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# POSTMONSOON EVALUATION OF SURFACE WATER WITH REFERENCE OF STATISTICAL PARAMETERS OF KORBA DISTRICT, CHHATTISGARH, INDIA

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## ABSTRACT

**Postmonsoon (Oct'09 to Dec'09) assessment was done for different surface water sources in Korba district (C.G.) India. Twenty seven water samples were collected in pre-cleaned polythene and glass bottles separately, then subjected for physicochemical and selected metallic element analysis as per prescribed method (APHA 2005). The obtained results were compared with the standard value stipulated by BIS (1991) and WHO (2008) of standard drinking water. The mean value for TDS (1737.77 mg/L), TS (1848.458 mg/L), Turbidity (123.74 NTU), Total Alkalinity (497.185 mg/L), T. Hardness (598.548 mg/L), Chloride (599.302 mg/L), Sulphate (252.967 mg/L), COD (38.619 mg/L) and Iron (0.572 mg/L) were reported from the above maximum desirable limit while fluoride (0.887 mg/L), DO (5.206 mg/L), Nitrate (37.37 mg/L), Phosphate (0.105 mg/L), Al (0.04 mg/L), Hg (0.04 mg/L) were found under the acceptable value. Strong correlations were established between Total Alkalinity and pH (0.811), Fluoride and EC ( 0.936), Fluoride and TSS (-0.946), Nitrate and Turbidity (0.863). WQI showing from 235.93 (KDS – 6) to 3631.27 (KDS – 3) indicating water quality of the study area was tremendously deteriorated during the monitoring period.**

**KEYWORDS:** Water Quality, Correlation Coefficient, WQI, Korba, Heavy Metals

Air, Water, Soil and foods are fundamental necessities for flora, fauna and human beings. The chief constituent of air is oxygen, which is inhaled by the living organism, plants intake carbon dioxide to synthesis of material through photosynthetic activity. Water is active as the universal solvent, by which various nutrients are entered in the living system. From the last few decades owing to various anthropogenic sources and natural weathering phenomenon the air, water, soil and food materials are continuous contamination by undesirable matters.

Trace metals could be heavy, when the density is greater than 5 mg/cm$^3$. Heavy metals acting as the activator or inhibitor for the enzymatic catalysis process(Hollond, 1998 and Reily, 1980). For keeping good health and human system, the required as well as intake quantity of mineral should be balanced. The imbalance may create serous health problems (WHO and Tripathi et.al., 1997). In trace amount the heavy metals are beneficial like Zn is an essential nutrient for many metabolic functions(Zodl, 2003, Crawford, 1972) which takes part in more than hundred enzymatic process. The deficiency of Zn causes diabetes. Cd occurring in earth's crust, it is entered in plants, animals and human body through food chain. It is chief pollutant metal and extremely toxic to living organism (Kaneta, 1986 and Oskarsson, 2004) induce material hypertension and affects the kidney and also Itai–Itai disease which is more common in Japanese people (Fangmin, 2006). Chromium (VI) form causes the various health hazards like skin rashes, upset stomach, respiratory problems, weakened immune system, Kidney, Liver damaged and lung cancer (Daisy, 1976 and Ducros, 1992). Fe is acting as the catalyst for fat oxidation, high concentration is causing of cerate haemochromatosis.

## STUDY AREA

Korba town and its district area is important in India as well as World map for industrial, natural resources and environmental significant point of view. Our study field is located at 22$^o$20' North latitude and 82$^o$42' East Longitude, with a height of 304.8 meter above mean sea level. The total area of district is 7,14,544 hectare in which near about 2 lakh population are residing as per census 2011. The study field is received rain from south west monsoon from mid June till the end of September. The average rainfall in the whole district in 1506.7 mm, with average temp 36$^o$C. The district is richest source of bituminous type coal (Tripathi, 2003), therefore coal based thermal power plants are setup by NTPC, CSEB Korba (East) and West, BALCO captive power plant etc. 3650 MW of electricity is generated, so that Korba district is known as ENERGY HUB. Owing to huge haphazardly mining and industrial activity, the different part of ecosystem is not free from unwanted materials. So we have taken major and extensive study of different aquatic system in

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the Korba district. In this paper we have discuss only the post monsoon assessment of physicochemical characteristics with some selected metallic elements of different surface water. The analytical results were interpreted by the statistical quality like Mean, SD, SE, %CV, r and SWQI.


