Poll Res. 41 (4) : 1246-1251 (2022)

ISSN 0257–8050

DOI No.: http://doi.org/10.53550/PR.2022.v41i04.016

PHYSICO–CHEMICAL ANALYSIS OF WATER SAMPLES COLLECTED FROM THE SELECTED STUDY AREAS OF RANIPET DISTRICT, TAMIL NADU, INDIA

A. MANGAYARKARASI* AND M. AKILAN

P.G & Research Department of Zoology, Voorhees College, Vellore 632 001, T.N., India
**P.G & Research Department of Zoology, Arignar Anna Govt Arts College (W) Wallajapet, Ranipet, T.N., India*

(Received 7 June, 2022; Accepted 1 August, 2022)

ABSTRACT

Various organic and inorganic pollutants present in the industrial effluents released into the aquatic ecosystem. This pollutant is harmful to the aquatic biota and also leads to the bioaccumulation in the terrestrial biota. Five different sampling sites (S1-S5) are selected for this study. The physico-chemical parameters such as pH, temperature, turbidity, electrical conductivity, total hardness, total dissolved solids, calcium, magnesium, sulphate, ammonia, nitrite, nitrate, chloride, biochemical oxygen demand and chemical oxygen demand of the water samples are analyzed by standard protocols and the data are interpreted by student t test and ANOVA. Results evidenced the significantly varied physico-chemical parameters, especially TH and TDS levels were beyond the permissible limit.

KEY WORDS : Effluent, BOD, COD, Ranipet, Physico-chemical parameter.

INTRODUCTION

In our ecosystem, water is one of the most promising elements for the survival of the living beings. Water is essential for all kinds of metabolic activities in a living system especially for the growth and development (Patil *et al*., 2012). Due to the rapid population growth, emergence of industrial era and urbanization leads to the releaseof contaminated domestic and industrial effluents into the water ecosystem which poses a serious threat to flora and fauna (Basavaraja Simpi *et al*., 2011). Due to the anthropogenic activities, numerous undesirable changes are happened to fresh and marine aquatic ecosystem. All these contaminants end with bioagumentation in plants and animals (Misra and Dinesh, 1991). Analysis of physical and chemical parameters of the water is considered as the quality index of water. It is essential to identify the water quality index for the utilization of water for agricultural, domestic or other purposes (Gupta *et al*., 2009).

For the regeneration of water sources and for the sustainable utilization, water pollution control is a great challenge due to the continuous emergence of pollutant into the water ecosystem. Contaminated water spread infectious diseases and also makes the water unsuitable for human usage (WHO, 2008). The physical parameter pH and temperature are responsible for the corrosive nature of the water which controlled the metabolic reactions of the flora and fauna. Altered pH and temperature leads to the mortality of the biota (Gupta, 2009). There is always a correlation between the electrical conductivity and TDS, COD, BOD, alkalinity and total hardness (Navneet *et al.*, 2010). Due to the biogeochemical reaction by the aquatic ecosystem resulted the release of CO_2 into the water? Carbonate, bicarbonate and hydroxyl ions present in the effluents leads to causticity nature (Wang *et al*., 2002).

BOD and COD are the measurement of the organic material composition in the water, other compounds like SO_4, NH_4, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, PO_4 are also responsible for the physcio-chemical nature of the water (Gnana *et al*., 2005). Hence an attempt was made to analyze various parameters of the water samples from the selected study areas of industrial operations.

MATERIALS AND METHODS

Study area and Sample collection

Ranipet district is well known for their industrial sectors. It was surrounded by palar river. Numerous heavy industries are present in the Ranipet district and their effluents were dumped into the nearby water channels. Totally 5 stations (Figure 1) such as TCC limited, Emerald Nagar, Puliyanganu lake, Karai SRP nagar and Puliyanganu were selected for the study (Station 1 to Station 5). According to BIS (2012), from each location three sampling was done during August 2020 to September 2021.

