Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

Analysis of Physico Chemical Properties in the Mangrove Ecosystem of Paravoor, Kollam District, Kerala, South India

Reshmi Vijayan[1], Aparna S Suresh[1], Sojomon Mathew[2*]

[1] Post Graduate Department of Zoology, Baby John memorial Government College, Chavara, Kollam- 691583, Kerala, India.

[2]Department of Zoology, Government College, Kottayam -686013, Kerala, India.

(Received: 07 January 2024 Revised: 12 February 2024 Accepted: 06 March 2024)

KEYWORDS

Mangroove, microplastics, Paravoor , physico-chemical

ABSTRACT:

The present investigation was carried out to assess the physicochemical characteristics in th ecosystem of Paravoor, Kollam district for a six month from March 2023 to August 2023. Su samples and sediments are collected from the chosen sampling stations at regular intervals and provide a baseline of physico- chemical parameters for ongoing monitoring and comparison with f identify any changes or trends. The physicochemical parameters chosen to be observed in the st dissolved oxygen, water temperature, pH, salinity, sediment nutrients (nitrate, nitrite, silicate, and and quantification of microplastics. The observed variation are; Dissolved oxygen in mg/l (3.7 - temperature in ℃ (28 ℃ – 34.8 ℃), PH (6.4 – 7.8), Salinity in ppt (15.48 – 48.31), Silicate in r 6.37), Nitrate in mg/L (0.012 – 0.558), Nitrite in mg/L (0.001 – 0.066), Phosphate in mg/L (0.001 - study area shows significant high positive correlation between Dissolved oxygen, nitrite; Disso pH; Water temperature, pH; Nitrate, Phosphate. Number of microplastics varying from 32 to 47 The study area contains elevated concentration of microplastics, they can affect the structure and of the ecosystem.

1.Introduction

The mangrove ecosystem acts as a buffer between coastal and lagoonal or estuarine transitional environments in terms of its effects on freshwater flow, salinity, and the adjacent water system in general (Ramanathan, 1997). In India, mangrove vegetation is observed all the time its 5,700 km long coastline. Total area mangroves are estimated to be about 700,000 hectares, which occupies about 6% of the mangroves of the world (Subash Chandran et al., 2012). Mangroves are mainly salt-tolerant forest ecosystems in tropical and subtropical intertidal zones around the world, serving as a bridge between terrestrial ecosystems and marine ecosystems. In India, the total area of mangrove forests is estimated at 6,740 km2 accounting for about 7% of the world's mangrove area. The term mangrove means a group of woody plant species present protected coastal areas and have an exclusive opportunity to function in a saline environment (Lugo, A. E., & Snedaker, 1974). The ecosystem is designed for marine tides and ecotones for freshwater biological communities that have important role in biochemical process, recycling of nutrients and often nutritionally limited (Alongi,2009). They are working for the protection of marine animals and the coast in ecosystems, the mangrove ecosystem is a repository biodiversity such as tropical rainforest (Swaminathan, 1991).

India's mangroves cover about 4827 km2, about 57 percent of them on the East Coast, 23% on the west coast and 20% inland Andaman and Nicobar Islands (Venkataraman and Wafar, 2005). Mangroves occupy all continent in tropical and sub-tropical region of the world Globally, mangroves can be divided into two groups: Old Mangroves of the World (Indo- Pacific)

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

and New World Mangroves (West Africa). The concentration of mangrove species is the highest Malaysian region (Chapman, 1975). The limited distribution of mangroves is due to their sensitivity to frost and cold. These forests cover the plains that lie between mean sea level and extreme floods. The condition of this area is characterized by the accumulation of mud and loose silt (Womersley, 1983).

Indian coastal zone is endowed with a very wide range of coastal ecosystems such as estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches, and coral reefs which are characterized by unique biotic and abiotic properties and processes. Among all the coastal ecosystems, mangroves are considered as vital in many ecological, economic, and social sense. Information on various physicochemical process that control the prevailing environmental conditions of the mangroves will eventually help to evaluate the ecological changes. Seasonal variation in ecological conditions have a considerable impact on animal and plant species distribution and population density (Odum,1971). Mangroves are among the planet's most prolific and physiologically significant ecosystems, offering essential ecosystem services and goods.

Mangrove in Kollam district, like in any other region, play a crucial ecological and socio-economic role. Understanding their significance is essential for implementing effective conservation and management strategies. Before choosing a plan for the introduction of additional populations or the conservation of the current ones, data regarding the size and variety of mangroves must be consolidated. Mangrove in Kollam district serve as critical habitats for a diverse array of plant and animal species, including numerous endangered and commercially important species. They provide nesting, breeding, and feeding grounds for various marine and terrestrial organisms. Information on various physicochemical processes that control the prevailing environmental conditions of the mangroves will eventually help to evaluate the ecological changes.

1. Objectives And Scope

This study was carried out to investigate the changes in physicochemical parameters in sediments in Paravoor mangrove ecosystem, Kollam.The main scope of the study are the following

2.1 To evaluate overall health and quality of the mangrove ecosystem by assessing parameters like water quality, sediment characteristics and nutrient level.

2.2 To understand the potential impact of microplastic on the ecosystem, including how they might affect wildlife, plant life and overall biodiversity.

2.3 To establish a baseline of physicochemical parameters and microplastic levels for ongoing monitoring and comparison with future data to identify any changes or trends

2.4

3.Material And Methods

3.1 Study area

Paravoor mangrove ecosystems located at Kollam districts of southern Kerala has a latitude of 8°48'51.08"N and a longitude of 76°40'2.14"E. Water samples and sediments were taken from three sites in Paravoor mangrove ecosystem. Three different sampling sites were chosen they are site 1, site 2, site 3, respectively. The distance between the stations was about 1 km. The study sites 1 was kayaking area. Study site 2 significant in improper waste disposal. The study site 3 is include urban development and pollution from nearby tourist homing.

3.2 Sampling Strategy, Sample Collection and Processing

The water and sediment samples were collected once in fifteen days from three different seasons to record the physicochemical characteristics of the Paravoor mangrove ecosystem. The study period of 6 months from March 2023 to August 2023. The study period (march to August) divided into two different seasons, summer (March-May) and monsoon (June to August). Surface water samples were collected from 1-2 meters depth of the water surface. The water samples are collected in 300 ml bottles and the sediment samples collected in the polyethylene bag. Field data like temperature, salinity, dissolved oxygen, pH and other nutrients were collected during morning to noon.

The water samples and sediments were tested for different physicochemical parameters in Paravoor mangrove ecosystem. For analysis of dissolved oxygen (D.O) water samples were collected biologically oxygen demand (BOD) bottles with a volume of 300

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

ml. The manganese sulphate and alkaline iodo-azide reagent is added immediately at the point of collection site to fix the samples for analysis of dissolved oxygen. The surface water temperature and were measured by using a Degree Celsius Thermometer (mercury).