**Figure 1: Map of Study Area (Korba Distrct)**

## MATERIALS AND METHODS

Water samples were collected from different selected site (Shown in Fig. 1) in precleaned polyethene and glass bottles of 1L capacity separately. The samples were preserved by the appropriate reagents and experiment was carried out by the standard method given in APHA (2005), Trivedi and Goel (1984) and Manivaksam (2002).

## RESULTS AND DISCUSSION

The experimental results in the form of mean, ranges, min., max., SD, SE, %CV are given in Table-I. The correlations between water quality parameter are presented in matrix form in Table–II.

The pH of the waste water mainly depends on the source and chemical composition of wastes. The lower level of pH > 7 is due to the release of organic acid(Meenambal, 2003) while the high level of pH is cause the dissolved ions like $HCO_3^-$ and $CO_3^{2-}$. pH contribute the positive impact on the water quality index. In postmonsoon period of 2009 the mean value was found 7.431 with ranging covered from 6.44 (KDS–2, Nov'2009) to 8.52 (KDS–1, Oct'2009) indicated the nature of water is from slightly acidic to

alkaline and marginal beyond the fixed ranges of pH; 6.50 to 8.50 pH units as per different water monitoring agency; BIS(1991) and WHO(2008). pH is negatively correlated with the temp (-0.016). Percentage of CV was calculated 0.077.

**Table I: Post Monsoon Report (Oct. to Dec. 2009)**

| S.No | PARAMETERS | No of Samples | Range | Min | Max | Mean | Std.Dev | %CV | Std Error | Drinking Water Std (WHO) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Temp | 27 | 20.1-26.4 | KDS-8,Dec | KDS-4,Oct | 22.748 | 2.061 | 0.091 | 0.076 | |
| 2 | pH | 27 | 6.44-8.52 | KDS-2,Nov | KDS1,Oct | 7.431 | 0.574 | 0.077 | 0.021 | 6.5 to 8.5 |
