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# Influence of Residential and Industrial Discharges on Physical and Chemical Parameters of Valliyaru River, Kanyakumari District, Tamilnadu, India

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**Abstract- Valliyaru is one of the major water sources of Kanyakumari District, India. Originating from Vellimalai hills; the southernmost tip of Western Ghats of India, this perennial river travels across 18 km, before pouring into Arabian Sea. It flows through thickly populated and vast agricultural area, serving as a source of water for domestic and agricultural needs. The physical, chemical and microbial parameters of the river were measured at five different locations in its course, from March to August, during the south west monsoon period of 2013. The results of these measurements are compared with World Health Organization (WHO) standards. Regression analyses for 22 different water quality parameters were performed and the correlation coefficients were calculated. Study reveals that most parameters obey WHO standards and the water from the river is well suited for agriculture and domestic application.**

**Keywords- Valliyaru River, Pollution, Water Quality Parameter, Regression equation, Correlation Analysis.**

## I. INTRODUCTION

Water is an invaluable and indispensable natural resource for survival of living organism on the earth. In spite of abundant availability of fresh water, reckless usage and improper management coupled with commoditization results in depletion of fresh water. Insensitive human actions often result in physical or chemical or biological contaminations of water, which eventually turns the resource unfit for domestic, agricultural and industrial purpose [3, 8].

There are number of causes of water pollution, to begin with, agricultural runoff and domestic sewage pollutes water bodies, resulting in eutrophication. Other human actions, such as mass bathing, disposal of dead bodies, rural/urban waste discharge and waste disposal, too result in water pollution. Apart from this, climate changes too cause water pollution. Last three decades have witnessed rapid deterioration of Indian rivers due to incessant discharge of agricultural run-off, industrial and domestic wastes [7].


Fig 1. a - Map of Kanyakumari District, Tamilnadu, India.


Fig 2. Flow of Valliyaru River across Kanyakumari District and water collected from five different locations.

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Study of physio-chemical parameters of some rivers was done by a number of researchers [6, 10]. Investigation of quality of water is encouraged around the world by various government and non-government organizations, since such evaluations play an important role in monitoring and controlling water pollution [4, 9]. Statistical analysis provides a picture of information and behavior of water resources.

Valliyaru River, a perennial river, which flows in Kanyakumari district, originates from Vellimalai Hills near Muttaikadu Region (Figure 1a). The Vellimalai hill is about 488 m, high from the mean sea level. The irrigation area of this river covers vast agricultural land which is mainly used for paddy, banana, and coconut and rubber plantation. Apart from a few small-scale rubber and cashew processing units, there are no industries in this area.

## II. COURSE OF THE RIVER

The river takes its course from Muttaikadu and flows through Padmanabhapuram and Thuckalay. At Kalkurichi, a part of Thuckalay municipality, 22,000 people use this river mainly for domestic and agriculture purposes. A few rubber processing units also make use of its water. A tributary river called Thoovalaru makes a confluence with Valliyaru at Thuckalay and flows downhill to Eraniel, which has a population of around 10,000. Agricultural runoff and sewage are being discharged into this river at this point. Throughout this downhill flow, it feeds a number of ponds that are essential for agriculture.

From Eraniel, it flows further downhill to reach Cheramangalam where it feed a massive pond having area of 615122 $m^2$, named Periakulam. Water in this pond is covered with algae. Periyakulam supplied water to Sevaral hectares of Paddy fields. The agricultural runoff from these fields is discharged into this river. From Cheramangalam, water flows through Manavalakurichi and finally flows into Arabian Sea at Kadiyapattanam, a fishing hamlet.

## III. MATERIALS AND METHODS

Water samples were collected from March to August of 2013. Various water quality parameters were evaluated with standard methods and statistical analysis were made.

Water samples were collected in clean plastic bottles from five diverse locations namely Muttaikadu, Kalkurichy, Eraniel, Cheramangalam and Kadiyappattanam region of Valliyaru River as shown in Fig. 1b. Twenty two water quality parameters such as Turbidity, Total Dissolved Solids (TDS), Electrical Conductivity (EC), pH, Alkalinity, Total Hardness (TH), Calcium ($C_a^{2+}$), Magnesium ($M_g^{2+}$), Sodium ($Na^+$), Potassium ($K^+$), Iron ($Fe^{2+/3+}$), Manganese ($Mn^{2+}$), Ammonia ($NH_3$), Nitrite ($NO_2$), Nitrate ($NO_3^-$), Chloride ($Cl^-$ ), Fluoride ($F^-$ ), Sulphate ($SO_4^{2-}$), Phosphate ($PO_4^{3-}$), Dissolved oxygen (DO), Biological Oxygen Demand (BOD) and Coliform (Coli) were estimated by standard procedures [2,11,12].

