Seasonal Variations of Physico-Chemical Assessment of Satak Reservoir Khargone (M.P.)

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Abstract: The aim of this work is relayed to the seasonal variations of physico-chemical properties of the Satak reservoir. The physico-chemical characters of this reservoir have been studied and analysed for a year, during Nov 2016 to 0ct 2017.Water samples were collected from 3 sample stations and the changes in physico-chemical parameters of water such as Water temperature, transparency, TDS, pH, BOD, COD, DO, chloride, alkalinity, sulphate, phosphate, Nitrate were analysed. The result was compared with the water quality standard of WHO (1997 and 1984). Between various physicochemical parameters systematic calculation of average and standard deviation was done to compare the water quality level at different stations. The above study shows that Satak reservoir comes under the mesotrophic water body in which Satak reservoir is gradually going towards the eutrophication.

Index Terms: Seasonal variations, Physico-chemical, Satak reservoir, mesotrophic, eutrophication.

I.Introduction

Water plays an important role in the world economy. The fresh water used by humans which goes to agriculture is approximately 70%. Fishing in salt and freshwater bodies is a major source of food for many parts of the world. Much of long distance trade of commodities (such as oil and natural gas) and manufactured product is transported by boats through seas, rivers, lakes and canals. Large quantities of water, ice and steam are used for cooling and heating, in industries and homes. Water is an excellent solvent for a wide variety of chemical substance; such as it is widely used in industrial processes, and in cooking and washing. As the water is very important resources have multidimensional approach including flood control, hydropower generation, water supply, navigation, restoration, etc. Satak, a small man made reservoir built over a Satak river in the Basin of Narmada River. This reservoir is a multipurpose point tank used for different activities like drinking water supply, irrigation, fisheries etc [2]. The present study was undertaken to assess the physico-chemical parameters of Satak reservoir khargone (M.P).

II.Material and method

The water samples for physico-chemical analysis were collected from Satak reservoir. From three different sampling stations in the early morning that are Station 1, Station 2, and Station 3. Monthly sampling was done from Nov 2016 to Dec 2017. Samples were taken between 7 am to 9 a.m. But transparency was measured between 11 am to 2 p.m. Water samples were taken in 1 lit. Polythene bottles. Temperature, pH, fixing of DO, and transparency were measured at the spot. Separate samples were collected from three sampling stations and samples were brought to the laboratory in ice boxes for the analysis of various physico-chemical parameters. The physicochemical characteristics of the dam water like water temperature, Air temperature, transparency, pH, BOD, COD, DO, total solids Dissolve (TSD), alkalinity, chloride, phosphate and nitrate were determined in summer, monsoon and winter according to standard methods (APHA, 2005 and R.K. Trivedy, and P.K. Goel, 1984, WHO 1987 and 1997).[33]