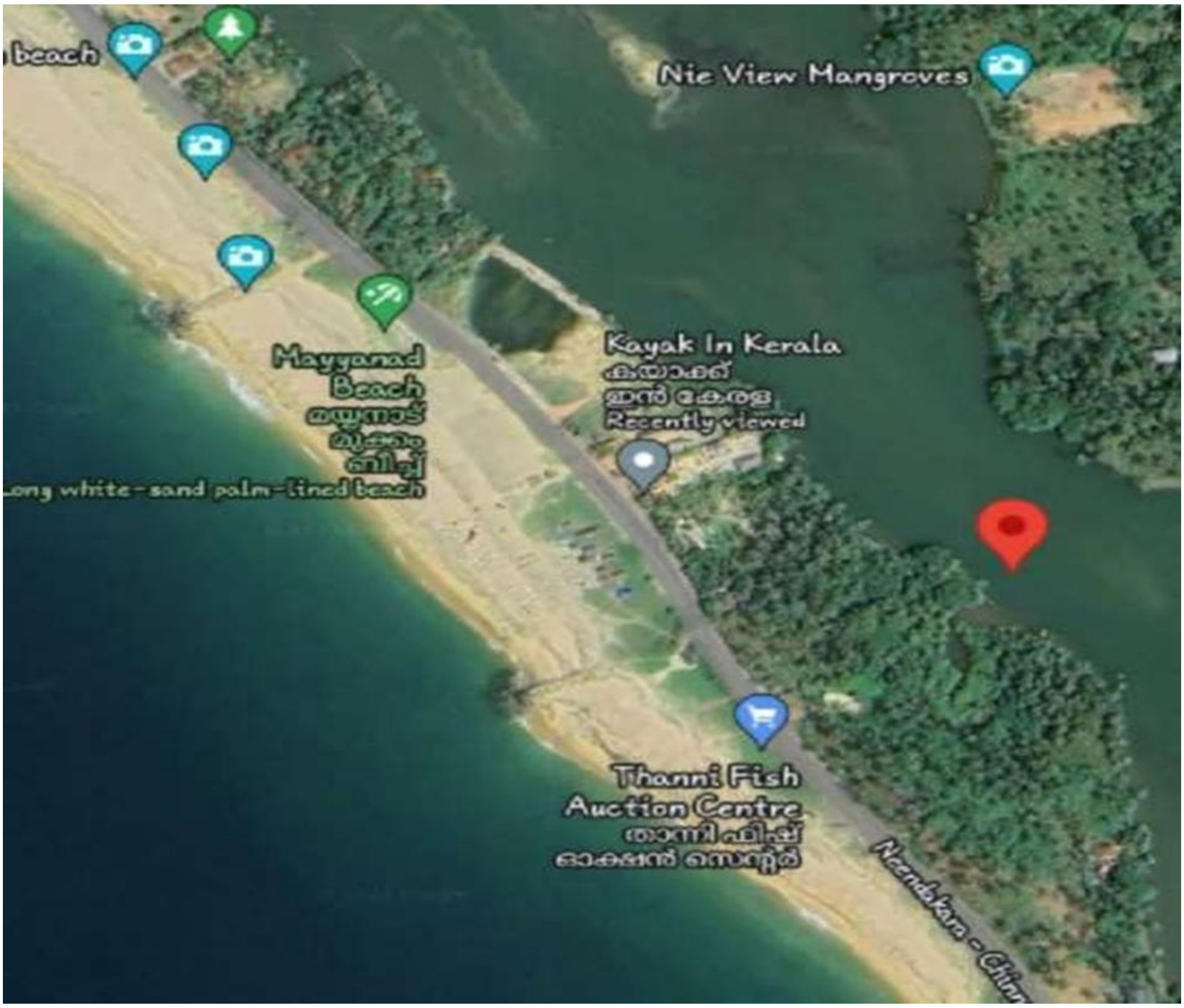


Figure 1. Map showing study area

Water salinity was estimated with the help of salinity refractometer (Atago-Japan). The water pH was measured using a digital pH meter (EUTECH). Dissolved oxygen of the sample was estimated by the modified Winkler's method (Strickland and Parsons, 1972). All the collected samples from the study area kept in ice box and immediately transferred into laboratory for further analysis.

Nutrients in sediments such as Silicate, Nitrite, Nitrate, Phosphate were analysed in the laboratory (National Centre for Earth Science Studies, Akkulam, Thiruvananthapuram). The nitrate is reduced to nitrite by a cadmium copper reductor. The nitrite is determined by the Griess reaction, the colour is measured at 540 nm Preparation: Dissolve the ammonium heptamolybdate in ± 800 ml distilled water. Fill up to 1 liter with distilled water and mix.

Oxalic acid solution (1 liter)

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

Required chemicals: Oxalic acid 44 g, $C_2H_2O_4$, $2H_2O$, Distilled water, H_2O.

Preparation: Dissolve the oxalic acid in ± 800 ml distilled water. Fill up to 1 liter with distilled water and mix.

L(+)Ascorbic acid solution (1 liter)

Required chemicals: L(+)Ascorbic acid 40 g, $C_6H_8O_6$, Distilled water, H_2O

Preparation: Dissolve the L(+)ascorbic acid in ± 800 ml distilled water. Fill up to 1 liter with distilled water and mix.

10.119 g, Na_2SiO_3,$9H_2O$, Distilled water,

H_2O.

Preparation : Dissolve the sodium metasilicate in ± 800 ml distilled water. Fill up to 1 liter with distilled water and mix.

Ammonium heptamolybdate catalyzed by potassium antimony (III) oxide tartrate reacts in an acidic medium with diluted solutions of phosphate to form a phospho-molybdic acid complex. This complex is reduced in an intensely blue colored complex by L(+)ascorbic acid. This complex is measured at 880 nm.