Important statistical parameters of physico- chemical characteristics of analyzed water samples namely Mean, Standard Deviation (SD), Standard Error (SE) and Coefficient of Variation (CV) were calculated. The correlation analysis between various water quality parameters was examined by regression analysis using Microsoft Excel version 2010. Correlation analysis measures the proximity of the relationship between selected independent and dependent variables. If the correlation coefficient is nearer to +1 or –1, it gives a very strong linear relationship between two variables. The correlation between the two parameters is characterized as very strong; when it is in the range of +0.8 to 1.0 and -0.8 to -1.0, fair: when it is in the range of +0.5 to 0.8 and -0.5 to -0.8, very poor: when it is in the range of +0.0 to 0.5 and-0.0 to -0.5 [1]. Correlation analysis helps to establish the relationship between the variables [5].

## IV. RESULTS AND DISCUSSIONS

The numerical values of correlation coefficient, R for the twenty-one different parameters are given in Table 3. It clearly highlights the interrelationship of various water quality parameters. Correlation values are observed for Turbidity between EC-TH, $C_a^{2+}$, $M_g^{2+}$, $Na^+$, $K^+$, $Cl^-$, $SO_4^{2-}$ and BOD. High negative correlation values exist between $F_e^{2+/3+}$ and DO for Turbidity.

Positive correlation is observed between TH– $C_a^{2+}$, $M_g^{2+}$ & EC. Hardness causes heart diseases in human. Hardness above 200ppm cause scales in water pipes and distribution system. However, it is Water quality parameters acquired by standard procedures of Valliyaru river during the period from

March to August 2013 (Mean values for four months) and World Health Organization (WHO) standards are given in Table 1. Various water quality parameters fall well within the WHO standard values except for EC, $C_a^{2+}$, $M_g^{2+}$, $Na^+$ and $K^+$. Exceeding values of these parameters from WHO standards are found maximum at Kadiyappatanam, the end point followed by Cheramangalam. But water from other collection sites has values within the WHO Standards. Kadiyappatanam is the place where Valliyaru and Arabian sea joins together and it is obvious that the values for the above mentioned parameters are high than the WHO Standards due to the confluence.

The maximum value, minimum value, range, mean, standard deviation, standard error & percentage coefficient of variation for various quality parameters of water collected during the South-West (SW) Monsoon period of 2013 is given below in Table 2. The coefficient of variations for EC, Alkalinity, TH, $C_a^{2+}$, $M_g^{2+}$, $Na^+$, $K^+$ and $Cl^-$ are found to be 28.53, 34.25, 105.33, 112.39, 99.39, 20.91, 97.45 and 23.33 % respectively. So, it is clear that variation of values for these parameters is high in different locations. It follows the following pattern. The variations are generally maximum at the origin and the increases along its downhill way and reaches maximum at Kadiyappattanam.

It observed that, water collected only from Kadiyappattanam has Hardness values above 350ppm. Strong correlation exists between pH - Alkalinity, Total Hardness (TH), Sodium ($Na^+$), Dissolved oxygen (DO) and Sulphate ($SO_4^{2-)}$ ion. There is a significant correlation between alkalinity and negative ions such as nitrite and fluoride ion. There is a strong correlation between Iron and entire negative ions present in the water.

The linear regression analyses have been carried out for five water quality parameters which are found to have correlation coefficient values above 0.97. The regression equations obtained are given in the Table 4. It is evident from the study that a very strong correlation exists between TDS – Ca2+ (Fig 2), TDS – Mg2+ (Fig 3), TDS – Na+ (Fig 4), TDS - BOD (Fig 5), EC – $Na^+$ (Fig 6), EC- BOD (Fig 7), pH – $Cl^-$ (Fig 8), Alkalinity – $M_g^{2+}$ (Fig 9), Alkalinity - BOD (Fig 10), TH - $M_g^{2+}$ (Fig 11), $C_a^{2+}$ - $M_g^{2+}$ (Fig 12), $C_a^{2+}$ - $Na^+$ (Fig 13), $M_g^{2+}$ - $Na^+$ (Fig 14), $M_g^{2+}$ - BOD (Fig 15), $Na^+$ - $K^+$ (Fig 16), $Na^+$ - BOD (Fig 17) and $K^+$ - BOD (Fig 18). Therefore, it is evident from the results that ions such as mentioned above play a crucial role in increased Electrical Conductivity and Total dissolved solids. TDS is correlated with TH (0.958) hence it is clear that $C_a^{2+}$ and $M_g^{2+}$ ions influence these two parameters. No significant correlation exists between many water quality parameters viz., Turbidity – DO (0.388), Alkalinity – $NO_3^-$ (0.081), $C_a^{2+}$ - DO (0.305), TH – $NH_3$ (0.204) and pH – $NO_3^-$ (0.314).

