RESEARCH PAPER:

A study on water quality of river Gangi at Ara town

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SUMMARY

The present study deals with the physical and chemical parameter of water like pH, TDS, TSS, DO, BOD, COD, alkalinity, phosphate, total hardness, Ca and Mg hardness, ammonia, nitrate, nitrite etc. in four selected sites of river Gangi at Ara town (Bihar). The physico-chemical characteristics of river Gangi water sampled from selected site were analyzed in mg/L for period of April, May and June months in the year 2009 according to International Standard (IS) of drinking water. There was in increasing order all the parameters except DO in April to June months

Key words :
Water quality, Gangi river, Pollution

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Water is the most important natural resource for substances of life on biosphere. It is the medium in which all living processes occur. Water dissolves nutrients and distributes them to cell, regulates body temperature, supports structures and removes waste products. About 60% of our body is water. We can survive for weeks without food, but not only a few days without water. The quality of water is vital concern for mankind since it is directly linked with human welfare. It is a matter of history that faecal pollution of drinking water caused water borne diseases, which wiped out entire population of cities. At the present menace of water borne diseases and epidemic still looms large on horizons of developing countries; polluted water is a culprit in all such cases. The major sources of water pollution are domestic waste from urban and rural areas, and industrial waste, which are discharged in natural water bodies. The history of human civilization reveals that water supply and civilization are almost synonymous. Several cities and civilization are having dispersed due to water shortage originating from climate changes. Millions of people all over the world, particularly in developing countries are losing their lives every year from water borne diseases.

Ara town, which is district headquarters of Bhojpur district of Bihar is situated between 25° 30' N to 25° 45' N latitude and 85° 30' E to 85° 45' longitude. The Gangi river is the most important water resource for domestic, industries and irrigation use in this region. The river Gangi is perennial river and tributary of the Ganga river. The Gangi river takes its origin from the Ganga near Keshavpur at Barahara block of Bhojpur district, which is at about 10 km distance from Ara town. Again it meets in the Ganga river near Buxar district of Bihar. Run off in the river depends on rain fall in catchments.

Study area:

The sites in river Gangi were located under Ara town. Four sampling sites namely, site-I (Mathwalia), site - II (Gangi bridge), site - III (Majhauan) and site - IV (Chandwa Mor) were selected for present study based on varying human activities, sewage discharge and other activities.

MATERIALS AND METHODS

The study was carried out from April to June months in the year 2009. Water samples were collected for physico-chemical parameters analysis from four selected sites of Gangi river, Ara. Water samples were collected in 2L capacity of polythene bottle from selected sampling station in early hours of day. All tests are conducted in the water testing laboratory within the stipulated period of each performed parameter. The water samples were analyzed as per the method described by ISI (2004), WHO, Trivedi *et al.* (1986).

RESULTS AND DISCUSSION

Present study was carried out for three consecutive months (April, May and June 2009). Four sampling sites were selected after preliminary survey of the river, considering the magnitudes of activities and disturbances. There has been a marked monthly variation of studied physico-chemical characteristics of water samples at different station of Gangi river in present investigation as given in Table 1.

pH :

The pH of the water of river Gangi has been found in range of 7.12 to 8.1 during April, May and June months. There has been higher pH of water in June month at site III and IV and lower in April at site I. The average pH value was 7.63 (Fig. 1). The water of the sites with intense human activities has shown comparatively higher pH than those with lesser human activities.

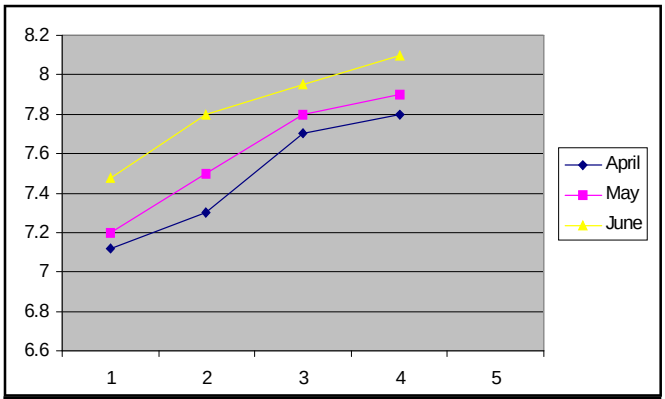

Fig. 1 : Monthly variation of pH

Total dissolved solids (TDS) and TSS:

The dissolved solids of the water have been found in the range of 135.5 to 465, 165 to 490, 155 to 490 and 160 to 520 mg/L during April, May and June. Minimum value (135.5) was reported in April at station - I whereas maximum value (520) was reported in June at station - IV. The average value was 290.04 mg/L (Fig. 2).

