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QUALITY ASSESSMENT OF SURFACE WATER AND GROUND WATER OF MEDAK DISTRICT A.P. INDIA.

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ABSTRACT

The present paper aims at the impact of surface water and quality of ground water on irrigation and heath of the human beings. The study was taken up in the area of Medak district, Andra Pradesh, India . Surface water and ground water samples collected seasonally, during peak rainy and peak winter season and were analyzed for pH, Electrical conductivity (EC), total dissolved solids (TDS), sodium (Na^+), potassium (k^+), Magnesium (Mg^{+2}), Calcium(Ca^{+2}), Carbonate (Co_3^{-2}) and bicarbonate (Hco^-_3), chloride (Cl^-), sulphate Sulphate (So_4^{-2}), Nitrate (No_3^-) and fluoride (F^-), the heavy metals analyzed were cadmium (Cd), Zinc (Zn), Nickel (Ni), Mangnese (Mn) and iron (Fe). US salinity Laboratory's and Wilcox's diagram, sodium Adsorption ratio (SAR), percent sodium % Na, residual sodium carbonate (RSC), used for evaluating the water quality for irrigation. Surface and ground water samples are not good for irrigation in both rainy and winter season.

Key words: Assessment, Medak, SAR, RSC

INTRODUCTION

Forty years ago, Patancheru, in the Medak district of Andra Pradesh, India, and the area surrounding it was verdant agricultural land, famous for its sparkling lakes and streams. Farming livestock rearing and fishing were the main occupations. The Andhra Pradesh industrial infrastructure corporation was formed in 1973. In the two decades, the Andra Pradesh Govt. created industrial estates in a 36 miles radius from Hyderabad. Agricultural land was procured at throwaway prices, and the several industries began to mushroom in the area. Some of the biggest bulk drugs and Pharmaceutical industries in Andra Pradesh are located in this area. There were few (or) no mechanism for the safe treatment and release of effluents and wastes.

Today the once-clear lakes of patancheru are in various toxic colours. The paints, plastic, chemical and bulk drug industries on the estate routinely dump their wastes into these water bodies. Pollution of these lakes, ponds, streams are contaminating the ground water system. The lakes is also a paleo–channel, which means it transport its contaminated water to larger distance invisibly under ground. Lakes, ponds are the primary source of irrigation in this district. These are mostly used for irrigation. They also help in recharging the ground water, thus maintaining the ground water table and sustaining wells for livelihood. Predominately people are dependent on agriculture, the very survival of the population here is dependent on the village lakes and tanks. The objective of this study is to assess the seasonal variation of surface water and ground water sample collected seasonally, peak rainy and peak winter season from the area are selected for the present study.

<u>MATERIALS AND METHOD:</u>

Samples were collected during peak rainy and peak winter seasons in the Medak district of A.P India. The layout of the area and the sample collection points are shown in Fig.1.