4. Observation and Results

Table.1 Variation in physico- chemical parameters of site 1

Month & year	Dissolved oxygen (mg/l)	Water temperature (°C)	pH	Salinity (ppt)	Silicate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Phosphate (mg/l)
Marcch 2023	4.67	32.5	7.6	34.23	1.03	0.012	0.016	0.062
April 2023	3.99	32	7	15.48	0.71	0.108	0.069	0.011
May 2023	5	28	6.8	21.98	0.59	0.0821	0.0054	0.0015
Jun 2023	4.57	29.1	6.9	26.91	1.58	0.029	0.007	0.158
July 2023	5.1	28	7.09	35.3	6.34	0.1071	0.0027	0.0054
August 2023	3.7	29	6.4	47.3	0.81	0.2779	0.0019	0.0147

Table.2 Variation in physico chemical parameters of site 2

Month & year	Dissolved oxygen (mg/l)	Water temperature (°C)	pH	Salinity (ppt)	Silicate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Phosphate (mg/l)
March 2023	4.67	33	7.5	33.11	0.91	0.231	0.055	0.043
April 2023	3.9	34.8	7.87	19.4	0.69	0.093	0.066	0.009
May 2023								

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

	5	28	7.35	27.7	0.64	0.558	0.0092	0.0011
June 2023	4.57	29.6	7.21	27.77	0.59	0.041	0.007	0.17
July 2023	5.1	29	7.23	35.79	6.37	0.0562	0.0032	0.0709
August	3.7	28	6.84	46.52	0.76	0.2718	0.0047	0.006

Table.3 Variation in physico chemical parameters of site 3

Month & year	Dissolved oxygen (mg/l)	Water temperature	pH	Salinity (ppt)	Silicate (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Phosphate (mg/l)
March 2023	4.58	32.9	7.3	34.21	1.1	0.541	0.043	0.051
April 2023	3.9	34	7.49	21.47	0.7	0.102	0.062	0.012
May 2023	4.9	28.1	7.13	31.51	0.7	0.1139	0.0138	0.0034
June 2023	4.55	29.5	7.44	18.46	1.06	0.139	0.068	0.012
July 2023	5.2	29	6.58	34.51	5.76	0.0057	0.009	0.0037
August 2023	3.9	29.5	7.11	48.31	0.83	0.0711	0.0043	0.0236

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

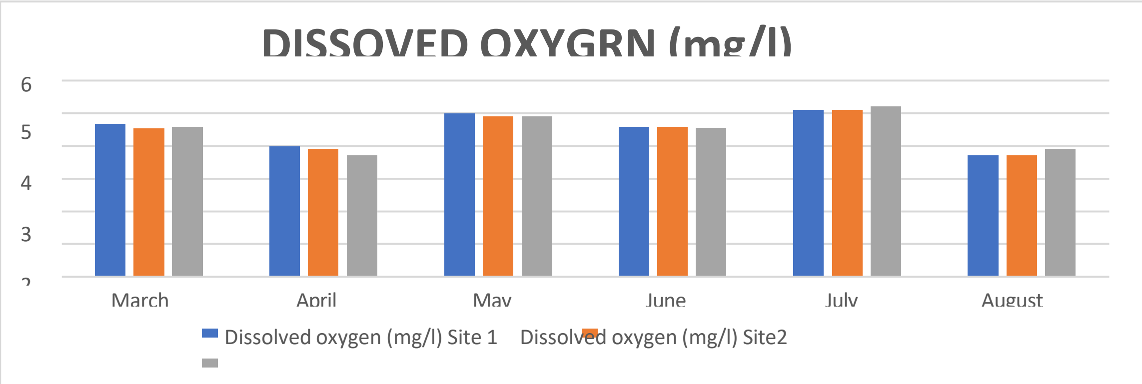


Figure - 2 Monthly variation of dissolved oxygen in Paravoor mangrove ecosystem

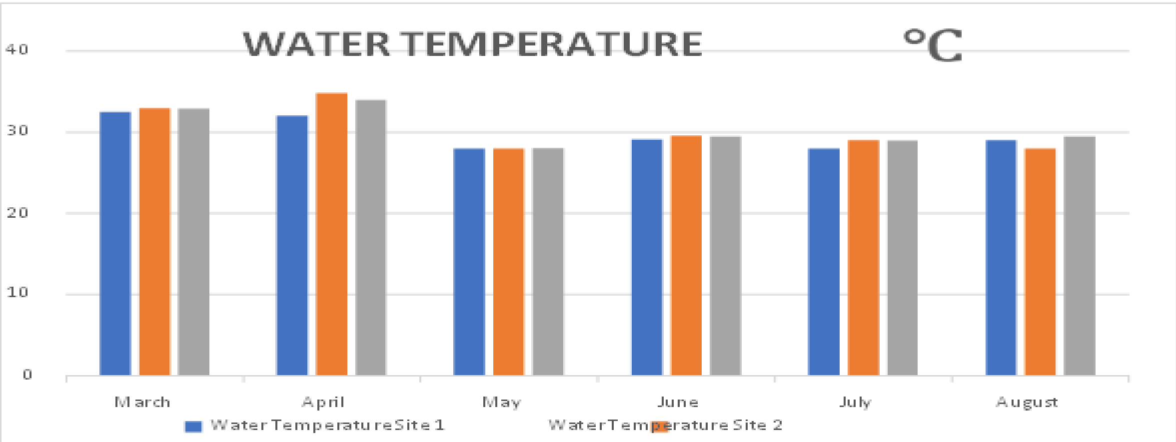
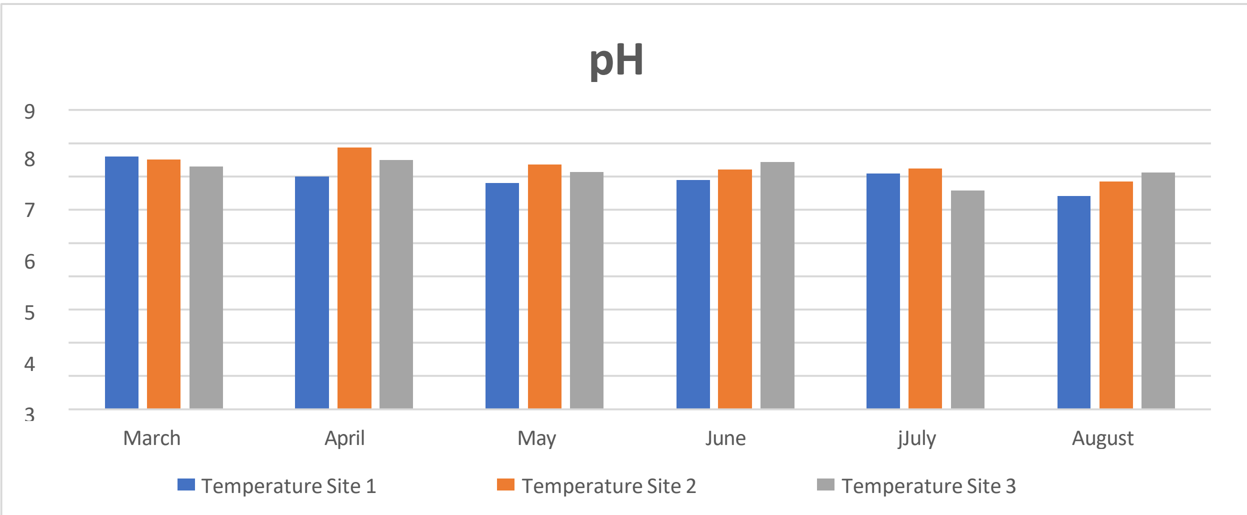