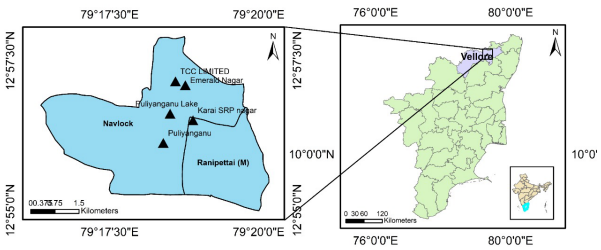


Fig. 1. Ranipet district - study area

Physico-chemical parameters

Water samples collected from area near toTCC limited, Emerald Nagar, Puliyanganu lake, Karai SRP nagar and Puliyanganu stations (S1-S5) are subjected to the physico-chemical parameters such as pH, Temperature, Electrical conductivity (EC), turbidity, total hardness (TH), total dissolved solids (TDS), calcium (Ca), magnesium (Mg), sulphate (SO_4), ammonia (NH_3), nitrite (NO_2), nitrate (NO_3), Chloride (Cl-) (Srinivsa Rao *et al.*, 2000; CPCB 2000) Biological dissolved oxygen demand (BOD) and chemical oxygen demand (COD)are also analysed in the water samples using standard procedures (American Public Health Association, 2005.

Statistical analysis

The observed data are evaluated and expressed as mean±SD. Values between the stations parameters are analyzed by t-test and obtained results are considered as significant at P<0.05 level in Two-way analysis of variance (ANOVA) by using SPSS software (17.0).

RESULTS AND DISCUSSION

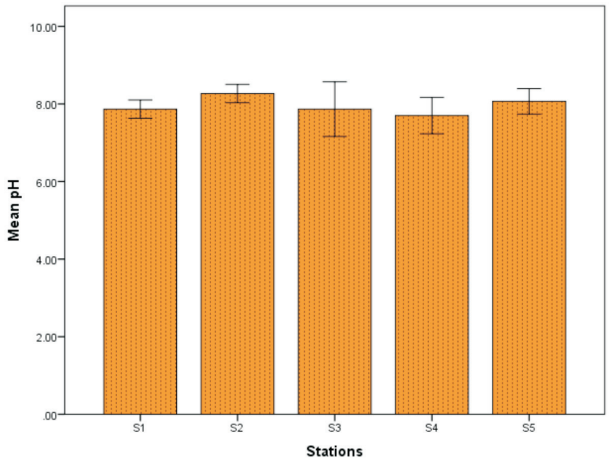
The pH of the collected water samples in five stations (S1-S5) were ranged from 7.7±0.56 to 8.3±0.21 (P<0.01, t values = -0.33) which was alkali

Table 2. Physico-chemical parameters of the selected stations (S1-S5) from Ranipet district