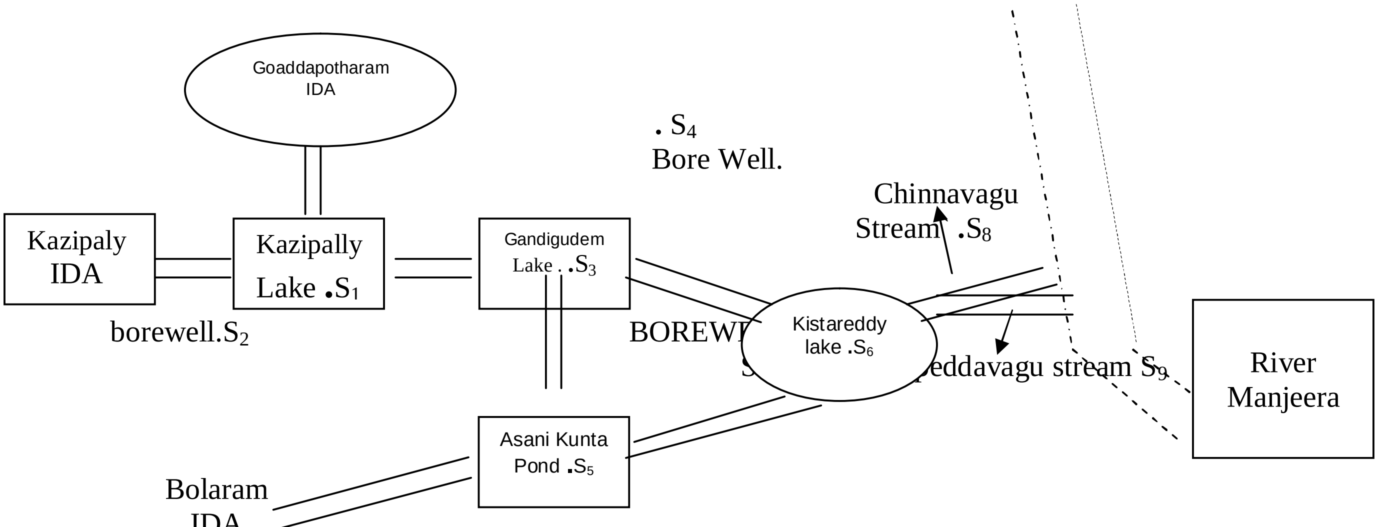

FIGURE 1

During sampling the samples were collected in a 2 litre polyvinyl chloride bottles and mixed in equal proportions to get uniform homogenous sample (Thatcher 1960). Random selection procedure was adopted for the selection of both sampling unit and the sampling points in a given site (APHA 1996). Tap water and 8M HNo_3 were used to wash the polythene bottles of 100ml capacity which is used for the sample preservation followed by washing it with distilled water and finally with double distill water (Jeffery 1996). Then the water bottles were rinsed with effluent samples and the samples were stored in a refrigerator at 4°c after adding preservatives (APHA1998). Preservatives are essential for retarding biological action, hydrolysis of chemical compounds and complexes and reduction of volatility of constituents. These samples were used for analysis of water quality parameters according to the standard methods reported in literature (Jeffery 1996, and APHA 1996).

Samples were analyzed immediately (APHA 1992) for hydrogen ion concentration (pH) and electrical conductivity (EC) using pH and EC meters. Sodium and potassium were measured by flame photometer. Co_3^{--}, HCo_3^{-} were estimated by titrating with Hcl. Ca^{+2} concentration were analyzed titrimetrically, using standard EDTA. Magnesium (Mg^{+2}) was calculated by taking differential value between TH and Ca^{+2} concentration. Anions such as chloride (Cl^{-}) ,Sulphate (So_4^{-2}), nitrate (No_3^{-}) and Fluoride(F^{-}) were analyzed by using ion – chromatography in Geo-Chemistry lab, National Geo-Physical research Institute (NGRI) Hyderabad.

For the heavy metal Analysis, the samples were preserved by adding 5ml concentrated. HNo_3 in one liter of sample to maintain the pH below 4.0 following the procedure suggested by Agemian and Chau(1975). The samples were then filtered through Whatmann filter paper No. 40 and the filtrate was directly used for analysis by Atomic Absorption Spectrophotometer. At the time of sampling the samples are acidified as per standard international method reference given by APHA, 1985.

RESULTS AND DISCUSSIONS:

Summary of the results of seasonal chemical analysis of surface and ground water is presented in Table 1 & 2. The pH of surface water ranges from 6.7 to 7.78 in rainy season and from 6.7 to 7.55 in winter season. The pH of the samples shows that the water of the lakes and ground water is mild alkaline in nature. Immature stages of aquatic organism are generally more sensitive to low pH levels and some sensitive species will not be present in water with pH values below 6.