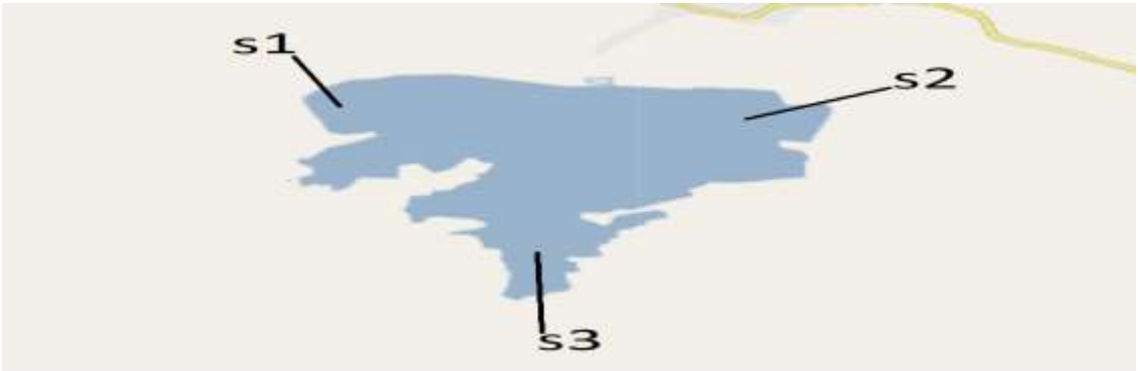


Fig.-1 Catchment Area of Satak Reservoir

Fig.-2 Satellite View of Satak Dam

Fig.-3 Photo of Satak Reservoir

Table 1: Methods Employed for the Measurement of Physicochemical Parameters

S.N.	Parameters	Method/ Instruments
1.	Water Temperature	Thermometer
2.	Transparency	Secchi Disk
3.	Alkalinity	Titrimetric
4.	Chloride	Gravimetric
5.	Sulphate	Nephelometer
6.	Nitrate	Spectrophotometric

7.	Phosphate	Spectrophotometric
8.	TDS	Conductometery
9.	BOD	Bottle Incubation Method
10.	COD	Open Reflux Method
11.	DO	Wrinkle's Method
12.	pH	pH meter

III. Result

In physico-chemical analysis of water of Satak reservoir it is observed that the water temperature varied between 22ºC-27.5ºC at sampling station S1. At sampling station S2 it ranged between 21.9ºC-28ºC and at sampling site S3 it ranged between 21ºC.6-27.9ºC , transparency was ranged at sampling site S1 between 20.6cm-43.5cm and at sample station S2 it ranged 20.2cm-44.1cm at sample station S3 it was 19.9cm-43.7cm, alkalinity was ranged at sample station S1 82.8mg/L-85.5mg/L and at sample station S2 was 82.8mg/L-85.5mg/L and at sample station S3 was 83.7mg/L-85.5mg/L , Chloride at sample station S1 ranged between 63.7mg/L-70.4mg/L, at sample station S2 was 63.7mg/L-70.4mg/L and at sample station S3 63.9mg/L-70.3mg/L, sulphate at sample station S1 ranged between 19.2mg/L-28.7mg/L and at sample station S2 19.3mg/L-28.5mg/L and at sample station S3 19.2mg/L-28.6mg/L, nitrate at sample station S1 ranged between 0.4mg/L-0.7mg/L and at sample station S2 it was 0.4mg/l-0.8mg/L and at sample station S3 it was 0.3mg/L-0.7mg/L, phosphate ranged at sample station S1 was 2.3mg/L-2.8mg/L and at sample station S2 2.4mg/L-2.9mg/L and at sample station S3 it was2.4mg/L-2.8mg/L, TDS ranged at sample station S1 148mg/L-185mg/L and at sample station S2 154mg/L-199mg/L and at sample station S3 148mg/L-188mg/L, BOD at sample station S1 ranged from 2.4mg/L-3.3mg/L at sample station S2 it ranged from 2.4mg/L-3.2mg/L and at sample station S3 it was 2.4mg/L-3.2mg/L, COD at sample station S1 ranged between 7.8mg/L-8.5mg/L at sample station S2 it was7.7mg/L-8.5mg/L and at sample station S3 it was 7.7mg/L-8.6mg/L, DO at sample station S1 ranges from 7.8mg/L-8.3mg/L at sample station S2 it ranged from 7.9mg/L-8.4mg/L and at sample station S3 it was 7.8mg/L-8.4mg/L and pH at sample station S1 ranges from 6.7-7.2, at sample station S2 it was 6.7-7.2 and at sample station S3 it ranges from 6.6-7.2.