## V. CONCLUSION

Water quality assessment of Valliyaru river confirms that many water quality parameters are within the WHO standards. Certain parameters such as TDS, $C_a^{2+}$, $M_g^{2+}$, $Na^+$ and $K^+$ are relatively high at Kadiyappattanam and to a certain extent at Cheramangalam when compared to other collection sites. This can be attributed to the sea water intrusion. Despite, thick population and vast agricultural fields, the river water is not highly polluted with organic or inorganic wastes from domestic sewages or agricultural run-off. Water at the origin, Muttaikadu and Eraniel are not polluted but only a small insignificant variation is observed between them. In general, the study brings to light that the Valliyaru river water is not significantly polluted during the South-West Monsoon period, hence can be well suited for agriculture and domestic application.

Table 1. Physicochemical & biological parameters of Valliyaru river during SW Monsoon for 2013

| Parameters | WHO standards | 2013 - SW Monsoon | | | | |
|---|---|---|---|---|---|---|
| | | Muttai kadu | Kal curicy | Eraniel | Chera mangalm | Kadiyap patanam |
| Turbidity | - | 19 | 25 | 23 | 28 | 32 |
| TDS | 500 – 1500 mg/l, | 439 | 510 | 520 | 610 | 760 |
| EC | 300 mg/l, | 67 | 92 | 107 | 117 | 149 |
| pH | 6.9 – 9.2 | 6.7 | 6.78 | 7 | 7.14 | 7.18 |
| Alkalinity | - | 12 | 14 | 18 | 18 | 28 |
| TH | 100 – 500 mg/l, | 40 | 45 | 58 | 124 | 345 |
| $C_a^{2+}$ | 75 – 200 mg/l, | 6 | 18 | 56 | 158 | 287 |
| $M_g^{2+}$ | 30 – 150 mg/l, | 2 | 55 | 69 | 129 | 278 |
| $Na^+$ | 50 – 60 mg/l, | 7 | 8 | 9 | 10 | 12 |
| $K^+$ | 20 mg/l, | 1 | 5 | 67 | 98 | 145 |
| $F_e^{2+/3+}$ | - | 0.59 | 0.82 | 0.35 | 0.47 | 0.47 |
| $Mn^{2+}$ | - | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| $NH_3$ | - | 0.12 | 0.46 | 0.31 | 0.32 | 0.35 |
| $NO_2$ | - | 0.09 | 0.11 | 0.24 | 0.14 | 0.11 |
| $NO_3^-$ | 40 – 50 mg/l, | 1 | 1 | 1 | 1 | 2 |
| $Cl^-$ | 200 – 600 mg/l, | 14 | 18 | 23 | 24 | 26 |
| $F^-$ | 1 – 1.5 mg/l, | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| $SO_4^{2+}$ | 200 – 250 mg/l, | 1 | 1 | 3 | 3 | 3 |
| $PO_4^{3+}$ | - | 0.5 | 0.8 | 0.7 | 0.9 | 0.2 |
| DO | - | 8 | 8.3 | 7.5 | 7.7 | 8.4 |
| BOD | - | 12 | 15 | 19 | 21 | 29 |
| Coli | - | 1129 | 1300 | 1100 | 980 | 520 |

Table 2. Statistical analysis of Valliyaru River Water Sample – SW Monsoon (2013).

| Parameters | WHO standards | 2013 - SW Monsoon | | | | |
|---|---|---|---|---|---|---|
| | | Muttai kadu | Kal curicy | Eraniel | Chera mangalm | Kadiyap patanam |
| Turbidity | - | 19 | 25 | 23 | 28 | 32 |
| TDS | 500 – 1500 mg/l, | 439 | 510 | 520 | 610 | 760 |
| EC | 300 mg/l, | 67 | 92 | 107 | 117 | 149 |
| pH | 6.9 – 9.2 | 6.7 | 6.78 | 7 | 7.14 | 7.18 |
| Alkalinity | - | 12 | 14 | 18 | 18 | 28 |
| TH | 100 – 500 mg/l, | 40 | 45 | 58 | 124 | 345 |
| $C_a^{2+}$ | 75 – 200 mg/l, | 6 | 18 | 56 | 158 | 287 |
| $M_g^{2+}$ | 30 – 150 mg/l, | 2 | 55 | 69 | 129 | 278 |
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| $K^+$ | 20 mg/l, | 1 | 5 | 67 | 98 | 145 |
| $F_e^{2+/3+}$ | - | 0.59 | 0.82 | 0.35 | 0.47 | 0.47 |
| $Mn^{2+}$ | - | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| $NH_3$ | - | 0.12 | 0.46 | 0.31 | 0.32 | 0.35 |
| $NO_2$ | - | 0.09 | 0.11 | 0.24 | 0.14 | 0.11 |
| $NO_3^-$ | 40 – 50 mg/l, | 1 | 1 | 1 | 1 | 2 |
| $Cl^-$ | 200 – 600 mg/l, | 14 | 18 | 23 | 24 | 26 |
| $F^-$ | 1 – 1.5 mg/l, | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| $SO_4^{2+}$ | 200 – 250 mg/l, | 1 | 1 | 3 | 3 | 3 |
| $PO_4^{3+}$ | - | 0.5 | 0.8 | 0.7 | 0.9 | 0.2 |
| DO | - | 8 | 8.3 | 7.5 | 7.7 | 8.4 |
| BOD | - | 12 | 15 | 19 | 21 | 29 |
| Coli | - | 1129 | 1300 | 1100 | 980 | 520 |