Electrical conductivity is a measure of salinity of the water. Salinity restricts the availability of water to plants by lowering the total water potential in the soil. EC is between 1200 µS/cm to 4000 µS/cm in rainy season and 4700 µS/cm to 14,200 µS/cm in winter season. EC for ground water samples varies from 1200 to 1800 µS/cm in rainy season and from 1900 to 4000 µS/cm in winter season. Conductivity between 150 to 500 µS/cm in streams generally support a healthy fish population. All the samples of the lakes have EC more than 500 µS/cm. EC is indirect measure of the presence of dissolved solids and can be used as indicator of water pollution. High concentrations of dissolved solids can cause water balance problems for organisms and result in lower DO levels, because oxygen dissolves easier in water with low level of dissolved solids. Concentration of salinity (TDS) for surface water ranges from 800mg/L to 2600mg/L in rainy season and from 3082 to 9200mg/L in winter season. TDS for ground water ranges from 800 to 1200mg/L in rainy season and from 1285 to 2600mg/L in winter season. Higher concentration of TDS is observed in winter samples with lower TDS in rainy samples. TDS is a measure of material dissolved in water such as carbonate, bi-carbonate, chloride, sulphate, nitrate, calcium, magnesium, sodium, and other ions. A certain level of these ions in water is necessary for aquatic life. If TDS concentration are too high as in the case of winter season samples, aquatic life may be limited and death may occur. High concentration of TDS may also reduce water clarity, contribute to a decrease in photosynthesis, lead to an increase in temperature, and transport toxic compounds and heavy metals. Ca^{+2} concentration ranges from 25mg/L to 115mg/L in surface water samples of rainy season and from 40 to 180mg/L during winter samples. Ca^{+2} concentration in ground water samples ranges from 25 to 45mg/L in rainy season and from 50 to 180mg/L in winter season. Calcium is an important element influencing flora of ecosystem which play an important role in metabolism and growth. Normally these ions are not problematic but at higher concentration increases total hardness of water (Ravi kumar et al 2005). The concentration of Mg^{+2} ions in surface water ranges from 43.2 to 115.9 mg/L in rainy season and from 32mg/L to 350mg/L in winter season. For ground water samples the concentration of Mg^{+2} ions varies from 20.5 to 54.9mg/L in rainy season and from 20 to 30mg/L in winter season. Concentration of Ca^{+2} and Mg^{+2} ions increases total hardness of water. The sample S_5 in winter season crosses the safety limit of 300mg/L, as suggested by BIS (Bureau of Indian Standards). Beyond the safety limit of 300mg/L, hard water leads to incidence of urolithiosis (WHO1984) anencephaly, parental mortality, some types of cancer (Agarwal and Jagetia 1997). The concentration

Table 1: Parameters measured at selected points in the lakes and ground water during the rainy season

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9
P^H	7.34	7.78	6.7	7.76	6.89	7.55	7.34	7.5	7.12
EC*	3200	1800	2100	1300	4000	1900	1200	1200	1400
TDS	2100	1200	1400	850	2600	1300	800	800	900
Na^+	460	290	260	175	520	300	170	150	190
K^+	36	7	20	25	22	14	30	06	14
Ca^{2+}	75	25	45	30	115	50	45	25	30
Mg^{2+}	115.9	54.9	86.6	49.5	161.05	69.5	20.5	43.2	51.2
Cl^-	1050	500	650	320	1300	630	300	350	350
So_4^{-2}	200	150	150	170	250	175	60	100	180
Co_3^{-2}	0	15	0	20	7.5	0	8.0	0	0
HCo_3^-	100	129.8	68.7	61.5	69.1	62.5	68.9	50.8	62.8
No_3^-	20.8	18.4	35.6	13.0	60.0	19.6	12.0	10.8	15
F^-	0.84	0.76	0.61	0.14	2.46	1.28	0.13	0.54	0.2
SAR	7.75	7.41	5.20	4.55	10.18	6.5	4.28	2.72	4.88
% Na	61	68.69	67	59	68	61.6	67.3	58	57.4
RSC	0	0	0	0	0	0	0	0	0
Cd	0.15	0.03	0.09	0.08	0.18	0.07	0.02	0.06	0.12
Zn	3.4	1.3	3.0	1.8	4.9	2.7	1.8	1.8	1.9
Ni	1.35	0.40	1.22	0.20	1.38	0.20	0.50	0.70	0.54
Mn	2.25	0.18	0.98	0.09	0.16	0.25	0.17	0.09	0.08
Fe	1.5	0.5	0.8	0.48	1.7	0.5	0.20	0.90	0.45