The total suspended solids of river water ranged from 56 to 80, 78 to 97, 87 to 99 and 81 to 104 mg/L during the studied months. The minimum value (56) was found in May at station -I whereas the maximum value (104) was reported in June at station - IV. The average value was 84.5 mg/L (Fig.3). Result suggested that increasing of total solids during June might be due to increasing concentration with decreasing addition of water (Trivedi *et al.*, 1987).

Table 1 : Water quality of river Gangi at different socdations indifferent monnths

Parameter	Month	Location			
		I	II	III	IV
pH	April	7.12	7.3	7.7	7.8
	May	7.2	7.5	7.8	7.9
	june	7.48	7.8	7.95	8.1
TDS	April	135.5	165	155	160
	May	245	215	215	225
	june	465	490	490	520
TSS	April	59	78	87	85
	May	56	88	100	81
	june	80	97	99	104
DO	April	7.1	6.3	6.1	6.1
	May	6.8	6.2	6.0	6.0
	june	6.3	5.9	5.8	5.7
BOD	April	1.7	2.1	3.0	3.2
	May	1.7	2.1	3.2	3.4
	june	1.8	2.3	3.5	3.4
COD	April	15.6	20.6	28.8	29.6
	May	15.6	24.8	29.6	31.4
	june	15.8	26.2	29.6	31.4
Total	April	110	122	155	152
hardness	May	122	132	150	142
	june	145	160	165	170
Ca hardness	April	24	28	38	38
	May	30	35	36	40
	june	40	42	42	43
Mg	April	15	19	18	17
hardness	May	17	19	19	15
	June	15	18	19	19
Alkalinity	April	124	127	130	127
	May	134	138	139	140
	June	140	142	140	138
Chloride	April	10.5	13.6	14.6	13.8
	May	10.4	13.6	14.6	13.7
	June	12.5	14.5	15.5	14.6
Ammonia	April	0.15	0.38	0.62	0.56
	May	0.17	0.38	0.66	0.58
	June	0.16	0.40	0.68	0.58
Nitrate	April	0.08	0.13	0.15	0.13
	May	0.08	0.15	0.15	0.15
	June	0.09	0.17	0.195	0.19
Nitrite	April	0.026	0.04	0.055	0.055
	May	0.026	0.04	0.06	0.05
	june	0.028	0.05	0.065	0.06
Phosphorus	April	0.002	0.005	0.005	0.006
	May	0.003	0.006	0.006	0.005
	june	0.003	0.007	0.007	0.004

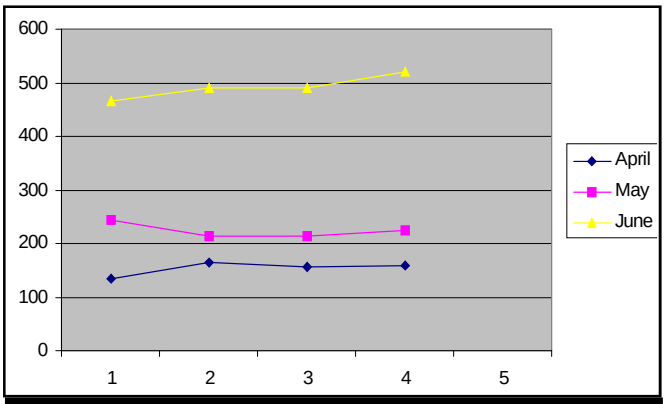

Fig. 2 : Monthly variation of TDS(mg/L)

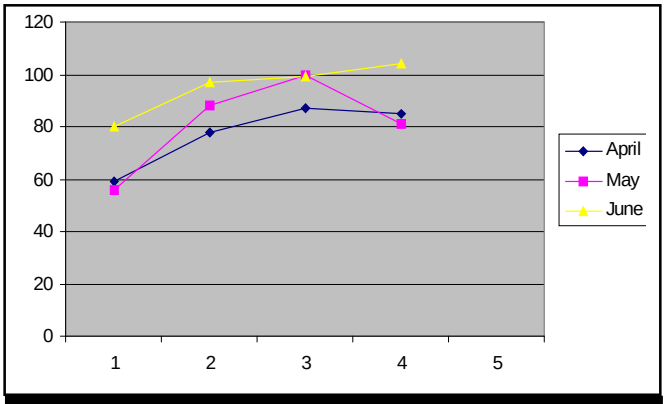

Fig. 3 : Monthly variation of TSS(mg/L)