Table 3. Correlation coefficients among various water quality parameters – SW Monsoon (2013).

| Parameters | Turbidity | TDS | EC | pH | Alkalinity | TH | $C_a^{2+}$ | $M_g^{2+}$ | $Na^+$ | $K^+$ | $F_e^{2+/3+}$ | $NH_3$ | $NO_2$ | $NO_3^-$ | $Cl^-$ | $F^-$ | $SO_4^{2+}$ | $PO_4^{3+}$ | DO | BOD | Coli |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turbidity | 1.00 | | | | | | | | | | | | | | | | | | | | |
| TDS | 0.96 | 1.00 | | | | | | | | | | | | | | | | | | | |
| EC | 0.94 | 0.97 | 1.00 | | | | | | | | | | | | | | | | | | |
| pH | 0.85 | 0.87 | 0.93 | 1.00 | | | | | | | | | | | | | | | | | |
| Alkalinity | 0.87 | 0.96 | 0.96 | 0.85 | 1.00 | | | | | | | | | | | | | | | | |
| TH | 0.86 | 0.96 | 0.88 | 0.75 | 0.95 | 1.00 | | | | | | | | | | | | | | | |
| $C_a^{2+}$ | 0.91 | 0.98 | 0.94 | 0.88 | 0.95 | 0.96 | 1.00 | | | | | | | | | | | | | | |
| $M_g^{2+}$ | 0.94 | 1.00 | 0.96 | 0.85 | 0.98 | 0.97 | 0.98 | 1.00 | | | | | | | | | | | | | |
| $Na^+$ | 0.94 | 0.98 | 0.99 | 0.94 | 0.97 | 0.92 | 0.97 | 0.98 | 1.00 | | | | | | | | | | | | |
| $K^+$ | 0.86 | 0.93 | 0.96 | 0.97 | 0.94 | 0.87 | 0.96 | 0.93 | 0.98 | 1.00 | | | | | | | | | | | |
| $F_e^{2+/3+}$ | -0.18 | -0.34 | -0.46 | -0.65 | -0.48 | -0.32 | -0.43 | -0.35 | -0.48 | -0.64 | 1.00 | | | | | | | | | | |
| $NH_3$ | 0.60 | 0.39 | 0.48 | 0.31 | 0.31 | 0.20 | 0.23 | 0.37 | 0.38 | 0.22 | 0.33 | 1.00 | | | | | | | | | |
| $NO_2$ | -0.09 | -0.08 | 0.16 | 0.31 | 0.08 | -0.22 | -0.10 | -0.08 | 0.09 | 0.19 | -0.65 | 0.13 | 1.00 | | | | | | | | |
| $NO_3^-$ | 0.75 | 0.87 | 0.78 | 0.58 | 0.91 | 0.97 | 0.86 | 0.90 | 0.81 | 0.74 | -0.22 | 0.17 | -0.26 | 1.00 | | | | | | | |
| $Cl^-$ | 0.85 | 0.85 | 0.95 | 0.98 | 0.86 | 0.71 | 0.83 | 0.84 | 0.93 | 0.94 | -0.61 | 0.46 | 0.42 | 0.57 | 1.00 | | | | | | |
| $F^-$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | | | | | |
| $SO_4^{2+}$ | 0.63 | 0.69 | 0.81 | 0.94 | 0.74 | 0.57 | 0.72 | 0.67 | 0.81 | 0.89 | -0.85 | 0.16 | 0.58 | 0.41 | 0.93 | 0.00 | 1.00 | | | | |
| $PO_4^{3+}$ | -0.28 | -0.49 | -0.38 | -0.17 | -0.61 | -0.71 | -0.53 | -0.56 | -0.43 | -0.40 | 0.20 | 0.26 | 0.32 | -0.85 | -0.15 | 0.00 | -0.10 | 1.00 | | | |
| DO | 0.39 | 0.37 | 0.20 | -0.12 | 0.30 | 0.49 | 0.31 | 0.40 | 0.21 | 0.03 | 0.63 | 0.31 | -0.78 | 0.61 | -0.11 | 0.00 | -0.40 | -0.56 | 1.00 | | |
| BOD | 0.92 | 0.98 | 0.99 | 0.92 | 0.99 | 0.93 | 0.97 | 0.98 | 1.00 | 0.97 | -0.50 | 0.36 | 0.11 | 0.84 | 0.92 | 0.00 | 0.80 | -0.49 | 0.22 | 1.00 | |
| Coli | -0.76 | -0.91 | -0.84 | -0.77 | -0.93 | -0.97 | -0.95 | -0.92 | -0.89 | -0.90 | 0.51 | 0.01 | 0.13 | -0.92 | -0.70 | 0.00 | -0.65 | 0.74 | -0.32 | -0.91 | 1.00 |