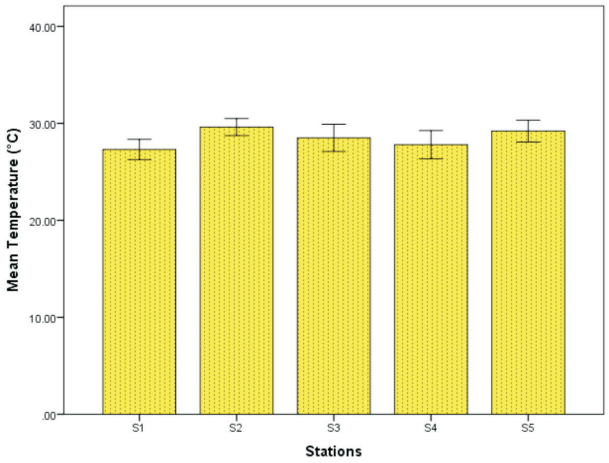
Parameters	S1	S2	S3	S4	S5	t value	Pvalue
pH	7.9±0.18	8.3±0.21	7.9±0.88	7.7±0.56	8.1±0.33	-0.33	0.019
Temperature (°C)	27.5±1.45	29.8±1.62	28.6±1.55	27.9±1.76	29.2±1.22	-0.12	0.023
EC (µS/cm)	2359.2±988.5	1657.8±678.8	2025.4±876.7	2678.8±893.6	1768.3±768.7	0.75	0.035
Turbidity (NTU)	43.5±9.89	38.9±6.78	41.5±7.53	40.56±6.78	37.8±5.78	0.68	0.035
TH (mg/l)	1879.6±435.7	1246.8±567.8	1987.2±846.4	1873.9±839.4	1156.9±786.8	0.52	0.041
TDS(mg/l)	2099.7±199.3	1875.6±256.8	2345.8±854.8	2534.4±724.8	1896.5±258.5	0.62	0.035
Ca (mg/l)	209.6±76.8	187.5±89.4	163.7±46.8	197.7±34.2	192.4±56.7	0.43	0.027
Mg (mg/l)	77.8±25.4	72.3±19.8	65.4±21.3	81.7±20.9	70.9±18.9	0.58	0.031
SO4 (mg/l)	259.8±68.9	321.6±55.6	299.8±72.3	266.8±77.8	308.5±67.8	0.23	0.047
NH3 (mg/l)	5.67±2.81	7.89±3.11	6.78±2.99	5.89±4.02	7.22±4.23	0.31	0.039
NO2 (mg/l)	0.5±0.22	0.9±0.14	0.4±0.02	0.3±0.09	0.8±0.12	-0.54	0.022
NO3 (mg/l)	4.9±0.89	5.2±0.91	4.8±0.77	4.5±0.90	5.5±0.81	-0.44	0.010
Cl (mg/l)	567.8±126.4	612.2±210.3	541.3±157.8	588.9±167.4	624.5±123.4	0.89	0.023
BOD (mg/l)	65.5±2.56	56.8±3.11	69.8±3.44	44.4±1.99	52.9±2.73	0.45	0.034
COD (mg/l)	183.3±3.58	148.2±2.47	185.5±2.99	122.3±2.09	140.6±3.46	0.65	0.029

in nature. The temperature of the water samples also ranged from 27.5 to 29.8°C (P<0.02, t value = -0.12). The electrical conductivity (EC) of the water samples was ranged as 1657.8±678.8 to 2678.8±893.6µS/cm with P value 0.03 (t value = 0.75). Water sample turbidity ranged from 37.8±5.78 to 43.5±9.89NTU (P<0.03, t value = -0.12). Total hardness (TH) values were ranged from 1156.9±786.8 to 1987.2±846.4 mg/l (P<0.04, t value = 0.52). 1875.6±256.8 to 2534.4±724.8 mg/l ranges of