| 3 | E.C | 27 | 543-2036 | KDS-8,Dec | KDS-6,Oct | 1559.22 | 498.9 | 0.32 | 18.478 | 1400* |
| 4 | T.D.S | 27 | 1509.9-1968.3 | KDS-1,Dec | KDS-3,Nov | 1737.77 | 125.89 | 0.072 | 4.663 | 50 |
| 5 | T.S.S | 27 | 37.717-243.412 | KDS-7,Oct | KDS-8,Oct | 110.684 | 54.93 | 0.496 | 2.035 | |
| 6 | Turbidity | 27 | 19-541 | KDS-7,Dec | KDS-3,Oct | 123.74 | 120.401 | 0.973 | 4.459 | 5 |
| 7 | Total Solids | 27 | 1603.39-2098.32 | KDS-1,Dec | KDS-3,Oct | 1848.458 | 111.347 | 0.06 | 4.124 | |
| 8 | T.Acl | 27 | 83-190 | KDS-7,Oct | KDS-1,Oct | 120.963 | 21.709 | 0.179 | 0.804 | |
| 9 | T.Alk | 27 | 398-678 | KDS-2,Nov | KDS-3,Dec | 497.185 | 70.279 | 0.141 | 2.603 | 200 |
| 10 | Hardness | 27 | 474.6-741.3 | KDS-8,Dec | KDS-2,Oct | 598.548 | 78.024 | 0.13 | 2.89 | 300 |
| 11 | Chlorides | 27 | 413.01-831.31 | KDS-9,Dec | KDS-6,Oct | 599.302 | 131.355 | 0.219 | 4.865 | 250 |
| 12 | Fluorides | 27 | 0.32-1.21 | KDS-8,Nov | KDS-2,Dec | 0.887 | 0.283 | 0.319 | 0.01 | 0.6-1.2 |
| 13 | Sulphates | 27 | 39.31-371.58 | KDS-6,Nov | KDS-5,Oct | 252.967 | 89.728 | 0.355 | 3.323 | 200 |
| 14 | D.O | 27 | 3.98-6.11 | KDS-3,Nov | KDS-2,Nov | 5.206 | 0.603 | 0.116 | 0.022 | 5.0* |
| 15 | C.O.D | 27 | 6.13-151.12 | KDS-7,Dec | KDS-9,Oct | 38.619 | 40.602 | 1.051 | 1.504 | |
| 16 | B.O.D | 27 | 3.41-18.31 | KDS-5,Dec | KDS-8,Nov | 9.267 | 4.569 | 0.493 | 0.169 | |
| 17 | Nitrogen Nitrate | 27 | 17.18-84.41 | KDS-2,Dec | KDS-5,Oct | 37.37 | 18.335 | 0.491 | 0.679 | 45 |
| 18 | Phosphate | 27 | 0.011-0.71 | KDS-7,Dec | KDS-1,Oct | 0.105 | 0.153 | 1.464 | 0.006 | |
| 19 | Al | 27 | 0.04-0.04 | KDS-2,Dec | KDS-2,Dec | 0.04 | | | | 0.03 |
| 20 | Fe | 27 | 0.07-1.53 | KDS-5,Oct | KDS-8,Nov | 0.572 | 0.419 | 0.732 | 0.016 | 0.3 |
| 21 | Hg | 27 | 0.04-0.04 | KDS-2,Dec | KDS-2,Dec | 0.04 | | | | No Relaxation |
| 22 | Zn | 27 | | | | | | | | 5 |