Figure- 3 Monthly variation of water temperature in Paravoor mangrove ecosystem



Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

Figure 4- Monthly variation of pH in Paravoor mangrove ecosystem

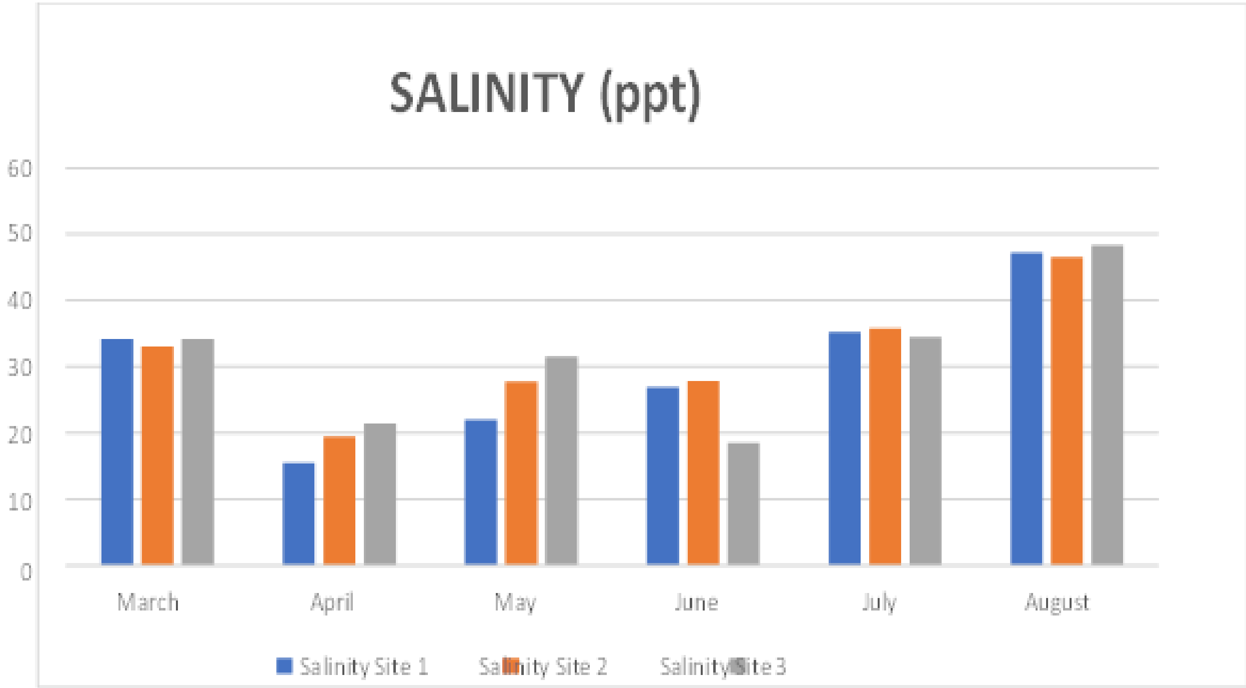


Figure - 5 Monthly variation of salinity in Paravoor mangrove ecosystem

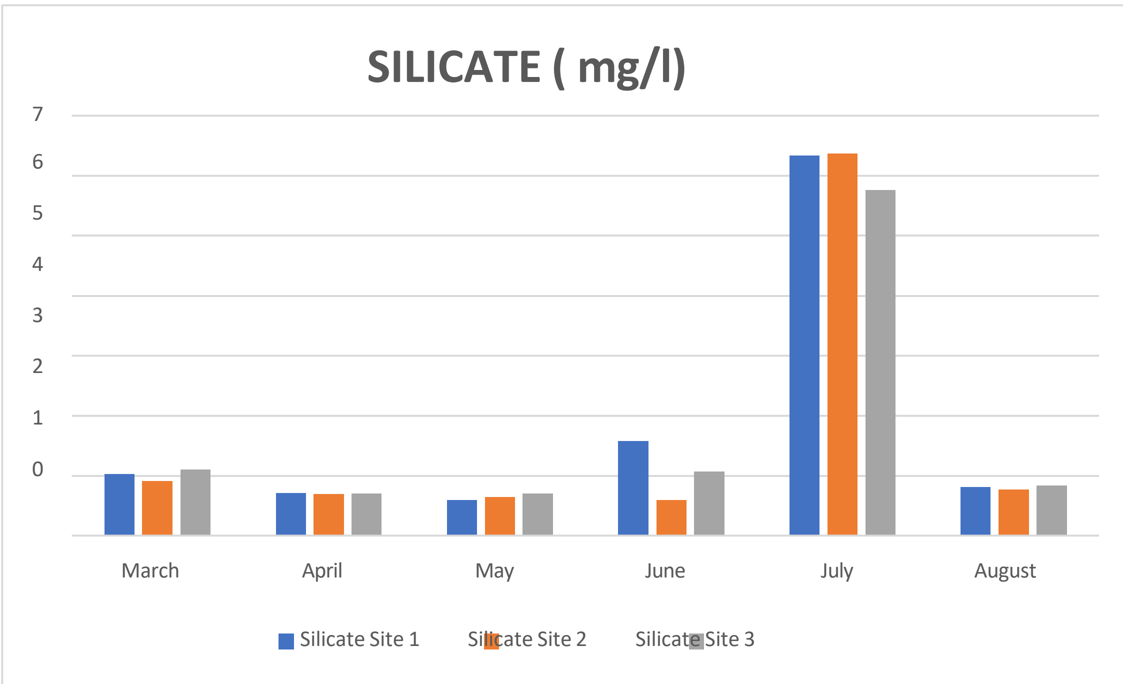


Figure- 6 Monthly variation of silicate in Paravoor mangrove ecosystem

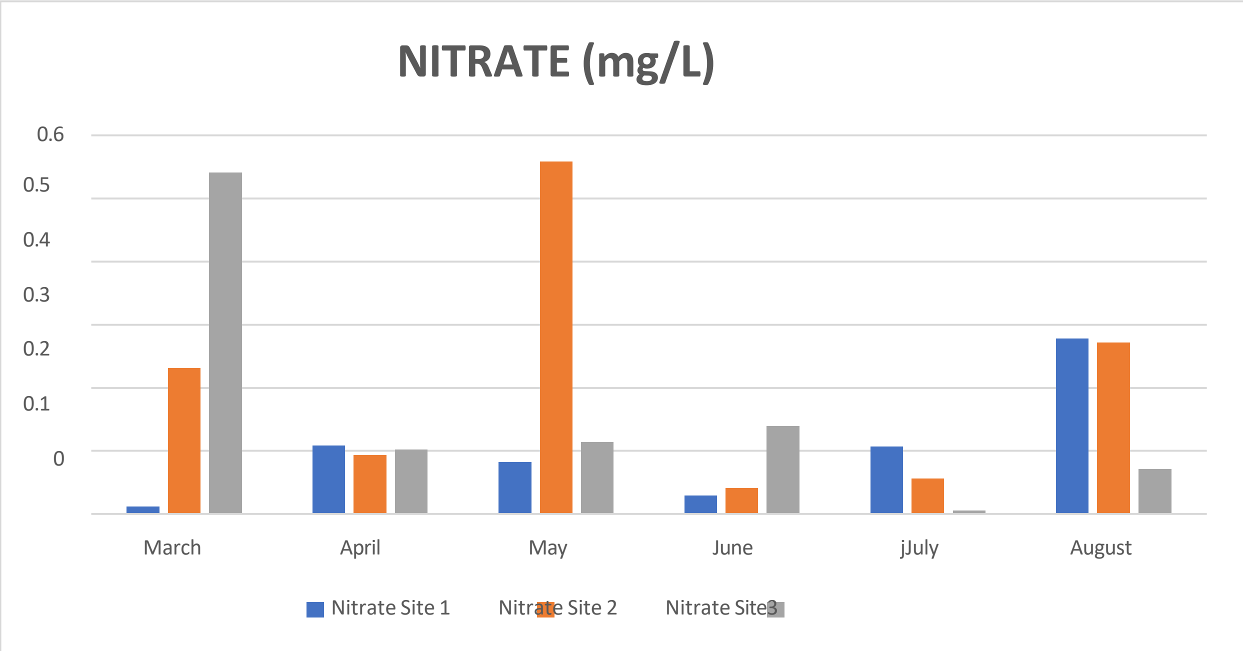


Figure- 7 Monthly variation of nitrate in Paravoor mangrove ecosystem

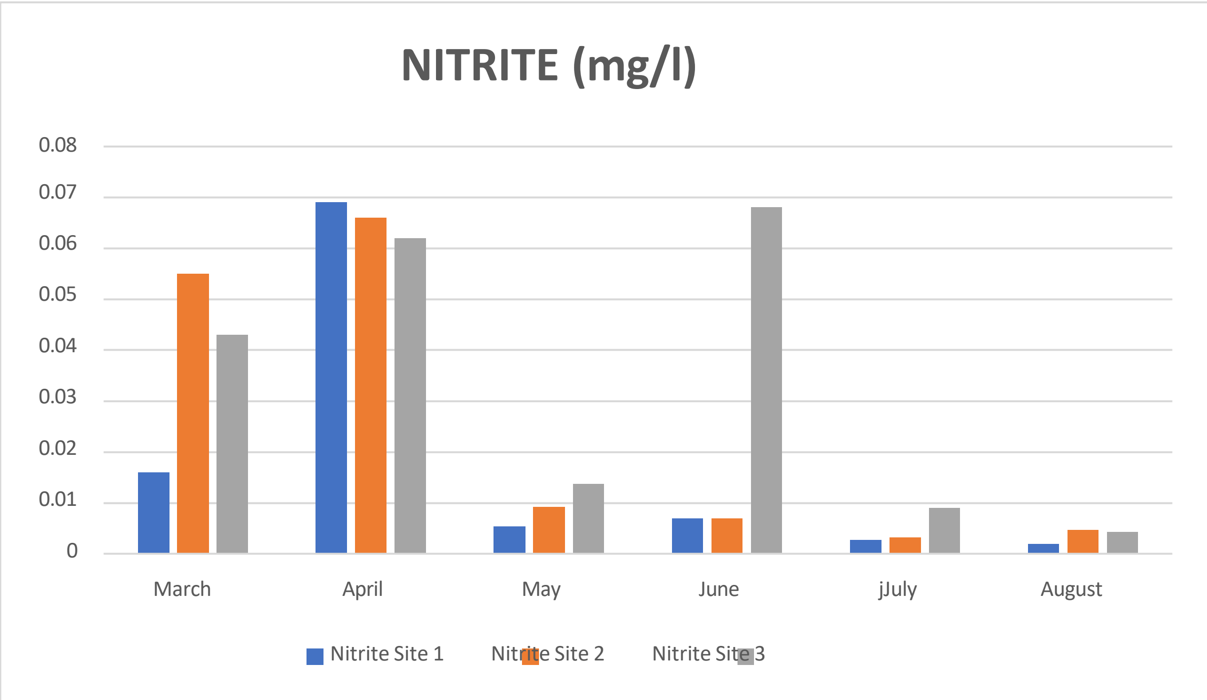


Figure - 8 Monthly variation of nitrite in Paravoor mangrove ecosystem

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

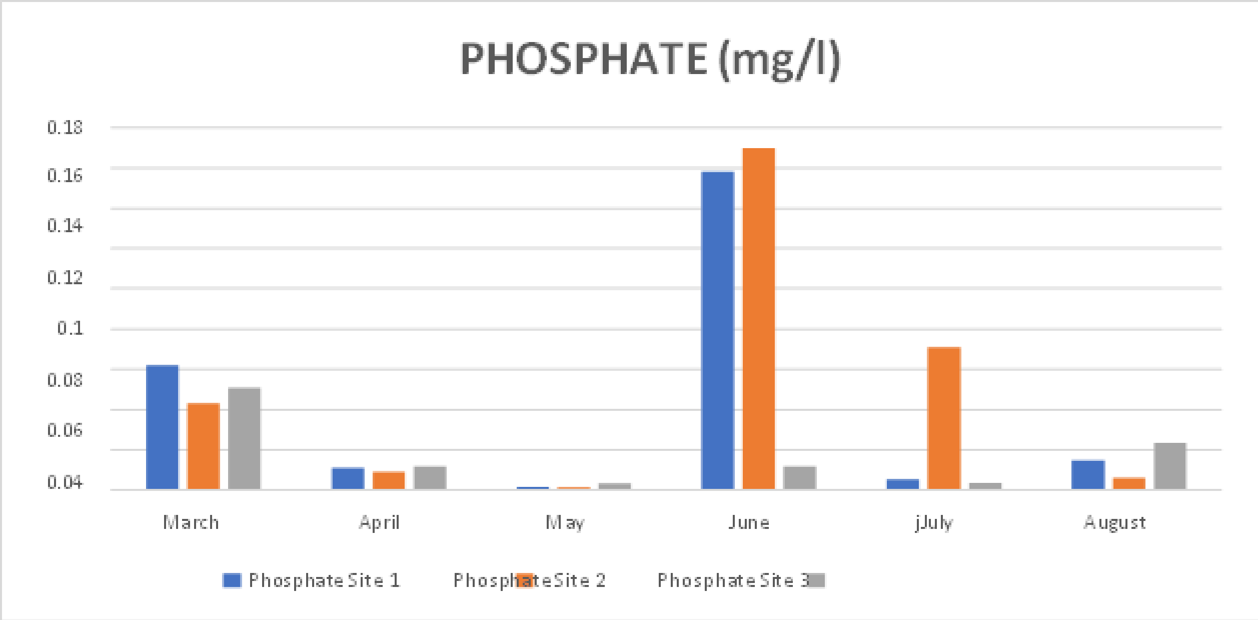


Figure - 9 Monthly variation of phosphate in Paravoor mangrove ecosystem

Figure 10 a. White film particle (MPs) in Paravoor mangrove ecosystem

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

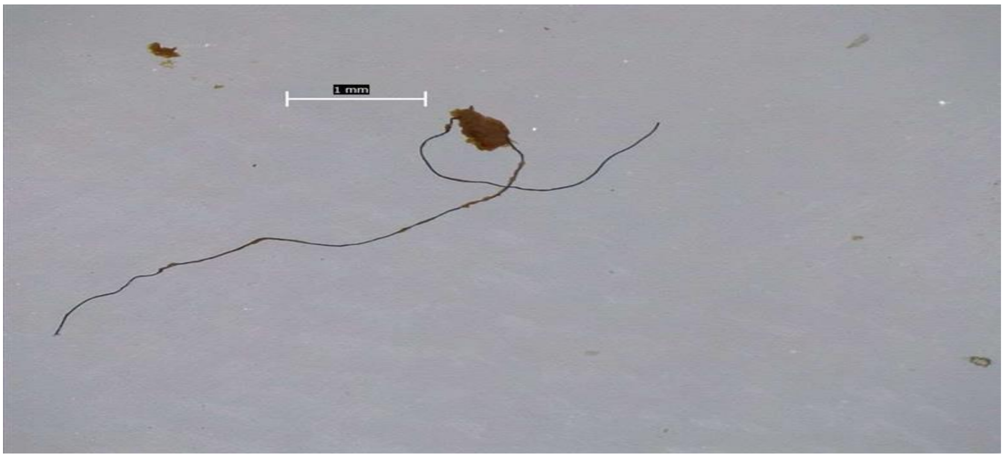