DO, BOD and COD :

DO of river water has been observed in 7.1 to 6.1, 6.8 to 6.0 and 6.3 to 5.7 mg/l during April, May and June, respectively. The average value was 6.19 mg/l (Fig. 4). The values of dissolved oxygen obtained for the water of other sites of Gangi river support to the observation of Kumar (1995), Raina *et al.* (1985) and Krishna Murthi and Bharti (1995).

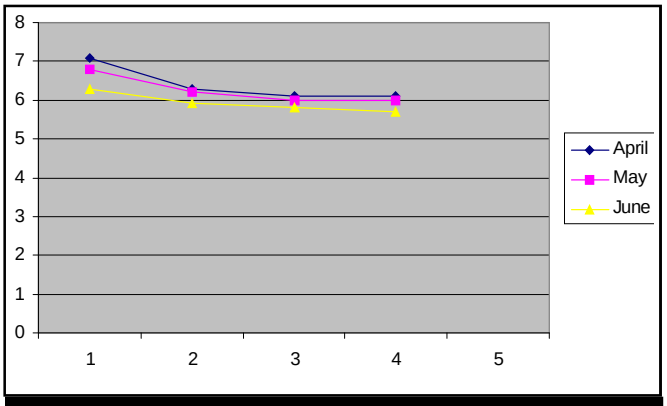

Fig. 4 : Monthly variation of DO(mg/L)

BOD of river water has been observed 1.7 to 3.2, 1.7 to 3.4, 1.8 to 3.4 during April, May and June, respectively. The minimum value was found in April and May month at site - I, whereas maximum value was reported in June at station - III. The average value was 2.6 mg/l (Fig. 5). Site - II, III, IV with intense human activities have shown higher value of BOD. This may attributed to the additional load of organic matter at these sites as a consequence of anthropogenic activities and discharge of domestic sewage.

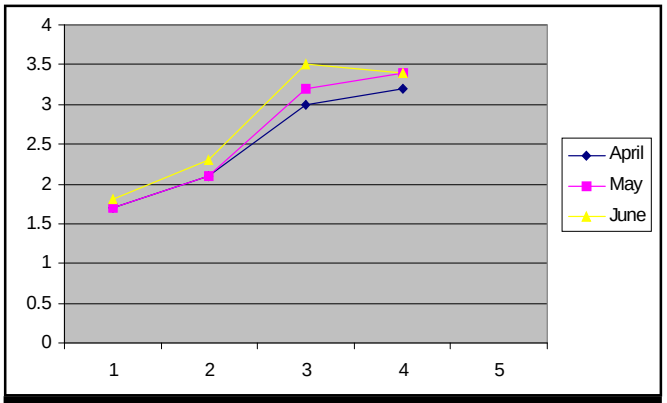

Fig. 5 : Monthly variation of BOD(mg/L)

COD value of river water has been observed 15.6 to 29.6, 15.6 to 31.4 and 15.8 to 31.4 mg/l during April, May and June, respectively. The average value was 24.91 mg/l (Fig. 6). Almost same pattern of COD values has been as for BOD values. Therefore, same inferences can be drawn for COD as were supposed to BOD value.

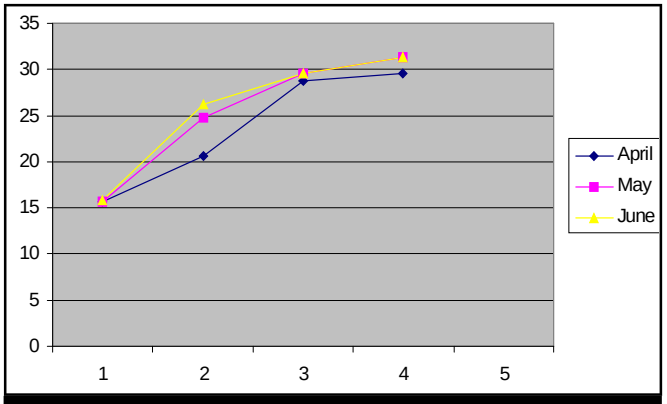

Fig. 6 : Monthly variation of COD(mg/L)