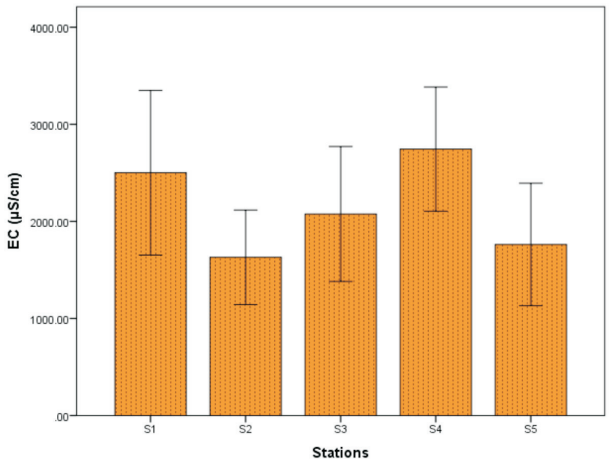
a. pH



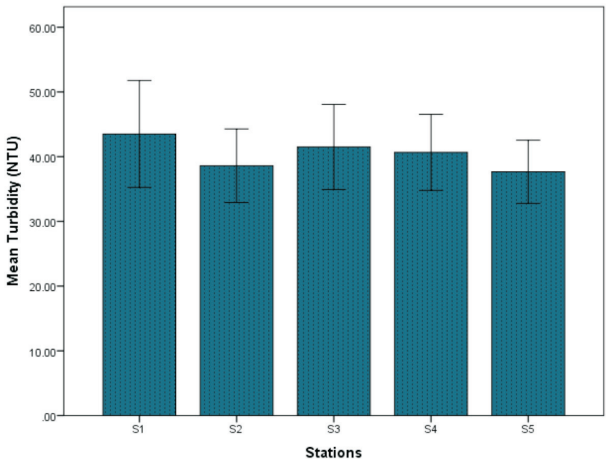
d. Temperature



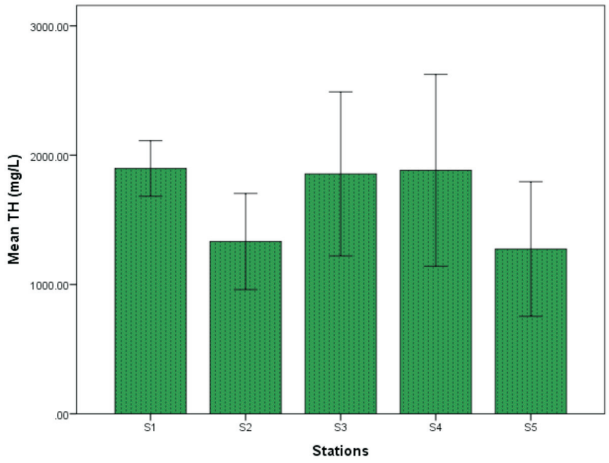
b. EC



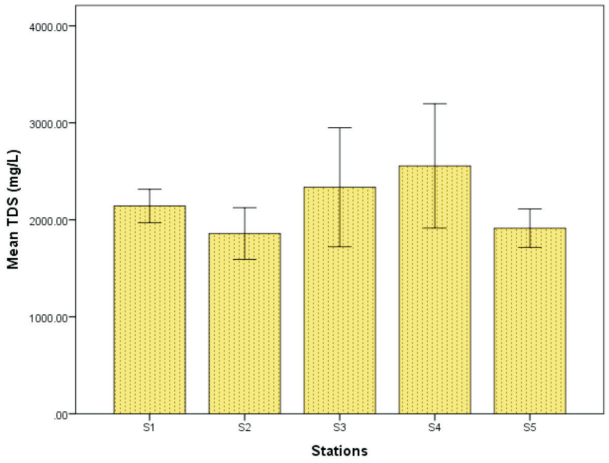
e. Turbidity

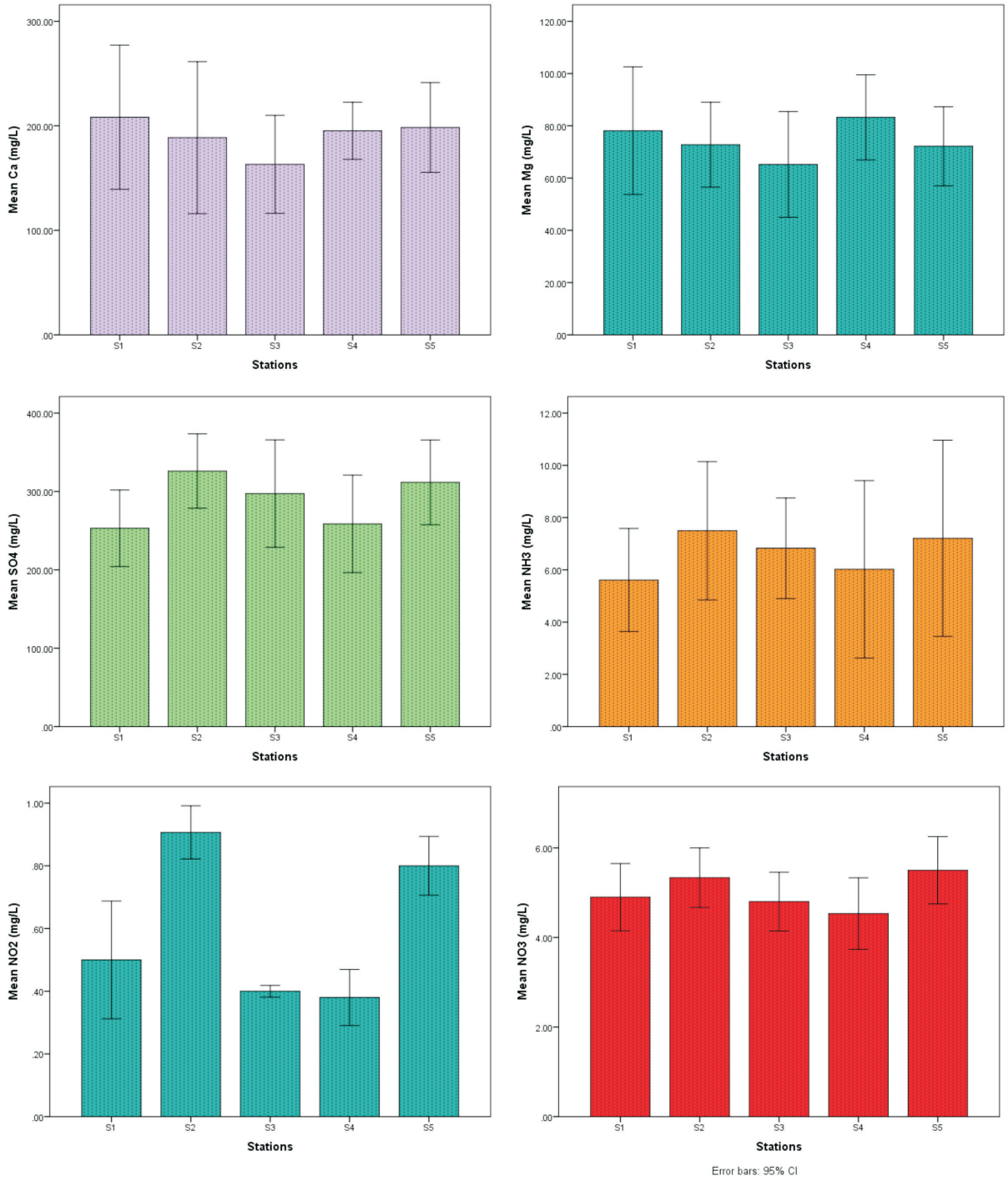


c. TH



f. TDS





total dissolved solids (TDS) were observed in the selected five stations with P value 0.03 (t value 0.62) (Table 2; Figure 2).

High Ca and Mg levels observed in TCC limited (S1)and Karai SRP nagar (S4) as 209.6±76.8 mg/l and 81.7±20.9 mg/l, respectively. whereas the low level of Ca (P<0.02, t – 0.43) and Mg (P<0.03, t – 0.58) observed in Puliyanganu lake (S3) as 163.7±46.8 mg/l and 65.4±21.3 mg/l, respectively. Sulphate (P<0.04, t – 0.23) and chloride (P<0.02, t – 0.89) contents are ranged as 259.8±68.9 to 321.6±55.6mg/l and 541.3±157.8 to 624.5±123.4 mg/l, respectively. Emerald Nagar (S2) station water sample showed high ammonia level as 7.89±3.11 mg/l whereas low level observed in TCC limited (S1) as 5.67±2.81 mg/l. The nitrite and nitrate levels were ranged as