Table 4. Linear correlation coefficient R and regression equation of Valliyaru River Water Sample - SW Monsoon (2013).

| Pairs of Parameters | R Value | Regression Equation |
|---|---|---|
| TDS – $C_a^{2+}$ | 0.984 | $C_a^{2+}$ = 0.941 TDS - 429.28 |
| TDS – $M_g^{2+}$ | 0.996 | $M_g^{2+}$ = 0.8557 TDS - 379.24 |
| TDS – $Na^+$ | 0.983 | $Na^+$ = 0.0153 TDS + 0.4953 |
| TDS - BOD | 0.978 | BOD = 0.0515 TDS - 10.051 |
| EC – $Na^+$ | 0.991 | $Na^+$ = 0.0628 EC + 2.5168 |
| EC - BOD | 0.989 | BOD = 0.2117 EC - 3.3255 |
| pH – $Cl^-$ | 0.975 | $Cl^-$ = 22.19 pH - 133.47 |
| Alkal – $M_g^{2+}$ | 0.975 | $M_g^{2+}$ = 16.763 Alkal - 195.14 |
| Alkal - BOD | 0.986 | BOD = 1.0395 Alkal + 0.4895 |
| TH - $M_g^{2+}$ | 0.974 | $M_g^{2+}$ = 0.8006 TH + 8.6085 |
| $C_a^{2+}$ - $M_g^{2+}$ | 0.981 | $M_g^{2+}$ = 0.8809 $C_a^{2+}$ + 14.107 |
| $C_a^{2+}$ - $Na^+$ | 0.973 | $Na^+$ = 0.0159 $C_a^{2+}$ + 7.5337 |
| $M_g^{2+}$ - $Na^+$ | 0.978 | $Na^+$ = 0.0178 $M_g^{2+}$ + 7.3067 |
| $M_g^{2+}$ - BOD | 0.979 | BOD = 0.0601 $M_g^{2+}$ + 12.796 |
| $Na^+$ - $K^+$ | 0.976 | $K^+$ = 31.27 $Na^+$ - 224.49 |
| $Na^+$ - BOD | 0.996 | BOD = 3.3649 $Na^+$ - 11.757 |
| $K^+$ - BOD | 0.972 | BOD = 0.1025 $K^+$ + 12.72 |