Figure 10 b. Blue microfiber (MPs) in Paravoor mangrove ecosystem

Figure10 c. White film particle (MPs) in Paravoor mangrove ecosystem

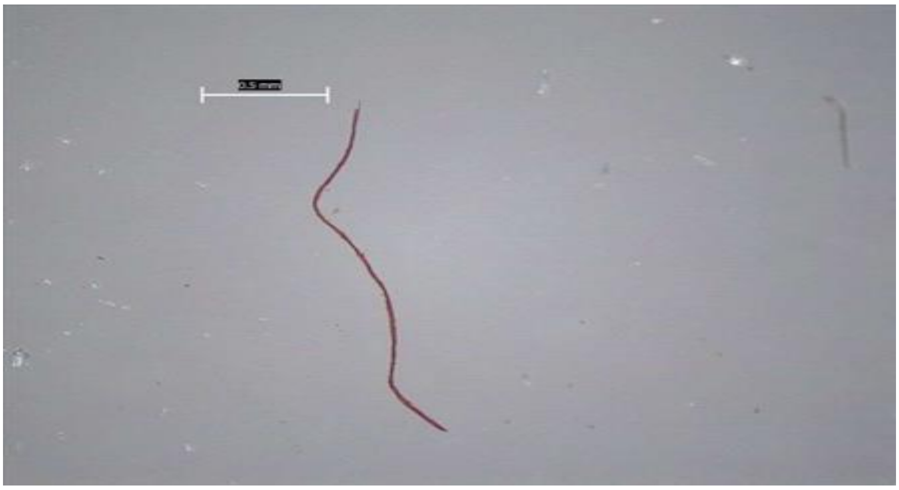


Figure.10 d. Pink microfiber (MPs) in Paravoor mangrove ecosystem.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

5. Discussion and Conclusion

The analysis of physicochemical parameters helps identify specific condition supporting diverse flora and fauna. This knowledge is crucial for conserving and protecting the unique diversity within mangrove ecosystems. Physicochemical analysis serves as an overall health of mangrove ecosystems. Monitoring parameters such as temperature, salinity, and sea level help assess the impact of climate change on mangrove ecosystems and help in water quality management.

Table.4 Correlation matrix for physicochemical parameters of site 1

	DO	*WT*	*pH*	*Salinity*	*Sio2*	*NO3*	*NO2*	*PO4*
DO	1							
WT	0.461088	1						
pH	0.347991	0.605395	1					
Salinity	-0.89083	-0.24457	-0.24556	1				