Table 2: Seasonal variation of physico-chemical parameters of Satak Reservoir sample station S1

Parameters	Units	Summer	Monsoon	Winter	SD	Maximum Range	Minimum Range	WHO Standard
Water Temperature	ºC	27.5	24.9	22	±2.9	27.5	22	-
Transparency	Cm	43.5	20.6	23.5	±12.4	43.5	20.6	-
Alkalinity	mg/L	85.5	82.8	84.9	±1.4	85.5	82.8	200
Chloride	mg/L	68.9	70.4	63.7	±3.51	70.4	63.7	250
Sulphate	mg/L	24	28.7	19.2	±4.75	28.7	19.2	250
Nitrate	mg/L	0.5	0.7	0.4	±0.15	0.7	0.4	50
Phosphate	mg/L	2.3	2.8	2.5	±0.25	2.8	2.3	5.0
TDS	mg/L	148	185	155	±19.6	185	148	600
BOD	mg/L	3.3	3.0	2.4	±0.45	3.3	2.4	6.0
COD	mg/L	8.5	8.0	7.8	±0.36	8.5	7.8	10
DO	mg/L	7.8	8.2	8.3	±0.05	8.3	7.8	5.0
Ph		6.7	6.8	7.2	±0.26	7.2	6.7	7-8.5

Table 3: Seasonal variation of physico-chemical parameters of Satak Reservoir Sample Station S2

Parameters	Units	Summer	Monsoon	Winter	SD	Maximum Range	Minimum Range	WHO Standard
Water Temperature	ºC	28	25	22	±3.0	28	21.9	-
Transparency	Cm	44.1	20.2	23.7	±12.4	44.1	20.2	-
Alkalinity	mg/L	85.5	82.8	84.9	±1.78	83.5	82.8	200
Chloride	mg/L	69.1	70.4	63.7	±3.39	70.4	63.7	250
Sulphate	mg/L	24.5	28.5	19.3	±4.61	28.5	19.3	250
Nitrate	mg/L	0.6	0.8	0.4	±0.15	0.8	0.4	50
Phosphate	mg/L	2.4	2.9	2.4	±0.28	2.9	2.4	5.0
TDS	mg/L	199	189	154	±23.6	199	154	600
BOD	mg/L	3.2	2.9	2.4	±0.40	3.2	2.4	6.0
COD	mg/L	8.5	7.7	7.8	±0.43	8.5	7.7	10
DO	mg/L	7.9	8.1	8.4	±0.20	8.4	7.9	5.0

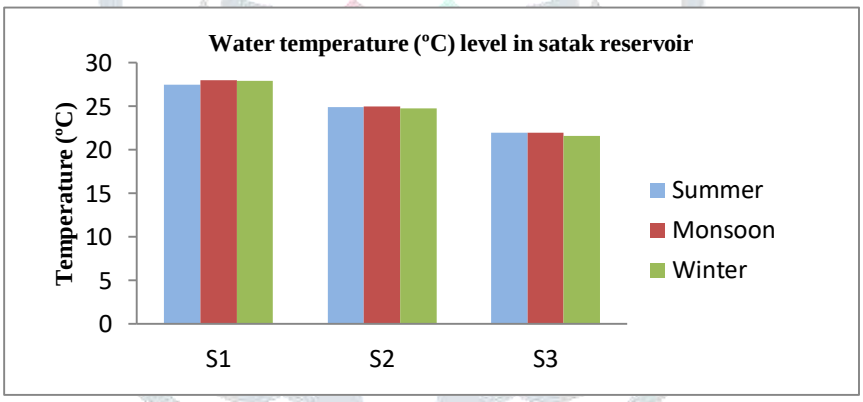
pH		6.7	6.9	7.2	±0.25	7.2	6.7	7-8.5

Table 4: Seasonal variation of physico-chemical parameters of Satak Reservoir Sample Station S3