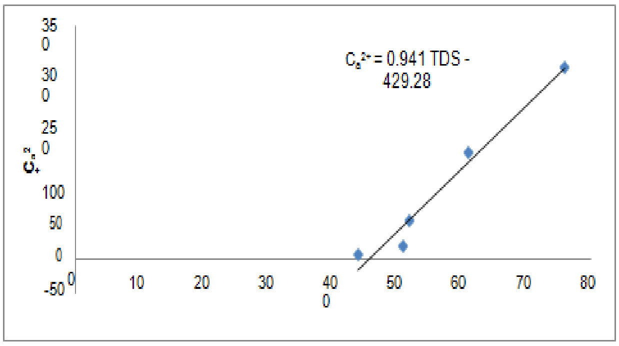


Fig 3. Correlation between TDS and $C_a^{2+}$

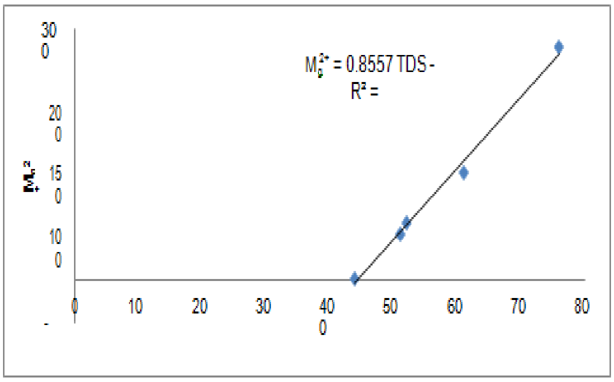


Fig 4. Correlation between TDS and $M_g^{2+}$

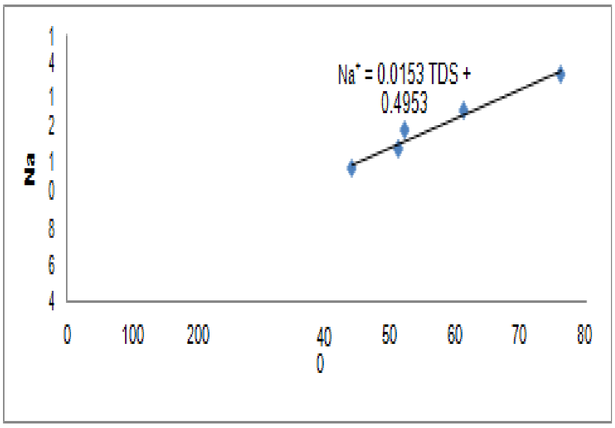


Fig 5. Correlation between TDS and $Na^+$

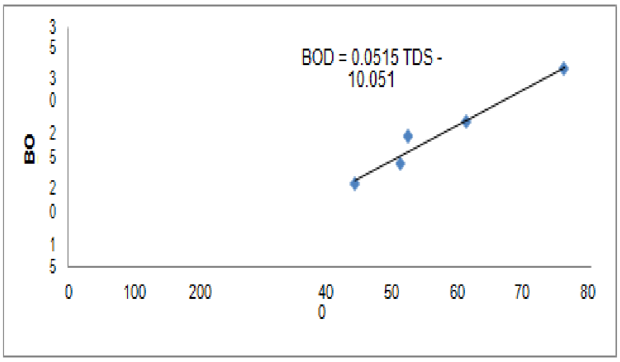


Fig 6. Correlation between TDS and BOD.

