a comparative physico- chemical and bacteriological analysis of drinking, borewell and sewage water in the three different places of Sivakasi and found Mg in between 31.66 to 111.44 mg/l. in sewage water.

VI. REFRENCES

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