Sio2	-0.57042	-0.42953	0.185838	0.238397	1			
NO3	-0.60695	-0.31116	-0.7944	0.562138	- 0.04571	1		
NO2	0.603525	0.687711	0.205824	-0.66727	- 0.30954	- 0.11112	1	
PO4	0.111219	0.107854	0.180742	-0.04837	- 0.14325	- 0.50771	- 0.17536	1

SiO2 – Silicate, NO3 – Nitrate, NO2-Nitrite, PO4 - Phosphate

Table. 5 Correlation matrix for physicochemical parameters of site 2

	DO	*WT*	*PH*	*Salinity*	*SiO2*	*NO3*	*NO2*	*P04*

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

DO	1							
WT	0.503901	1						
PH	0.717027	0.563563	1					
Salinity	-0.6902	-0.29217	-0.51975	1				
SiO2	-0.58901	-0.30069	-0.86994	0.13424	1			
NO3	0.231567	0.514081	0.39102	-0.00687	-0.34515	1		
NO2	0.635211	0.606278	0.791722	-0.85171	-0.39441	0.318059	1	
P04	-0.05241	0.542011	0.318888	0.291005	-0.32495	0.899936	0.162808	1

SiO2 – Silicate, NO3 – Nitrate, NO2-Nitrite, PO4 – Phosphate

Table.6 Correlation matrix for physicochemical parameters of site 3

	DO	*WT*	*pH*	*Salinity*	*Sio2*	*NO3*	*NO2*	*PO4*
DO	1							
WT	0.560061	1						
pH	0.802803	0.861695	1					