Range of concentration are in mg/L, except for pH,Temp, temp measured in deg C

* WHO specification for drinking water

**Table II: Correlation Matrix for various Physico-Chemical Analysis Parameter of Water Post-Monsoon (Oct. to Dec. 2009)**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | Temp | pH | E.C | T.D.S | T.S.S | Turbidity | Total Solids | T.Acl | T.Alk | Hardness | Chlorides | Fluorides | Sulphates | D.O | C.O.D | B.O.D | Nitrogen Nitrate | Phosphate | Al | Fe | Hg | Zn |
| 1 Temp | 1.000 | | | | | | | | | | | | | | | | | | | | | |
| 2 pH | 0.195 | 1.000 | | | | | | | | | | | | | | | | | | | | |
| 3 E.C | 0.194 | 0.000 | 1.000 | | | | | | | | | | | | | | | | | | | |
| 4 T.D.S | 0.211 | 0.101 | 0.396 | 1.000 | | | | | | | | | | | | | | | | | | |
| 5 T.S.S | 0.061 | 0.031 | -0.646 | -0.035 | 1.000 | | | | | | | | | | | | | | | | | |
| 6 Turbidity | 0.231 | 0.376 | 0.170 | 0.730 | -0.052 | 1.000 | | | | | | | | | | | | | | | | |
| 7 Total Solids | 0.352 | 0.130 | 0.129 | 0.900 | -0.035 | 0.800 | 1.000 | | | | | | | | | | | | | | | |
| 8 T.Acl | -0.014 | 0.170 | 0.119 | -0.280 | -0.146 | -0.090 | -0.388 | 1.000 | | | | | | | | | | | | | | |
| 9 T.Alk | 0.033 | 0.649 | 0.192 | 0.496 | -0.034 | 0.702 | 0.544 | -0.066 | 1.000 | | | | | | | | | | | | | |
| 10 Hardness | 0.211 | -0.538 | 0.501 | 0.429 | -0.393 | 0.079 | 0.291 | -0.080 | -0.103 | 1.000 | | | | | | | | | | | | |
| 11 Chlorides | 0.131 | 0.474 | 0.679 | 0.238 | -0.234 | 0.306 | 0.153 | 0.001 | 0.535 | 0.142 | 1.000 | | | | | | | | | | | |
| 12 Fluorides | -0.049 | -0.153 | 0.792 | 0.315 | -0.608 | 0.067 | 0.056 | 0.333 | 0.156 | 0.514 | 0.417 | 1.000 | | | | | | | | | | |
| 13 Sulphates | 0.339 | 0.217 | 0.436 | 0.498 | -0.466 | 0.356 | 0.333 | 0.165 | 0.376 | 0.271 | 0.256 | 0.542 | 1.000 | | | | | | | | | |
| 14 D.O | -0.071 | -0.552 | -0.226 | -0.092 | -0.065 | -0.296 | -0.136 | -0.177 | -0.487 | 0.439 | -0.530 | -0.074 | -0.075 | 1.000 | | | | | | | | |
| 15 C.O.D | 0.122 | 0.122 | -0.289 | 0.251 | -0.008 | 0.238 | 0.280 | -0.025 | 0.374 | 0.222 | -0.229 | -0.172 | 0.319 | 0.220 | 1.000 | | | | | | | |
| 16 B.O.D | 0.632 | 0.167 | 0.004 | 0.143 | 0.008 | 0.055 | 0.166 | -0.096 | -0.046 | 0.208 | 0.008 | -0.195 | 0.171 | 0.121 | 0.200 | 1.000 | | | | | | |
| 17 Nitrogen Nitrate | 0.428 | 0.492 | 0.248 | 0.545 | 0.023 | 0.753 | 0.628 | -0.160 | 0.677 | 0.090 | 0.492 | 0.070 | 0.442 | -0.362 | 0.344 | 0.121 | 1.000 | | | | | |
| 18 Phosphat | 0.012 | 0.364 | -0.073 | -0.351 | -0.143 | -0.221 | -0.467 | 0.813 | -0.077 | -0.366 | -0.179 | 0.130 | 0.187 | -0.106 | 0.013 | -0.012 | -0.233 | 1.000 | | | | |
| 19 Al | # | # | # | # | # | # | # | # | # | # | -0.036 | # | # | # | # | # | # | # | 1.000 | | | |
| 20 Fe | 0.034 | 0.392 | -0.539 | -0.053 | 0.646 | # | 0.259 | 1.000 | 0.325 | -0.321 | -0.036 | -0.604 | -0.271 | -0.137 | 0.239 | 0.219 | 0.222 | -0.134 | # | 1.000 | | |
| 21 Hg | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | 1.000 | |
| 22 Zn | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | 1.000 |

# Indicates that it has no correlation due to below detection limit in the samples (No exact concentration detected)

**Table III: SWQI (Post Monsoon 2009)**

| S. No. | Sample Code | WQI |
|---|---|---|
| 1 | KDS - 1 | 1409 |
| 2 | KDS - 2 | 1235.31 |
| 3 | KDS - 3 | 3631.27 |
| 4 | KDS - 4 | 459.12 |
| 5 | KDS - 5 | 805.7 |
| 6 | KDS - 6 | 235.93 |
| 7 | KDS - 7 | 567.29 |
| 8 | KDS - 8 | 715.27 |
| 9 | KDS - 9 | 1235.8 |