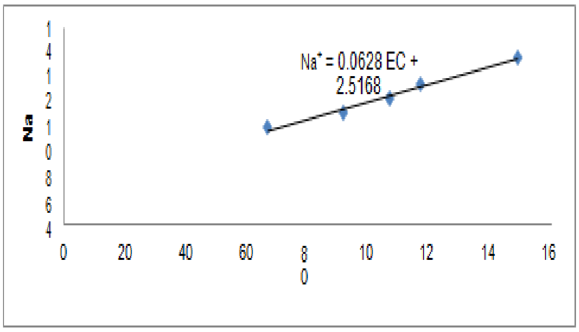


Fig 7. Correlation between EC and $Na^{+}$

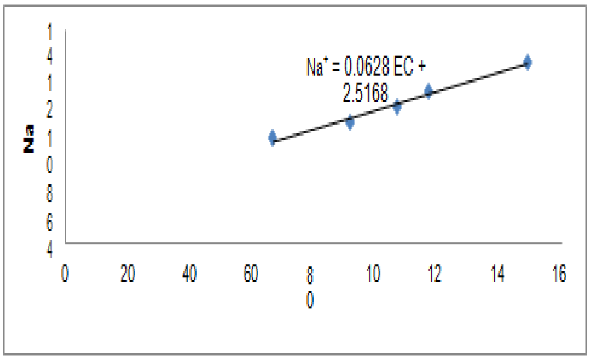


Fig 8. Correlation between EC and BOD

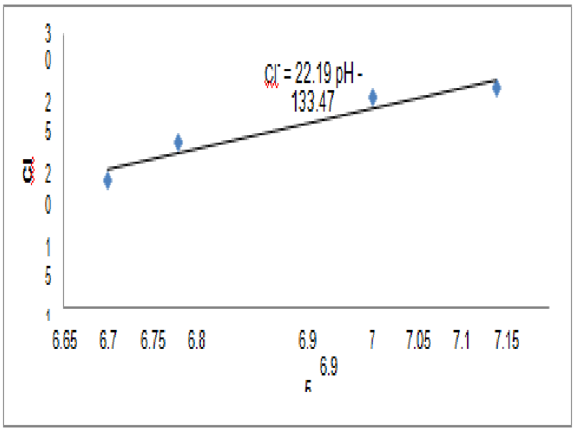


Fig 9. Correlation between pH and $Cl^{-}$

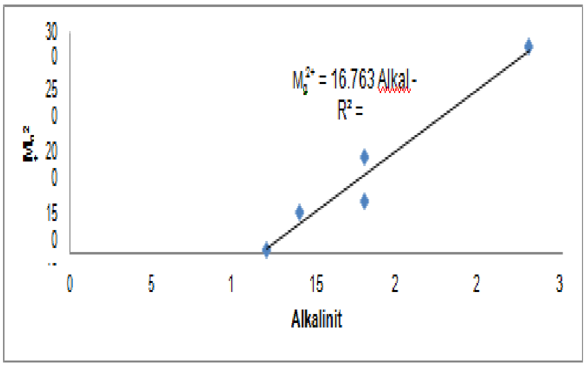


Fig 10. Correlation between Alkal and $M_g^{2+}$

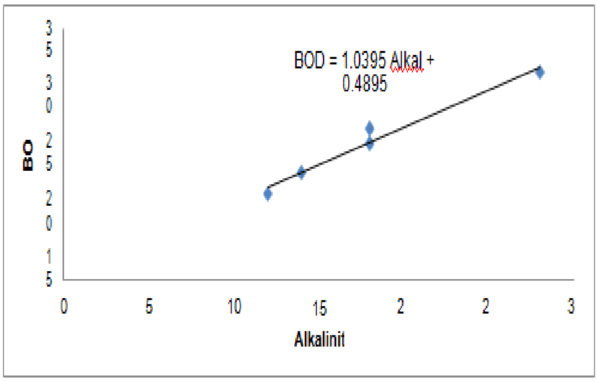


Fig 11. Correlation between Alkal and BOD

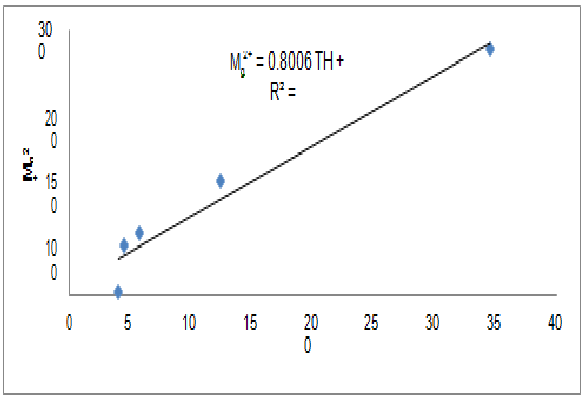


Fig 12. Correlation between TH and $M_g^{2+}$

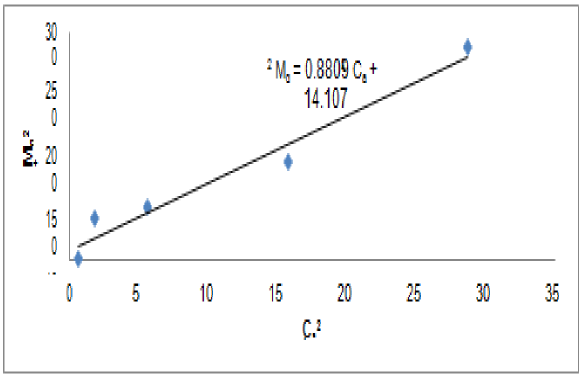


Fig 13. Correlation between $C_a^{2+}$ and $M_g^{2+}$

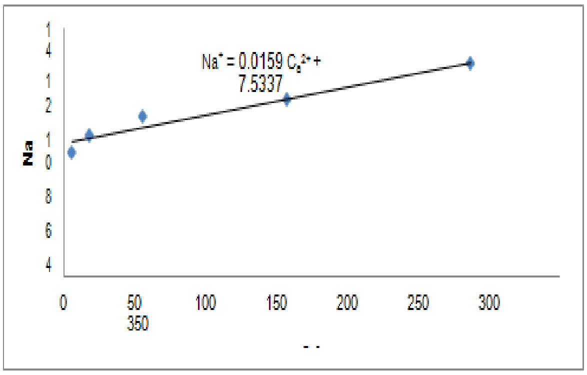


Fig 14. Correlation between $C_a^{2+}$ and $Na^{+}$

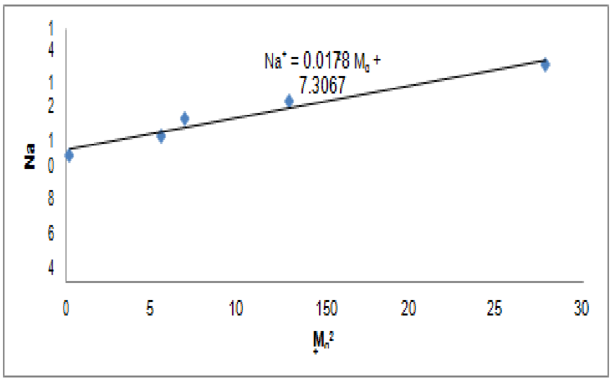


Fig 15. Correlation between $M_g^{2+}$ and $Na^+$

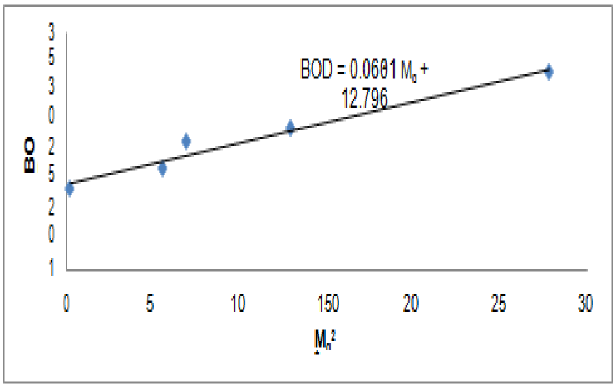


Fig 16. Correlation between $M_g^{2+}$ and BOD

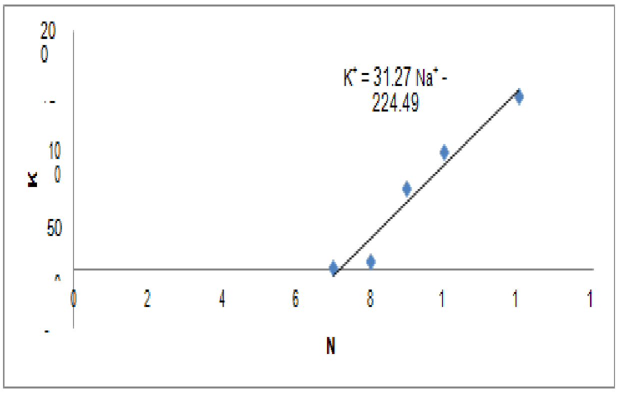


Fig 17. Correlation between $Na^+$ and $K^+$

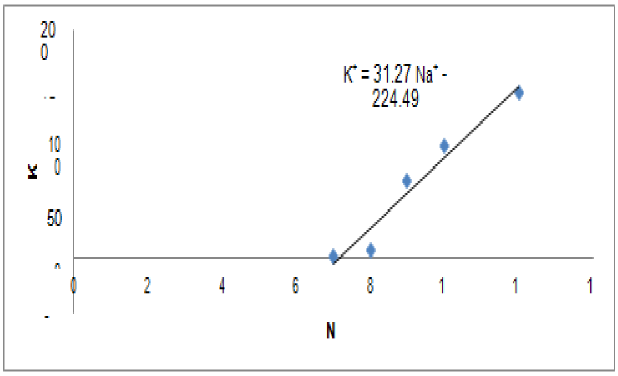


Fig 18. Correlation between $Na^+$ and BOD

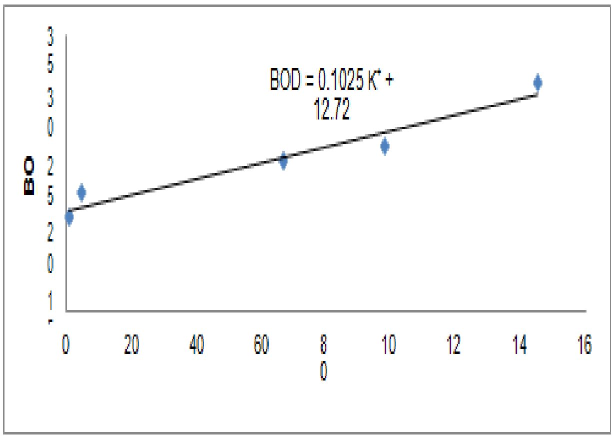


Fig 19. Correlation between $K^+$ and BOD.

## REFERENCES


[1] Achuthan Nair, G., Abdullan I. Mohamad and Mahamoud Mahdy Fadiel, 2005, Physio-Chemical parameters and correlation coeeficients of ground waters of North-east Libya, Pollution Research., Vol. 24(1), 1-6.

[2] APHA, 1998. Standard Methods for the Examination of Water and Wastewater, 20th ed., American Public Health Association, Washington DC, pp: 2005-2605.