Hardness:

Total hardness :

The total hardness of Gangi river water has been observed 110 to 152, 122 to 142 and 145 to 170 mg/l during

April, May and June, respectively. The minimum value was found in April at station -I, whereas the maximum value was reported in June month at station - III. The average value was 143.75 mg/L. (Fig.7)

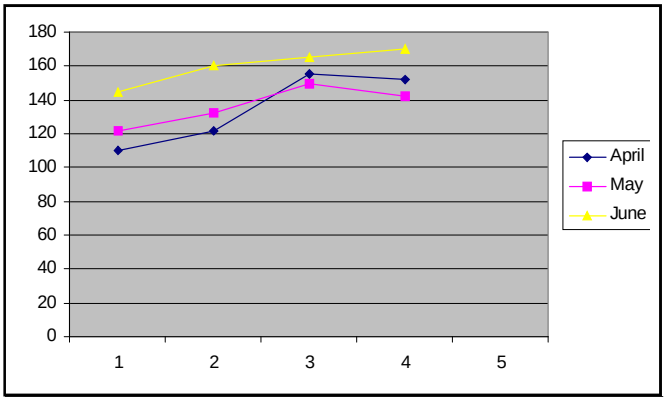

Fig. 7 : Monthly variation of T. hardness(mg/L)

Calcium hardness:

Similarly the calcium hardness was found to be 24 to 38, 30 to 40 and 40 to 43 during studied months. The minimum value was found in April at station - I, whereas maximum value was reported in June at station - IV. The average value was 36.33 mg/L (Fig. 8).

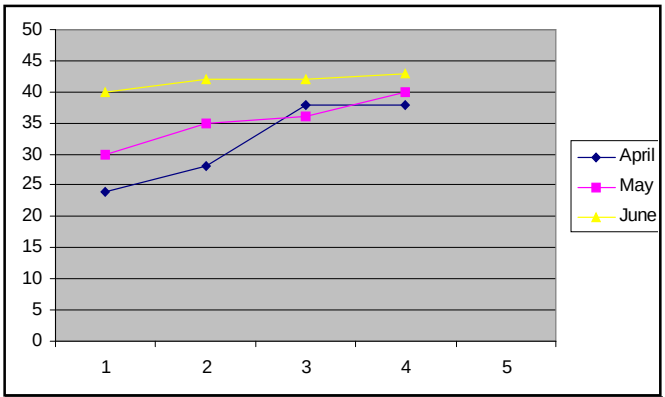

Fig. 8 : Monthly variation of Ca hardness(mg/L)

Magnesium hardness:

Magnesium hardness has been observed in the range of 15 to 19 during all studied months. The average value was 17.5 mg/l. (Fig. 9).

These values fall well below the permissible limit prescribed by BIS and WHO. The hardness was comparatively higher at site - III during studied months. The hardness of water at this site may be due to domestic waste and human activities as observed by Kumar (1995).

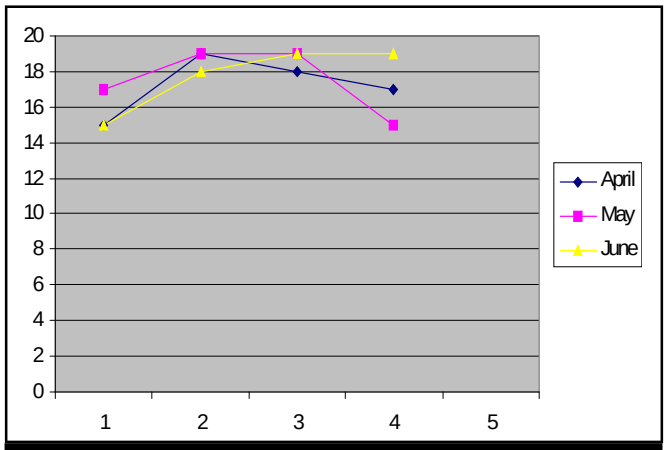

Fig. 9 : Monthly variation of Mg hardness(mg/L)

Alkalinity:

Alkalinity of Gangi river water, under present investigation varied between 124 to 127, 134 to 140 and 138 to 142 mg/l during all the studied months. The minimum value was found in April at station - I whereas the maximum value was reported in June month at station - II. The average value was 134.91 mg/l (Fig. 10). The perusals of results reveal that there were higher value of alkalinity in water sampled at the site with comparatively more human activities, such as bathing, cleaning of utensils and cloth washing might have contributed higher organic load (Pandey and Mishra, 2001).