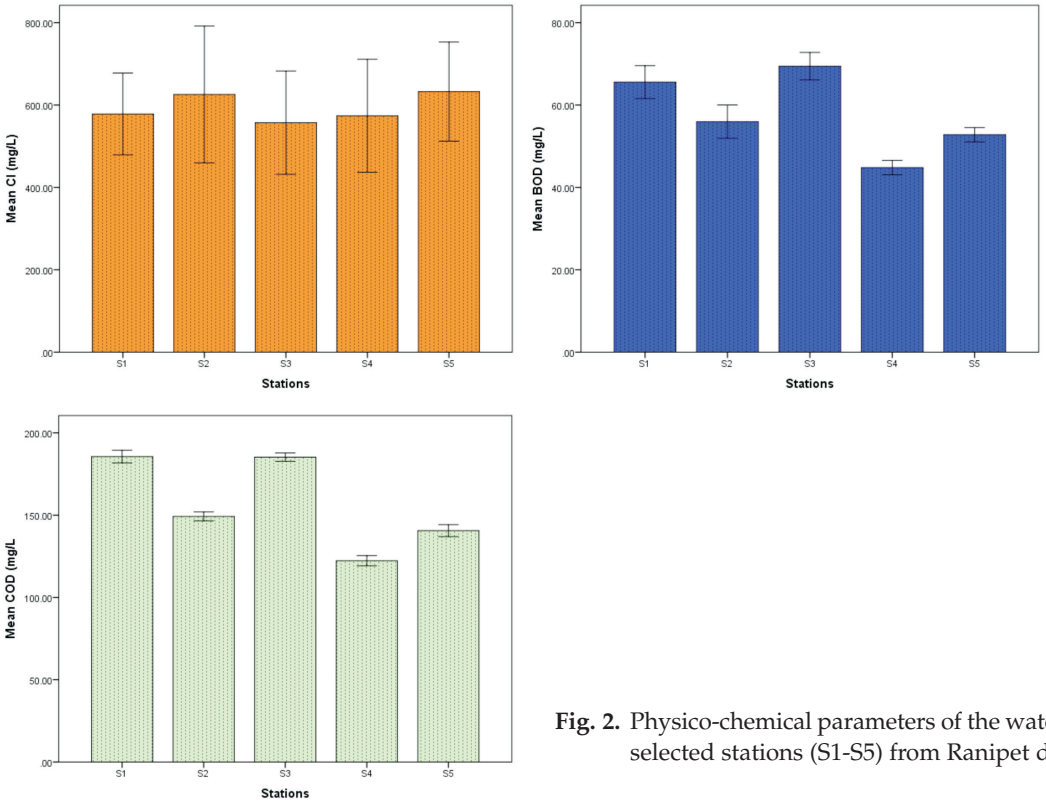


Fig. 2. Physico-chemical parameters of the water samples from the selected stations (S1-S5) from Ranipet district.

0.3±0.09 to 0.9±0.14 mg/l and 4.5±0.90 to 5.5±0.81 mg/l, respectively.

Due to the enhanced inorganic compounds in the water samples, the oxygen levels were greatly influenced. The biological oxygen demand (BOD) represented the amount of oxygen insufficiency which influence aquatic biotic community. Similarly, the chemical oxygen demand (COD) represented the amount of oxygen required for the metabolic reaction of the biota species. High BOD ($P<0.03$, t - 0.45) and COD ($P<0.02$, t – 0.65) levels were observed in Puliyanganu lake (S3) station as 69.8±3.44 and 185.5±2.99 mg/l which indicated the release of high inorganic pollutants in the effluents.

Due to magnimous growth of industrial sectors, amenities and exhaust chambers in the Ranipet regions, the air, water (freshwater, groundwater) and sediment regions are highly polluted by the perilous dumping of effluents into the environment which resulted in the geoaccumulation of pollutants (Subramanian *et al*., 2021). Effluents from tannery industries and domestic sewages leads to the significant increase of COD, BOD, Cl- and TDS are due to the chromium contamination in the effluents (Khwaja *et al*. 2001). (Manomanai *et al*. 1991) also reported the increased concentrations of K, Na, Mg and other organic pollutants are due to the release of tannery effluents into the aquatic ecosystem.

From industries, the effluents are released into the nearby waterbodies eventually altered the physico-chemical and biological properties of the water with significant reduction in DO leads to increased BOD and COD. Increased TSS, alkalinity and SO_4 leads to the reduced lifespan of biota in the water (Srinivasa and Pradip, 2008). Jingxi *et al*. (2020) also reported the physicochemical parameters were determined such as pH, temperature, electrical conductivity, turbidity, TDS, TSS, total alkalinity, BOD, COD, dissolved oxygen, nitrate, phosphate and sulphate concentrations in the food waste water efflux into the aquatic ecosystem.

CONCLUSION

The observed physico-chemical parameters of the water sample collected from five selected stations in Ranipet district were analysed with the help of SPSS software,the significant relation (t test) and mean comparison (Two-way ANOVA) between the study stations (S1-S5) were analysed. Results showed that physical and chemical parameters are varied in each station due to the increased contaminants from the

effluents. Among the tested five stations (S2 and S5) were highly contaminated zones. This investigation seeks immediate attention for remedial measures to minimize or removal of the contaminants from the aquatic system.