* micro Siemens/cm . All other parameters are measured in mg/l

S_1 = Kazipally lake
S2 = kazipally ground water
S3 = Gandigudam lake
S4 = Gandigudam Ground water
S5 = Asanikunta pond
S6 = Kistareddy pet lake
S7 = Kistareddypet ground water
S8 = Peddavagu stream
S9 = Chinnavagu stream

Table 2: Parameters measured at selected points in the lakes and ground water during the Winter season

	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9
P^H	7.05	7.15	6.8	7.04	6.7	7.55	7.35	7.13	7.02
EC *	11,900	1900	9500	3500	14,200	7800	4000	5800	4700
TDS	7735	1285	6185	2300	9200	5000	2600	3800	3082
Na^+	2190	355	1850	700	2270	1600	850	1200	980
K^+	178	24	212	80	146	90	50	80	60
Ca^{2+}	150	50	150	80	180	80	50	40	40
Mg^{2+}	250	30	60	20	350	70	25	70	32
Cl^-	3800	340	3000	1150	4000	2400	1250	1750	1450
So_4^{-2}	900	200	650	200	1500	550	300	500	350
Co_3^{-2}	30	15	45	25	35	23	45	40	25
HCo_3^-	200	200	250	100	350	200	100	200	150
No_3^-	60	45	75	50	120	48	45	55	60
F^-	1.5	1.2	1.4	1.3	5.4	2.5	0.85	1.1	0.68
SAR	25.3	9.76	32.16	18.0	22.61	31.47	24.4	26.4	28.02
% Na	77.9	76.2	87.2	85.1	72.8	87.9	89.3	87.4	90.4
RSC	0	0	0	0	0	0	0	0	0
Cd	0.46	0.04	0.53	0.19	0.55	0.28	0.19	0.15	0.19
Zn	5.4	1.5	3.9	2.7	6.5	3.0	3.3	4.0	3.4
Ni	3.81	0.90	3.89	0.94	3.88	0.45	1.99	0.80	1.26
Mn	3.0	0.2	1.52	0.12	1.39	0.29	0.19	1.12	1.72
Fe	5.98	0.85	5.1	2.1	6.20	5.94	0.80	5.2	5.9

*micro Siemens/cm . All other parameters are measured in mg/l

S_1 = Kazipally lake
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of sodium should not exceed 200 mg/l. A Sodium restricted diet is recommended to patient suffering from hyper tension (or) congenial heart diseases and also from kidney problems. For such people, extra intake of Na^+ through drinking water may prove critical (Holden 1971). The concentration of Na^+ in surface water varies from 150 to 460 mg/l in rainy sample, and from 980 mg/l to 2270 mg/l in winter season. In ground water samples it varies from 170 to 460 mg/l in rainy season and from 355 to 850mg/l in winter season. Surface water samples in rainy seasons exceed the permissible limit of 200 mg/l. The ground water samples S_2, S_3 and S_7 are with in the permissible limit during rainy season.The ground water and surface water samples in winter season have Na concentrated above the permissible limit of 200mg/l. Cl^- ranges form 300 mg/l to 1300 mg/l in rainy season and from 340 mg/l to 4000 mg/l in winter season for surface water and ground water samples. All the rainy and winter surface water and ground water samples have chloride concentration exceeding the required limit of 250 mg/l as per BIS. Excess concentration of Cl^- gives a salty taste and has a laxatic effect in people not accustomed to it. Concentration of So_4^{-2} ranges from 100 mg/l to 250 mg/l in rainy season for ground water and surface water samples. Samples S_1, S_5, S_6, S_9 have So_4^{-2} content above the permissible limit of 150 mg/l.The concentration of So_4^{-2} in winter season ranges from 350 mg/l to1500 mg/l. All the samples in winter season have sulphate concentration above the permissible limit. Higher concentration of So_4^{-2} associated with respiratory problem(Subba Rao 1993). In combination with $Na^{+,}$ Mg^{+2} ,So_4^{-2} also exerts cathortic effects on digestive tracts. No_3^- concentration of surface and ground water sample ranges from 10.8 to 60 mg/l in rainy season. The concentration of No_3^- ranges from 45 mg/l to 120 mg/l in winter season. In rainy season sample S_5 only exceed the permissible limit of 45 mg/l. All the surface water and ground water samples belonging to winter season exeeds the permissible limit. Excess No_3^- can cause a no. of health disorders, such as methamoglobinemia, gastric cancer, goitre, birth malformations and hyper tension (Majumdar and Gupta 2000). Fluoride is an essential element for maintaining normal development of healthy teeth and bone. Deficiency of F^- below 0.6 mg/l contributes to tooth F^- concentration in surface water samples ranges from 0.2 mg/l to 2.46 mg/l in rainy season and it range from 1.1 mg/l to 5.4 mg/l in winter season. It is above the permissible limit for samples S_5, S_6 in rainy season sample and crosses the permissible limits in winter samples. F^- concentration of ground water samples ranges from 0.13 mg/l to 0.76 in rainy season and from 0.85 to 1.3 mg/l in winter season.