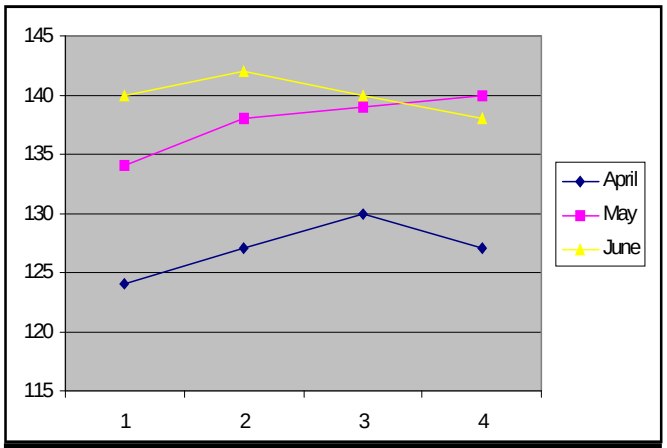

Fig. 10 : Monthly variation of Alkalinity(mg/L)

Chloride:

Chloride has been basic parameter detecting pollution of water by sewage before the development of bacteriological procedure (Sawyer, 1960). The chloride contents of Gangi river have been observed in 10.5 to 13.8, 10.4 to 13.7 and 12.5 to 15.5 mg/l during all the

studied months. The average value was 13.49 mg/l (Fig. 11). The chloride values were well below the standard limit set for river water by WHO (1971) and IS(1991).

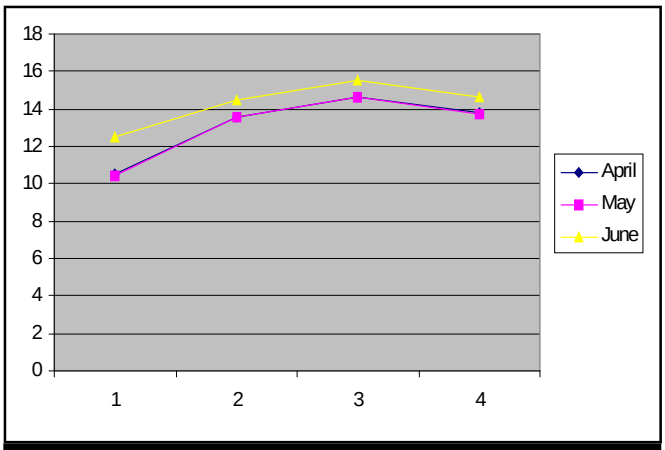

Fig. 11 : Monthly variation of Chloride (mg/L)

Ammonia, nitrate and nitrite:

Ammonia nitrogen of the Gangi river water has been observed 0.15 to 0.56, 0.17 to 0.66 and 0.16 to 0.68 mg/l during all the studied months. The minimum value was found in April at station - I whereas maximum value was reported in June at station - III. The average value was 0.44 mg/l. (Fig. 12) Result, indicated the range of nitrate Nitrogen 0.08 to 0.195 mg/l during all studied months.

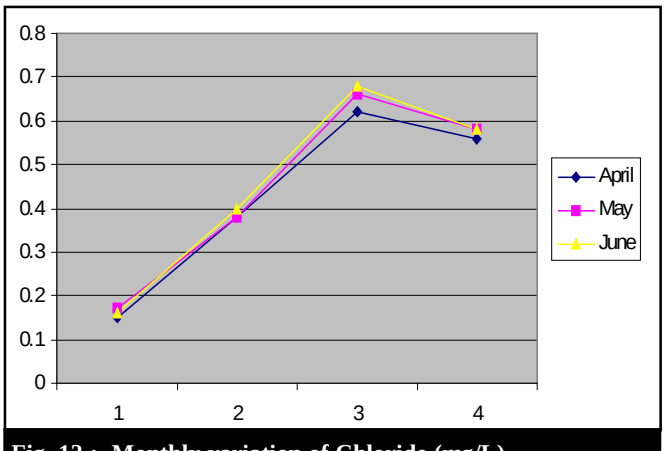

Fig. 12 : Monthly variation of Chloride (mg/L)

The average value of nitrate was 0.13 mg/L (Fig. 13).