[3] Jothivenkatachalam, K., A. Nithya and S. Chandra Mohan, 2010, Correlation analysis of drinking water quality in and around Perur block of Coimbatore District, Tamil Nadu, India, Rasayan Journal Chemistry, Vol. 3(4), 649654.

[4] Kot, B., R. Baranowski and A. Rybak, 2000. Analysis of mine waters using X-ray fluorescence spectrometry, Polish Journal of Environmental Studies, Vol. 9, 429.

[5] Kumar, N. and D.K. Sinha, 2010. Drinking water quality management through correlation studies among various physicochemical parameters: a case study, International Journal of Environmental Sciences, Vol. 1(2), 253259.

[6] Praus P, 2005. Water quality assessment using SVD-based principal component analysis of hydrological data. Water SA, Vol. 31, 417–422.

[7] Simeonov, V., Stratis, J., Samara, C., Zachariadis, G., Voutsa, D., Anthemidis, A., Sofoniou, M. and Kouimtzis, T., 2003. Assessment of the surface water quality in Northern Greece. Water Research, Vol. 37, pp. 4119-4124.

[8] Sonawane, V.Y. and A.M. Khole, 2010. Water quality of some drinking waters in Parbhani city:

a case study, Journal of Chemical Pharmaceutical Research, Vol. 2(5), 104107.

[9] Soylak. M., F. Armagan Aydin, S. Saracoglu, L. Elci and M. Dogan, 2002. Chemical analysis of drinking water samples from Yozgat, Turkey. Polish Journal of Environmental Studies, Vol.11 (2), 151- 156.

[10] Spanos T, Simeonov V, Stratis J, XristinaX, 2003. Assessment of water quality for human consumption. Microchim Acta, Vol.141, 35–40.

[11] Standard Organization and Iran Industrial Research, 1997. Water treatment physico chemical Specification of Iran (Tehran), Edition 5, Standard, pp: 1053.

[12] WHO, 1996, Guidelines for drinking water quality, World Health Organization (WHO), Vol.2, 236.