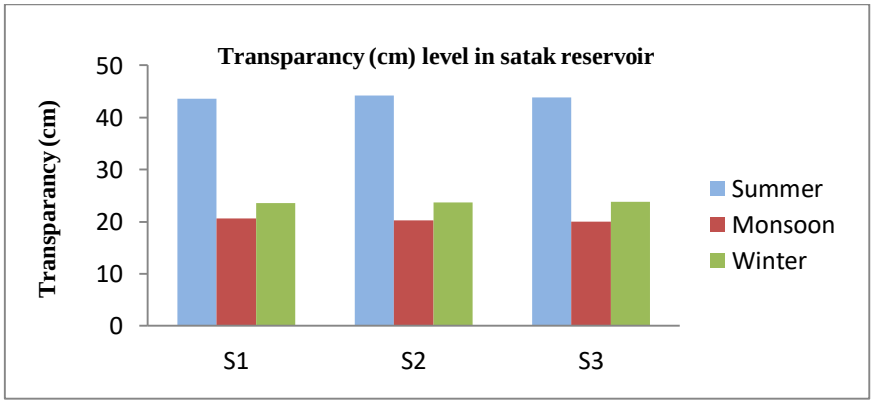
Parameters	Units	Summer	Monsoon	Winter	SD	Maximum Range	Minimum Range	WHO Standard
Water Temperature	ºC	27.9	24.8	21.6	±3.52	27.9	21.6	-
Transparency	Cm	43.7	19.9	23.7	±12.7	43.7	19.9	-
Alkalinity	mg/L	85.5	83.7	85.1	±0.94	85.5	83.7	200
Chloride	mg/L	69	70.3	63.9	±3.38	70.3	63.9	250
Sulphate	mg/L	24.6	28.6	19.2	±4.71	28.6	19.2	250
Nitrate	mg/L	0.5	0.7	0.3	±0.2	0.7	0.3	50
Phosphate	mg/L	2.4	2.8	2.5	±0.20	2.8	2.4	5.0
TDS	mg/L	148	188	154	±21.5	188	148	600
BOD	mg/L	3.2	2.9	2.4	±0.40	3.2	2.4	6.0
COD	mg/L	8.6	7.7	7.8	±0.4	8.6	7.0	10
DO	mg/L	7.8	8.1	8.4	±0.05	8.4	8.3	5.0
pH		6.6	7	7.2	±0.30	7.2	6.6	7-8.5

IV.DISCUSSION

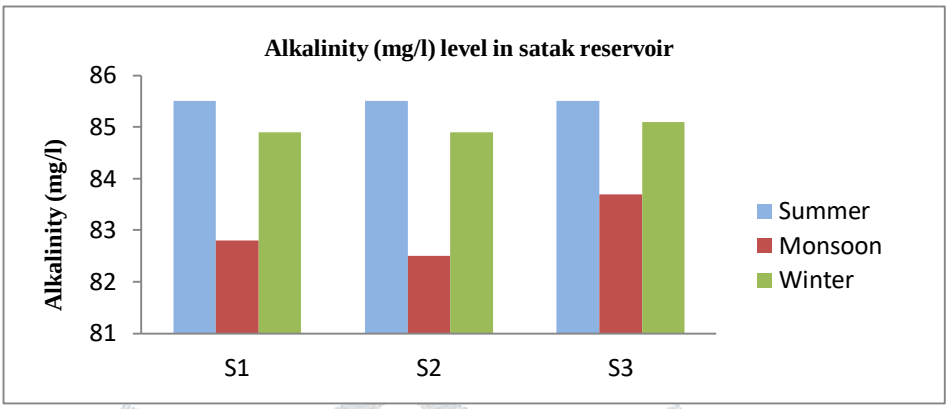
Temperature- water temperature is one of the important physical parameter which directly influences some chemical reaction in aquatic ecosystem. Temperature value was maximum during monsoon and minimum during winter. Similar findings were reported by Kesre *et al*. (2007); Tiwari *et al*. (2011); Jain *et al*. (1996).