Nitrite of Gangi river has been observed in range 0.026 to 0.065 mg/l in studied months. The average value of nitrite was 0.046 mg/l (Fig.14).

Results indicate that the nitrate, nitrite and ammonia nitrogen have shown an increased concentration at the site - III, where human activities were more. The

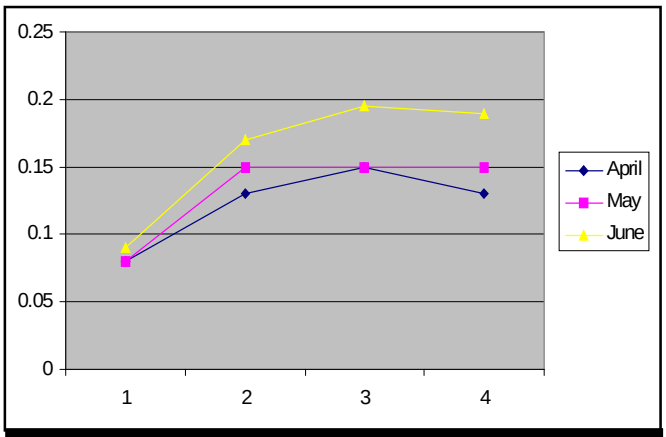

Fig. 13 : Monthly variation of nitrate (mg/L)

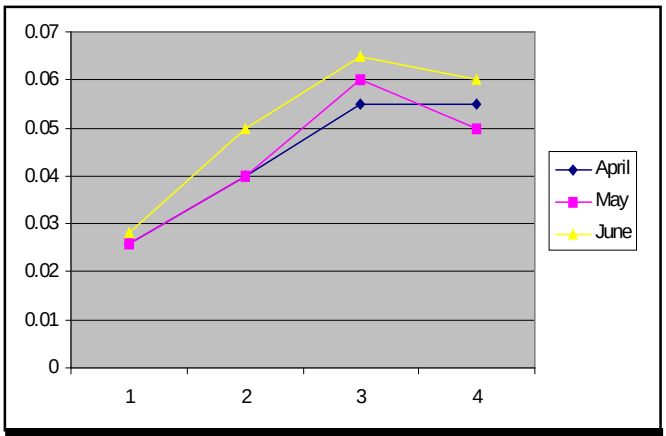

Fig. 14 : Monthly variation of nitrite (mg/L)

occurrence of inorganic nitrogen (nitrite nitrogen) in higher concentration at site - III and IV indicate that the organic pollution has not fully stabilized and mineralized. Concentration in excess of 0.3 ppm is considered sufficient to stimulate algae blooms (Culf and Gupta, 1974). The observed concentration of NO_3 - N is expected to have hazardous effect of human beings. However, a control on the sewage discharge into the river and human activities will have to be effected so that permissible limits of NO_3 - N are not exceeded.

Phosphorus:

Phosphorus contents of Gangi river varied from 0.002 to 0.007 mg/l during all studied months. The average value was 0.0049 mg/l (Fig. 15). The sites - II, III and IV with intense human activities have shown comparatively higher concentration of phosphate in river water. The increased application of fertilizers in agricultural fields use of detergent, domestic sewage and surface run-off from agricultural fields have been considered the major sources for heavy loading of phosphate in the aquatic ecosystems

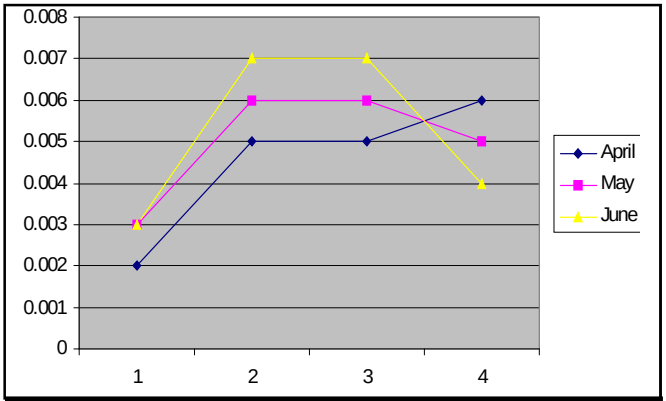

Fig. 15 : Monthly variation of phosphate (mg/L)

(Golterman, 1975).

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