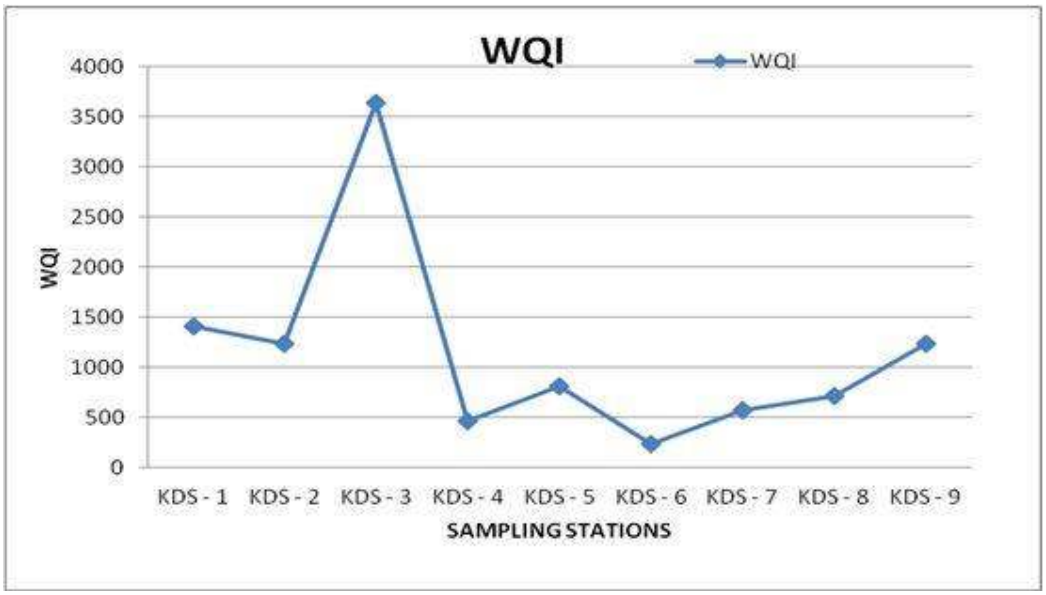


**Figure 2: Water Quality Index**

Electrical Conductivity is measured the concentration of inorganic and organic salts in aqueous medium. High electrical conductivity reduces the osmotic activity of plants and interferes with adsorption of water and nutrients from the soil (Joshi, 2011). In the investigation of the post monsoon period of 2009 the mean and ranging values were obtained 1559.22 µS $cm^{-1}$, 543 to 2036 µS $cm^{-1}$ at the sampling points KDS–8 (Dec. 2009) and KDS–6 (Oct. 2009) respectively. EC showed positive and negative correlation with temp. (0.117) and pH ( – 0.074). The %CV was also reported 0.32, which is also too much narrow.

Turbidity is detected the magnitude of suspended particles as clay, silt and less dissolved organic wastes. In research field the two statistical values; mean was found 123.74 NTU, while ranging values were fluctuated from 19 NTU (KDS–7, Dec' 2009) to 541 NTU (KDS–3, Oct 2009). These data are many fold greater than prescribed range 0–5 NTU. The water sources are highly polluted by the suspended particles. Turbidity established low degree correlation with temp. (0.570), pH(0.395) and EC (0.327). The % CV was reported too much less as 0.973.

The total dissolved solids in water is represented by the weight of residue left, when a water sample has been evaporated upto dryness(Tatawat, 2007). The average data was calculated as 1737.77 mg/L and min. concentration was obtained at the site KDS-1 (Dec. 2009); 1509.9 mg/L and max. concentration was found at the sampling spot KDS–3 (Nov. 2009); 1968.3 mg/L. These low and high concentration was far away from the acceptable limit 500–1500 mg/L as per WHO (2008) guideline. TDS showed high positive significant correlation with temp (+ 0.714). The %CV was found 0.072 for TDS, which is very low and indicating the variation ranges is narrow.

The chemical constituents of Total alkalinity is $CO_3^{-2}$, $HCO_3^{-1}$, $O^-H$, $BO_3^{-3}$, $HPO_4^{-1}$ , $HS^-$, $NH_3$. In study period the mean value was obtained 497.185 mg/L which is higher than desirable value; 200 mg/L, but less than excessive permissible limit; 600 mg/L as per BIS (1991) and WHO (2008). The low concentration 398 mg/L was observed at the position of KDS–2 (Nov. 2009); 678 mg/L. Total alkalinity is correlated with pH (0.811) and turbidity ( 0.749) respectively. The % CV was computed 0.141 as less value.