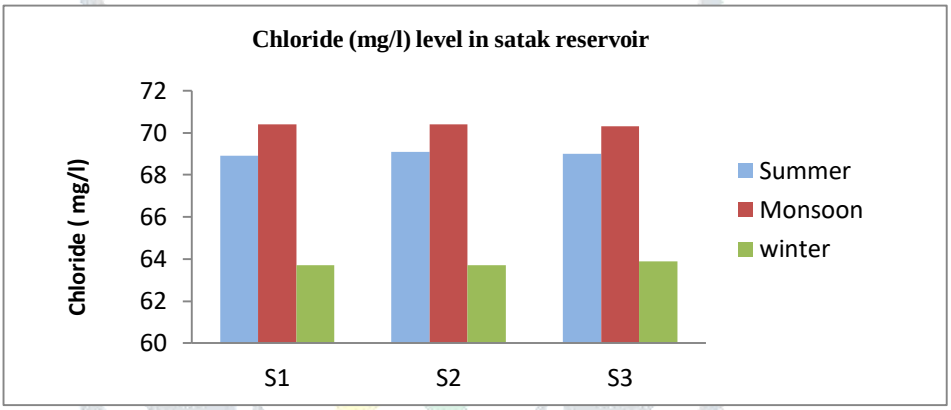
Transparency-Transparency value was higher during summer because of less turbidity and lower value of transparency was during monsoon which may be due to influx of rain water from catchment area and suspended inert particulate matter. Transparency shows positive relationship with DO, BOD and COD while shows negative relationship with hardness and pH. Similar conditions were observed by Tripathi *et al*. (2014).



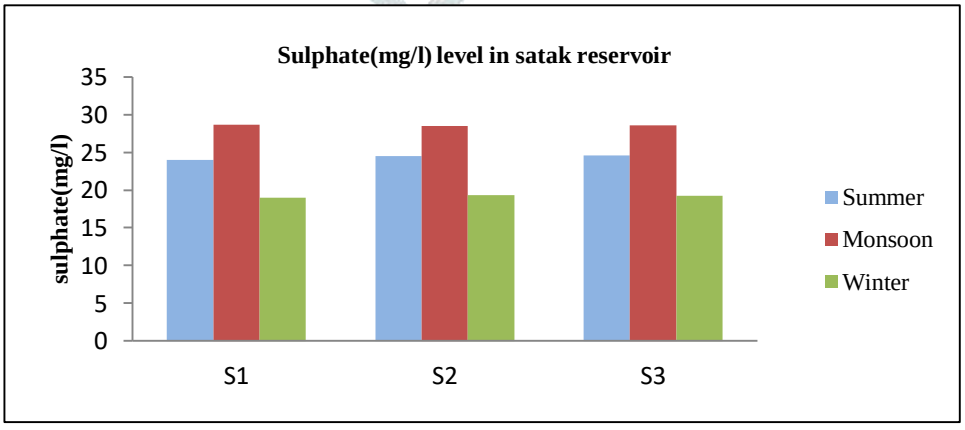
Alkalinity- Alkalinity of water can be defined as the ionic concentration, which can neutralize the hydrogen ion. It is due to the presence of bicarbonates, carbonates and hydroxides of calcium, magnesium and sodium. Alkalinity value was higher during summer and lower during monsoon. . Patil (2014); Shrivastava (2005); Hujare *et al*.(2008); Sawant *et al.* (2009) also obtained similar results.



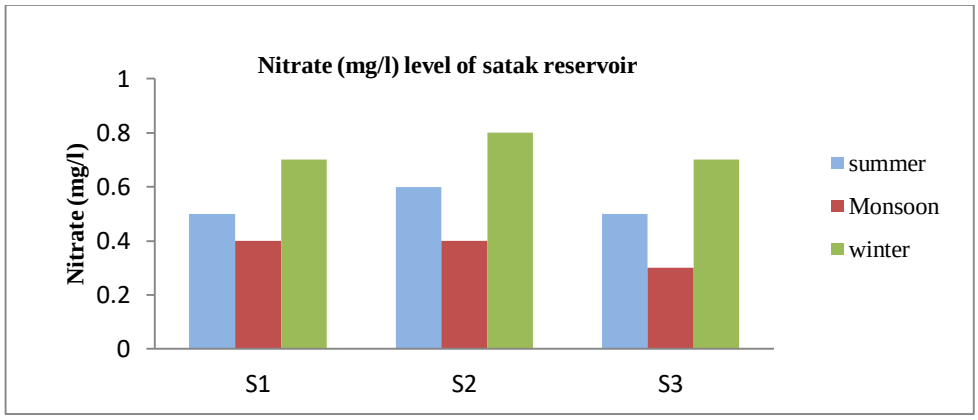
Chloride- In Satak reservoir the chloride values were higher during summer which was may be due to increase in temperature. The chloride value was found during winter. Similar conditions were observed by Anand *et al*. (2000); Sharma *et al.* (2000); Subhashini *et al*. (2005); Patil (2014).