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

Salinity	-0.88406	-0.60693	-0.87148	1				
Sio2	-0.56341	-0.22425	-0.14507	0.23665	1			
NO3	0.263894	-0.39406	-0.1412	0.114535	-0.3791	1		
NO2	0.614094	0.967408	0.848012	-0.55063	-0.33908	-0.1631	1	
PO4	-0.11062	-0.11004	-0.17396	-0.11738	0.140005	-0.61031	-0.30928	1

SiO2 – Silicate, NO3 – Nitrate, NO2-Nitrite, PO4 - Phosphate

Dissolved oxygen is an important characteristic of water and its availability in mangrove sediment is critical for the respiration of roots and microbial community. Dissolved oxygen content varies from 3.8 mg/L to 5.2 mg/L during the study period. The higher values are observed during monsoon season might be due to the increased freshwater input due to heavy rainfall and river runoff. This influx of fresh water reduces salinity level in the mangrove ecosystem. Lower salinity enhances the solubility of oxygen in water, leading to higher dissolved oxygen content. Also, the turbulent mixing caused by the monsoon rains helps to aerate the water, further contributing to elevated dissolved oxygen levels in mangrove area during this season. Prabu et al., (2008) reported Variation in dissolved oxygen content was from 2.4 to 5.0 mg/L in the case of Pichavaram mangroves. In the case of Muthupettai mangroves Srilatha et al., (2013) reports DO range from 3.92 to 5.22 mg/L (Figure.2).

Water temperature plays a significant role because it regulates biological activity and regulates the solubility of gases in water. The water temperature varied between 26°C to 34. 8°C. Usually, surface water temperature It is to the effects of solar intensity radiation, evaporation, freshwater inflow and cool and mix with tide of adjacent neritic waters. The maximum water temperature recorded during summer and low water temperature recorded during mansoon, maybe decreased due to shorter photoperiod atmospheric temperature. Behera et al., (2014) observed that water temperature range between 24.2-30.9°C in mangrove ecosystem of Mahanadi River delta. Ramamurthy et al., (2012) observed that water temperature in the range of 26°C to 28°C at the Vedaranyam mangrove forest. Prabu et al., (2008) observed water temperature range between 26°C to 37°C in Pichavaram mangrove (Figure.3).

The pH of the mangrove soils can significantly impact nutrient availability and microbial activities. The pH values ranged from 6.4 to 7.8. High pH in the summer season. While low pH values were observed in monsoon seasons. Generally, fluctuations in pH values during different seasons of the year is attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of seawater by freshwater influx, reduction of salinity and temperature and decomposition of organic matter (Upadhyay, 1988; Rajasegar, 2003). While studying on Pichavaram mangrove Ramanathan et al., (1999) observed pH in the range of 7.71 – 7.82. Prabhu et al., (2008) reported

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

pH in the range of 7.2 – 8.2 in pichavaram mangroves (Fig 4). Salinity is one of the important factors that influences various physiological processes of mangrove plants, affecting their distribution and diversity. The fluctuation in salinity affects the biological characters of mangroves. The observed salinity values in the study area ranged from 15.8 ppt to 48.31 ppt. Higher values observed during summer may be due to the higher rate of evaporation. Low salinity was observed during monsoon and early post monsoon season due to lesser evaporation and freshwater inputs from river (Figure. 5)

Silicate is an essential element for the health and growth of mangroves, it is a key component in the formation of plant structure, diatom productivity, nutrient cycling, biotic interactions and stress resistance. The observed silicate value in the study area ranged from 1.03 to 6.37 mg/L. Higher values is observed during monsoon might be due to the increased runoff and river discharge and growth of algal blooms. Prabhu et al., (2008) reported reactive silicate varying from 22.1 to 89.8 µM (Figure. 6).

Nitrates play a crucial role in mangroves as they contribute to the nutrient dynamics within these ecosystems. They serve as a vital nitrogen source, influencing plant growth and overall productivity of mangroves. The study area observed the nitrate content varied from 0.012 to 0.558 mg/l. The reduction in nitrates id may be due to the microbial processes such as denitrification, plant uptake, sediment adsorption, and other biogeochemical reactions contribute to nitrate reduction in mangrove ecosystem. Human anthropogenic activities, such as pollution, and change in land use can also impact nitrate levels in sediment. Dattatreya et al., (2018) reported nitrate level varying from 1.84 to 4.85 µg/l (Figure. 7).

Nitrite in mangrove is a key component of the nitrogen cycle and play a role in various ecological processes. Its concentration is influenced by the oxidation or reduced condition of the system. Nitrite levels can influence the abundance and diversity of microbial communities, which in turn affect other organisms in mangrove ecosystem. These interactions contribute to the resilience and stability of the ecosystem. The concentration of Nitrites in study area range between 0.0019 to 0.066 mg/L. The observed maximum value during April might be due to the local environmental condition such as change in temperature and precipitation, anthropogenic activities such as wastewater discharge and microbial decomposition. Saravanakumar et al., (2008) reported nitrite values ranging from 0.04 to 0.87 µM along the western mangroves of Kachchh-Gujarat (Figure. 8).

Phosphate concentration ranged from 0.0011 to 0.170 mg/L. Higher values of phosphate were noticed during monsoon and lower value observed during transition period between warmer and colder month. The observed high value during monsoon season might be due to increased runoff from adjacent land area, triggered decomposition of organic matter, higher river discharge. changes in redox (oxidation – reduction) conditions during the monsoon can affect the mobility of phosphate in sediments. The lower phosphate level during summer might be due to increased biological uptake, reduced runoff and enhanced nutrient cycling. Srilatha et al., (2013) reported phosphate value ranging from 0.470 to 2.620 µmol/L while studying on Point Calimere and Muthupettai mangroves (Figure. 9).

Microplastics are small plastic particles, typically ranging in size from 5 millimeters (0.2 inches) down to microscopic dimension). The number of microplastics estimated from the study area site 1, site 2, site 3 is 32, 37 and 49 particles/L respectively. This shows the elevated levels of microplastic concentration in the study area. Microplastics come in various forms, the major types observed in study area are microfibers and film particles. Elevated levels of microplastics could be attributed to the human activities and environmental conditions. It includes urban runoff, river transport, waste disposal, aquaculture activities, shipping and boating activities, land-based pollution and atmospheric deposition (Figure. 10(a- d)).