REFERENCES

American Public Health Association, 2005. *Standard methods for the examination of water and waste water*. American Public Health Association (APHA), Washington, DC,USA

Basavaraja, Simpi, S. M., Hiremath, K. N. S. Murthy, K. N. Chandrashekarappa, Anil N. Patel and Puttiah, E.T. 2011. Analysis of Water Quality Using Physico-Chemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India, *Global Journal of Science Frontier, Research*. 1(3): 31-34.

BIS (Bureau of Indian Standards), Specification for Drinking Water, Indian Standards Institution, New Delhi, India, 2012.

CPCB, 2000. Central Pollution Control Board, Review of Water Quality objectives, Requirements and Zoning and Classification for Indian Water Bodies, Government of India, New Delhi, India, 2000.

Gnana Rani, D. F., Arunkumar, K. and Sivakumar, S. R., 2005. Physico-chemical analysis of waste water from cement units. *Journal of Industrial Pollution Control*. 21(2): 337-340.

Gupta, D. P., Sunita and Saharan, J. P. 2009. Physico-chemical Analysis of Ground Water of Selected Area of Kaithal City (Haryana) India, *Researcher.* 1(2): 1-5.

Jingxi, M., Shuqing, W., Ravi Shekhar, N. V., Supriya, B. and Anoop, K.S. 2020. Determination of Physico-chemical Parameters and Levels of Heavy Metals in Food Waste Water with Environmental Effect. *Hindawi Bioinorganic Chemistry and Applications.* Volume 2020, Article ID 8886093, 9 pages

Kataria, H. C., Quershi, H. A., Iqbal, S. A. and Shandilya, A. K. 1996. Assessment of water quality of Kolar reservoir in Bhopal (M.P.). *Pollution Research*. 15(2): 191-193.

Khwaja, A.R.K., Singh, Rashmi and Tandon, S. 2001. Monitoring of Ganga Water and Sediments Vis-à-Vis Tannery Pollution at Kanpur (India): A Case Study. *Environmental Monitoring and Assessment.* 68. 19-35. 10.1023/A: 1010790705006.

Manonmani, K., Raj Kumar, J., Ponpalippans and Swaminathan, K. 1991. Effect of tannery effluents on the quality of on irrigation canal water. *J. Indust. Poll. Control.* 17 : 87-89

Misra, S. G. and Dinesh, D. 1991. *Soil Pollution*. Ashing Publishing House, New Delhi, India

Navneet, Kumar, and Sinha, D. K. 2010 Drinking water quality management through correlation studies among various physico-chemical parameters: A case study, *International Journal of Environmental Sciences,* 1(2): 253-259.

Patil, P.N., Sawant, D.V. and Deshmukh, R.N. 2012. Physico-chemical parameters for testing of water – A review. *International Journal of Environmental Sciences.* 3(3) : 1194-1207.

Srinivasa, G. and Pradip Govil, K. 2008.. Distribution of heavy metals in surface water of Ranipet industrial area in Tamil Nadu, India. *Environ Monit. Assess.* 197-207.

Srinivsa Rao, C.H., Srinivasa Rao, A. and Subba, Rupa,T.R., 2000. Plant mobilization of soil reserve potassium from fifteens mectitic soils in relation to soil test potassium and mineralogy (July). *Soil Science.* 165(7) : 578-586.

Subramanian, A., Miriam, V., Samuel, T., Mohamed, M., Athikesavan, R., Selvaraj, D. and Kamatchi, P. 2021. Analysis of soil and water quality in selected villages of Ranipet district, Tamil nadu, India. *Current World Environment*. 16(2): 477-491.

Wang, Z., Wang, Y. and Cai, W. J. and Liu, S. Y. 2002. A long lathlength spectrophotometric pCO_2 sensor using a gas-permeable liquid-core waveguide. *Talanta*. 57: 69-80.

WHO, 2008. *Guidelines for Drinking-water Quality.* Vol. 1. Recommendations. Geneva. World Health Organization, 668.