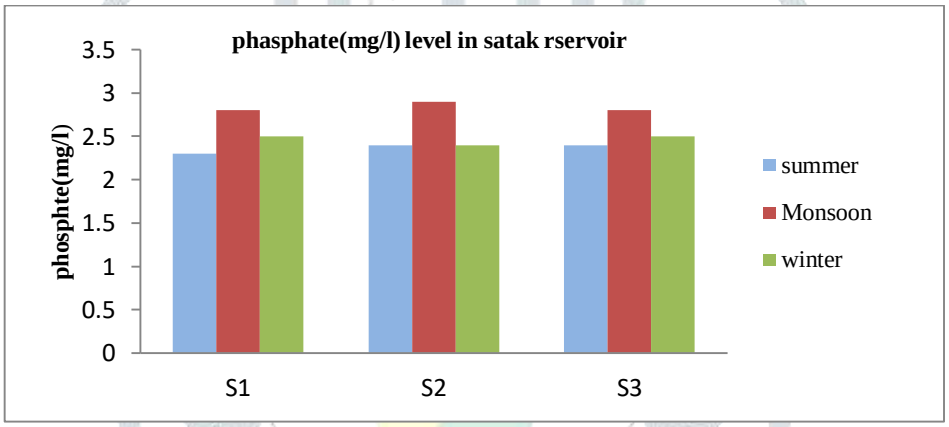
Sulphate- Sulphate value was observed higher during monsoon and lower during winter. Sulphate shows positive relationship with water temperature, alkalinity and electrical conductivity and negative relationship with total solids. Similar findings were reported by Sharma *et al.* (2012); Sharma *et al.* (2004); Kesre *et al*. (2007)



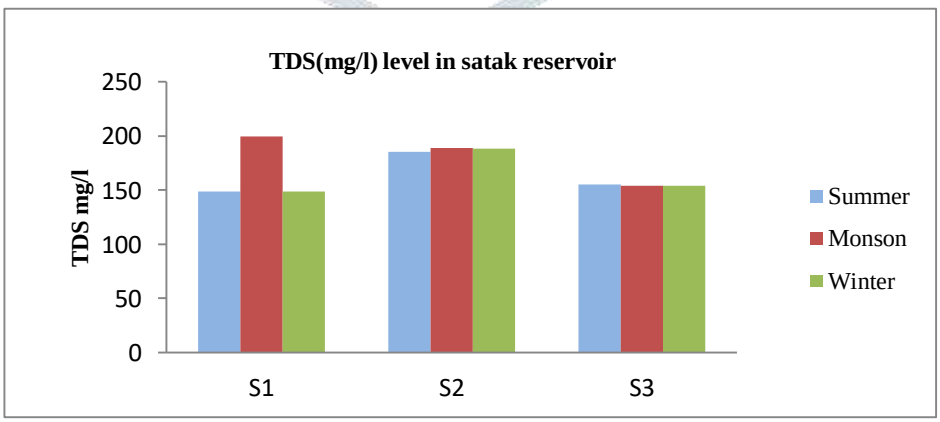
Nitrate- The value of nitrate was highest during monsoon which might be due to rain and surface runoff and lowest during winter. Similar results were obtained by Mankar *et al.* (2015); Karuthapandi *et al.* (2013).