In table 1 (Correlation matrix) it depicted the bivariate inter- correlation among physicochemical parameters that observed during the study. From the table it can be observed that Dissolved oxygen shows moderate correlation with Nitrite (R=0.6035) as their R value was near to one as shown in table. Water temperature shows moderate positive correlation with pH (R=0.6053) and Nitrite (0.6877) as their R value near to one as shown in table. There exists a significant moderate positive correlation between salinity, NO_3. Dissolved oxygen shows Significant low positive correlation with water temperature (R=0.4610). Dissolved oxygen shows high negative correlation with salinity (R= -0.8908). Significant moderate negative correlation between dissolved oxygen and NO_3 (R=-0.6069) and between Salinity and Nitrite (R=-0.6672). Significant low negative correlation between Dissolved oxygen, Silicate; Nitrate, Phosphate.

In table 2 (Correlation matrix) it depicted the bivariate inter- correlation among physicochemical parameters that observed during the study. From the table 2, it can be observed that in case of site 2, Water temperature shows significant high positive correlation with Nitrite (R =0.9674), as their R value close to one as shown in the table. Dissolved oxygen shows significant high positive correlation with pH (R= 0.802), as their R value are near to one as shown in table. Water temperature shows significant high positive correlation with pH (R=0.8616), as their R value near to one as shown in table. From the table it is observed that there exists a significant moderate correlation between Dissolved oxygen and Nitrite (R =0.6 140). There R value near to one as shown in table. Dissolved oxygen shows significant low positive correlation with water temperature (R =0.5600). The table shows significant high negative correlation between Dissolved oxygen and salinity (R =-0.8840). Water temperature show significant moderate negative correlation with salinity (R =-0.6069). Nitrate shows significant moderate negative correlation with Phosphate (R=-0.6103). Significant low negative correlation shows between Dissolved oxygen, Silicate (R =-0.5634); Salinity, Nitrite (R =- 0.5506)

In table 3 (Correlation matrix) it depicted the bivariate inter- correlation among physicochemical parameters that observed during the study. From the table 3, it can be observed that in case of site 3, Nitrate shows significant high positive correlation with Phosphate (R =0.8999), as their R value near to one as shown in table. There is a significant moderate positive correlation between Dissolved oxygen, pH (R =0.7170); Dissolved oxygen, Nitrite (R=0.6352); Water temperature, Nitrite(R=0.6062); pH, Nitrite (R =0.7917), as their R value near to one as shown in the table. Significant low positive correlation between Dissolved oxygen, Water temperature (R =0.5039); Water temperature, pH (R =0.5635); Water temperature, Phosphate (R =0.5420). pH shows significant high negative correlation with Silicate (R =-0.8699) . Salinity shows significant high negative correlation with Nitrite (R =- 0.8517). Significant moderate negative correlation between Dissolved oxygen, Salinity (R =- 0.6902). Dissolved oxygen shoes significant low negative correlation with Silicate (R =- 0.5890). pH shows significant low negative correlation with Salinity (R =-0.5197).

Acknowledgement

The authors are thankful to the P.G Department of Zoology, Baby John memorial Government College, Chavara, Kollam for providing technical support for the completion of the research paper.

Statement Of Conflict Of Interest

The authors did not receive support from any organization for the submitted work. No funding was received for conducting this study or to assist with the preparation of this manuscript. No funds, grants, or other support was received. On behalf of all authors, the corresponding author states that there is no conflict of interest (Financial and non -financial)

References

1. Alongi, D. M. (2014). Carbon cycling and storage in mangrove forests. *Annual review of marine science*, 6, 195–219.
2. Chapman, V. J. (1976). Mangrove Vegetation Cramer. *Leutershausen, Germany*.pp.447
3. Dattatreya, P. S., Madhavi, K., Satyanarayana, B., Amin, A., & Harini, C. (2018). Assessment of physico-chemical characteristics of mangrove region in the Krishnapatnam Coast, India. *International Journal of Current Microbiology and Applied Sciences*, 7(5), 2326-2342.
4. Lugo, A. E., & Snedaker, S. C. (1974). The ecology of mangroves. Annual review of Ecology and systematics, 5(1), 39-64.
5. Odum, E. P. (1971). Fundamentals of Ecology. Third Edition, W.B. Saunders Co., Philadelphia, 1-574.

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 54-69 | ISSN:2251-6727

6. Prabu, V. A., Rajkumar, M., & Perumal, P. (2008). Seasonal variations in physico- chemical characteristics of Pichavaram mangroves, southeast coast of India. *Journal Of Environmental Biology*, 29(6), 945-950.
7. Rajasegar, M. (2003). Physico-chemical characteristics of the Vellar estuary in relation to shrimp farming. *Journal of Environmental Biology*, 24, 95-101.
8. Ramamurthy, V., Radhika, K., Kavitha, A. A., & Raveendran, S. (2012). Physicochemical analysis of soil and water of Vedaranyam mangrove forest, Tamil Nadu, India. *International Journal of Advanced Life Sciences*, 3(1), 65-71.
9. Ramanathan, A. L., Subramanian, V., Ramesh, R., Chidambaram, S., & James, A. (1999). Environmental geochemistry of the Pichavaram mangrove ecosystem (tropical), southeast coast of India. *Environmental geology*, *37*, 223-233.
10. Saravanakumar, A., Rajkumar, M., Serebiah, J. S., & Thivakaran, G. A. (2008). Seasonal variations in physico-chemical characteristics of water, sediment and soil texture in arid zone mangroves of Kachchh-Gujarat. *J. Environ. Biol*, 29(5), 725-732.
11. Srilatha, G., Varadarajan, D., Chamundeswari, K. and Mayavu, P. (2013). Study on physicochemical parameters in different mangrove regions, Southeast Coast of India. *Journal of Environmental And analytical Toxicology*, 3(5), 2-8.
12. Strickland, J. D. H., & Parsons, T. R. (1972). A practical handbook of seawater analysis.
13. Subash Chandran, M. D., Prakash N. Mesta, Ramachandra, T. V., BharathSettur, Joshi,N. V., & Vishnu D. Mukri. (2012). Conservation and management of mangroves in Uttara Kannada, Central Western Ghats. In: ENVIS Technical Report 50, 1-160
14. Swaminathan, M. S. (1991, January). Genesis of workshop (fore word). In *Proceedings of the formulation workshop for establishing a global net work of mangrove genetic resource centres for adaptation to sea level rise. January* (pp. 15-19).
15. Upadhyay, S. (1988). Physico-chemical characteristics of the Mahanadhi estuarine ecosystem, east coast of India. *Indian journal of marine sciences*, 17, 19- 23.
16. Venkataraman, K., & Raghunathan, C. (2015). Coastal and marine biodiversity of India. In *Marine faunal diversity in India* (pp. 303-348). Academic Press.
17. Womersley, J. S. (1983). An introduction to the nomenclature and taxonomy of the mangrove flora in Papua New Guinea and adjacent areas. In *Biology and ecology of mangroves* (pp. 87-90). Dordrecht: Springer Netherlands.