Total hardness was calculated as arithmetic mean value 598.548 mg/L which is crossed the desirable limit. The sampling site KDS 8 (Dec. 2009) showed low value of hardness; 474.6 mg/L while the water of site KDS–2 (Oct. 2009) contain high concentration of total hardness component; 741.3 mg/L. The ranging values are beyond the standard value prescribed by BIS (1991) and WHO (2008)300 – 600 mg/L. The hardness formed inverse relation with TSS with r value of – 0.655, indicating the compounds responsible for hardness is not imparting in TSS. The variation of concentration of total hardness is measured in terms of %CV which is very low; 0.13.

The fluoride concentration in water plays a significant role for the human health, the excess concentration of fluoride ions cause the dental fluorosis, while less concentration are creating the dental carries (Parashuram, 2007). In investigation period the mean value was seen 0.887 mg/L which is lower than the required value and ranging data was varied from 0.32 mg/L at KDS–8 (Nov. 2009) to 1.21 mg/L at KDS–2 (Dec. 2009). The mathematical values are indicating that the water sources are not affected by fluoride compounds. In one hand fluoride forms high significant of positive correlation with EC (+ 0.936) indication of fluoride compounds play key role in value of EC but other hand fluoride forms negative correlations with TSS (– 0.946). The %CV for fluoride is 0.379 intimated narrow changes in concentration of fluoride compounds among selected water samples.

In nature chloride ion occur in conjunction with sodium concentration (Jameel, 2003). The acceptable range of chloride ion concentration in water prescribed by BIS (1991) and WHO (2008); 250 mg/L to 1000 mg/L. In our study mean values was computed 599.302 mg/L and ranges were recorded from 413.01 mg/L at KDS–9 (Dec 2009) to 831.31 mg/L at KDS–6 (Oct. 2009). These data are showed that the water sources are received chloride ions greater than desirable value, however less than upper limit. Chloride established positive significant of correlation with EC (r = + 0.570 and Total Alkalinity ( r = + 0.603). The %CV was found 0.219 showed little changes in conc. of chloride ion form location to location.

The source of nitrate in water systems is anthropogenic ways like domestic sewage, excess using of fertilizers, agriculture, human and animal excreta and decomposition of organic compounds. High concentration of nitrate (>45 mg/L) is causing of health hazard such as gastric cancer, oral cancer, methemoglobninemia in infants. In the present study the 37.37 mg/L is obtained as mean value within desirable limit. The low concentration was recorded at KDS–2 (Dec. 2009) 17.18 mg/L and high conc. was observed at the site of KDS–5 (Oct. 2009); 84.41 mg/L, this may be attributed the inputs from waste and agricultural runoffs. Nitrate ion established positive correlation with turbidity (+ 0.863), TS (+ 0.666) and Total alkalinity (+0.881) respectively. The % CV was found 0.491 as less value.

Phosphate is occurring in nature as orthophosphate. Its chief sources are phosphate containing fertilizers and pesticides through comes in water bodies (Joseph, 2010). The analysis of post monsoon 2009 the mean value was found 0.105 while ranging values was changes from 0.011 mg/L as min. at location site KDS–7 (Dec. 2009) to max. conc. of 0.710 mg/L at the sampling site no KDS–1 (Oct. 2009). The high concentration be attributed to discharge of agricultural wastes in water bodies. Phosphate formed a high degree of positive significant correlation with T. Acidity (+0.859). The % CV was found 1.464, indicating little changes in concentration of phosphate among various selected spots.

The highest concentration of sulphate was found at point KDS–5 (Oct. 2009); 371.58 mg/L within excessive permissible limit and lowest value was reported at sampling point KDS–6 (Nov – 2009); 39.31 mg/L. The average value was added as 252.967 mg/L which is a lightly higher than the desirable limit; 200 mg/L stipulated by BIS (1991) and WHO (2008) standard. Sulphate showed positive significant of correlation with different degree among $SO_4^{-2}$ vs Temp. (0.561), $SO_4^{-2}$ vs EC (0.671), $SO_4^{-2}$ vs TDS (0.715), $SO_4^{-2}$ vs T. Hardness (0.715), $SO_4^{-2}$ vs Fluoride (0.715). The %CV was found 0.335.