Phosphate-Phosphate value was highest during monsoon which was may be due to rain, agriculture runoff and lowest value was during summer. Similar conditions were reported by Shukla *et al.* (2013); Sharma *et al.* (2012); Jain R. *et al.* (2000) .

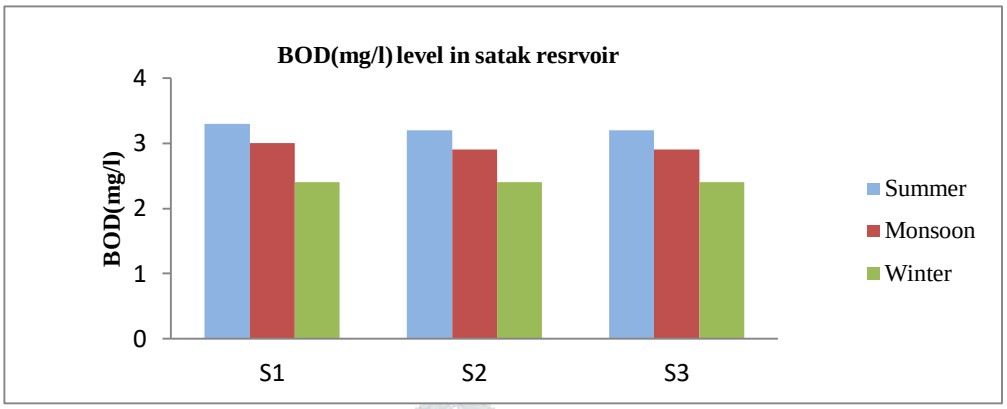


Total Dissolved Solids- The quality of aquatic environment was affected by presence of dissolved salts. May be due to surface runoff soil, clay etc the higher value of TDS was during monsoon and due to settling of suspended particles the lower value was during winter. Tilekar (2013); Mankar *et al.* (2015); Kesre *et al.*(2012) were also reported similar findings.

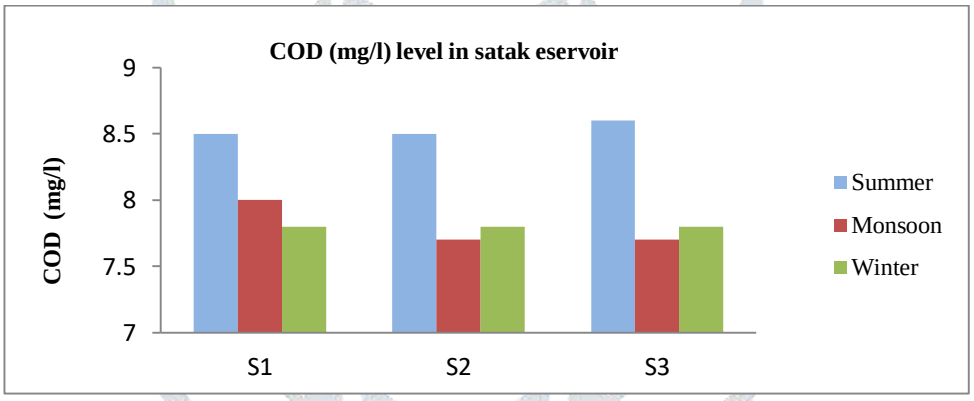


BOD-It is the amount of dissolved oxygen needed by aerobic biological organism to breakdown organic material present in a water sample at certain temperature over a specific time period. BOD value was higher during summer which may be due to higher temperature which promotes microbial activities and lower during winter which may be due to low temperature and