The dissolved form of oxygen is depended upon the temp, photosynthetic activity, oxygen demanding substances and reducing matter (Parashuram, 2007). Owing to population load the concentration of dissolved oxygen decline the posses thorough on the aquatic ecosystem. In the present

investigation the mean value was found 5.206 mg/L within the desirable level. The min. conc. was detected at the KDS–3 (Nov. 2009); 3.98 mg/L. The low conc. may be attributed to the presence of domestic and agricultural wastes. The high concentration was reported at the sampling site no. KDS–2 (Nov. 2009). Dissolved oxygen showed mild degree negative correlation with pH (r = – 0.718). Like other parameters, the %CV was also showed the narrow value 0.176.

Chemical oxygen demand is the amount of oxygen required for oxidation of organic compounds with strong oxidising agents. In the present analysis the ranging values vary from 6.13 mg/L (KDS–7, Dec. 2009) to 151.12 mg/L (KDS–9, Oct. 2009) with 38.619 mg/L as mean value. These statistical data showed that the average and max. value are crossed the max. admissible value; 10 mg/L as set by BIS (1991)[17] and WHO (2008)[18]. COD outlined positive significant correlation with Temp.(+ 0.595) and sulphate (+ 0.501). 1.051 values was calculated as % CV for COD. The magnitude of BOD is depended upon the presence of biodegradable organic material, temp. and density of plankton. In the present study the average value was found 9.267 mg/L and ranging data were changes as 3.41 mg/L as min. value at KDS–5 (Dec. 2009) to 18.31 mg/L at KDS–8 (Nov. 2009). The BOD formed positive significant correlation with temperature ( r = + 0.542) and DO ( 0.544). The %CV was also low for BOD; 0.493.

We have selected four metallic elements namely aluminium, iron, mercury and zinc. In the study period the mean value for iron was detected as 0.572 mg/L and ranging data varied form 0.07 mg/L at the sampling site KDS–5 (Oct. 2009) to 1.53 mg/L from site KDS–8 (Nov. 2009), which is crossed the upper limit for drinking water. Al and Hg were found in same concentration 0.04 mg/L a mean value. Aluminium established positive significant correlation with high degree for Turbidity (r = 0.870), Total Solid (r = 0.755) and Total Alkalinity (r – 0.712) orderly. Iron form high degree correlation with TSS (r = + 0.751). The %CV was calculated only for iron 0. 732, this show very low concentration changes from one sampling site to another sampling site.

### WQI

Water quality index is defined as a rating which reflects the composite influences of different water quality parameters on the overall quality of water. In study field and post monsoon period of 2009 water quality index was computed on the basis of selected physic chemical parameters. The results were obtained from 235.93 as min. on sampling spot KDS–6 to 3631.27 as max. in the sampling site KDS–3. These ranges are far further away from the standard value of WQI; 0–25 excellent, 26–50 Good, 51–75 poor, 75–100 very poor and above 100 unsuitable. All water sources are highly polluted by the intrusion of various kinds of pollutants.

## CONCLUSION

From the above experimental values the physicochemical properties except pH, Fluorides, DO, Nitrates, Phosphates, Aluminium, Mercury and Zinc were reported beyond the desirable value. TS positively related with TDS indicating total dissolved solid as part of total solids. Strong correlation was found between F vs EC as positively and F vs TSS as negatively, showed fluoride compounds are imparting in electrical conductivity while these class of compounds are not contributing in TSS. Like sulphate was also established negative significant correlation with TSS but with Total Hardness positively correlation means the hardness is caused by sulphatic compounds. SWQI's were ranges from 235.93 (KDS–6) to 3631.27 (KDS–3) indicating the surface water sources of the study field is highly polluted and not applicable for domestic, industrial and agricultural purpose. Prior using of different purpose, the water of different sources and purification.

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