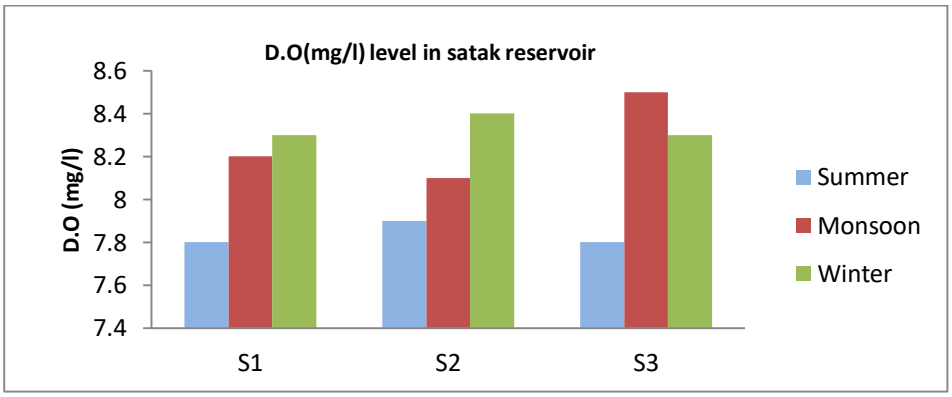
sufficient amount of water in the reservoir. Similar conditions were also reported by Bondage *et al.* (2017); Saxena *et al.* (2011); Sharma *et al*. (2012); Pathak *et al*. *(*2005).



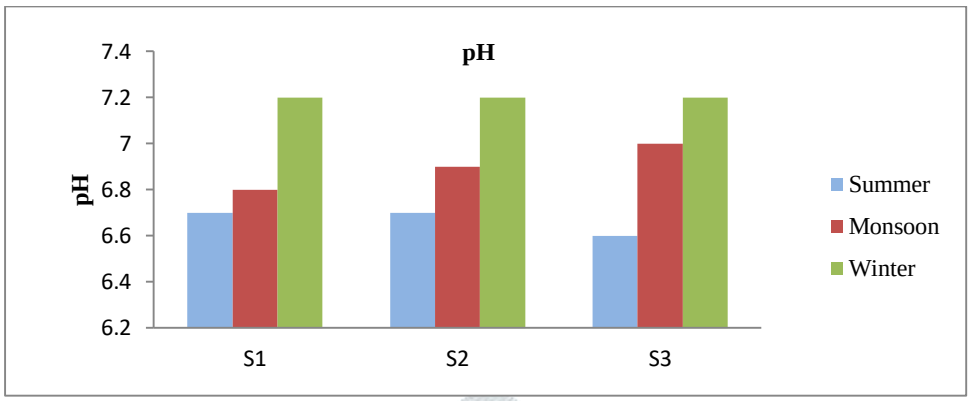
COD- COD value was observed highest in summer and lowest in monsoon. COD shows positive relationship with pH and BOD while it shows negative relationship with hardness and total solids. Similar results were also found by Tripathi *et al*. (2014).



DO- One of the important abiotic factors regulating the life of animals in water is DO Aquatic animals use dissolved oxygen for their respiration and metabolic processes, photosynthesis may cause alterations in dissolved oxygen due to production of oxygen. Highest value of DO was during winter and lowest was during summer also reported by Mankar *et al. (*2015); Mahadeo *et al*. (2010); Tilekar (2011); Kesre *et al.* (2012).



pH- Indicator of primary productivity level of the ecosystem is pH. Throughout the study in all stations pH in Satak Reservoir was higher in winter and lower during summer. Therefore, the level of pH indicates moderate primary productivity. Similar finding were reported by Choudhary *et al.* (2010); De, A. K. (2002); Verma *et al.* (2006).



V. Conclusion

The present study of physico chemical parameters of Satak reservoir reveals that the value of different parameters like temperature, transparency, alkalinity, chloride, sulphate, nitrate, phosphate, TDS, BOD, COD, DO, pH were found within the permissible limit as per WHO standards and the quality of water is good but from the previous study and the present study on Satak reservoir it can be concluded that it is a mesotrophic water body which was gradually going towards eutrophication is now increasing slightly and now it is necessary to conserve and manage the reservoir so that it can be best utilized.

VI. References

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