The heavy metal Cd ranges from 0.36 to 0.18 in surface and ground water sample during rainy season and it range from 0.04 mg/l to 0.55 mg/l in winter season.It is above the permissible limit of 0.01 mg/l as per Bureau of Indian Standards (BIS). There are few recorded instances of Cd poising in human being following consumption of contaminated fishes. It is less toxic to plants than Cu**.** Similarly in toxicity to Pb and Cr it is equally toxic to invertebrate and fishes (Moore 1984).

Zn ranges from 1.3 to 4.9 mg/l of surface water and ground samples during rainy season and from 1.5mg/l to 6.5 mg/l in winter season. It is with in the permissible in rainy season. Samples S_1, S_5 crosses the permissible limits of 5 mg/l as per BIS during winter season. Zinc is toxic to many pants at widely varying concentration however it has been found to have low toxicity to man. Prolonged consumption of large doses can result in some health complications such as fatigue, dizziness and neutrophemia (Awofolu et al 2005). Although Zn is essential element involved in metabolic functions and is important for both man and plant heath growth (Jeffery 1992), but plants do not accumulate Zn to a degree that would be toxic to animals or human.

Ni varies from 0.20mg/l to 1.35mg/l in rainy samples. Samples S_1, S_3, S_5 are above the permissible limit of 1 mg/l as per BIS. The concentration of Ni varies from 0.45 to 3.81 mg/l in winter season. Samples S_1, S_3, S_5 S_7 and S_9 have Ni concentration above the permissible limit of 1mg/l. Ni is naturally occurring element found in a no. of minerals ores including enzyme urease and as such is considered to be essential to plants and some domestic animals (Awofolu Et al 2005).

Mn ranges from 0.08 to 2.25mg/l in rainy season and from 0.12 to 3.0 mg/l in winter season. Except S_4, S_8, S_9 all the samples in rainy season are above the permissible limit of 0.1mg/l as per BSI. All the samples of winter season are crossers the permissible limit. Mn has its source from industrial affluent at certain level, it is toxic to a no.of crops however there is no available data of human to toxicity.

Quality criteria for irrigation propose

EC and Na^+ plays a vital role in suitability of water for irrigation. Higher salt content in irrigation water causes an increase in soil solution osmotic pressure (Thorne and Peterson 1954). EC is a measure of the ions present in water and also effectively a surrogate for total dissolve solids. Salinity restricts the availability of water to plants by lowering the total water potential in the soil. Salinity also has an impact on crop physiology and yield with visible injury occurring at high salinity levels.

The food and agriculture organization (FAO Ayres and Westcot 1994) has developed guide line for the evaluation of water quality for irrigation and suggests that there need be

- No restriction on the use of irrigation water with an EC of 700 µS/cm or a TDS concentration of less than 450mg/L
- Moderate restriction if concentrations are in the range of 700 – 3000µS/cm or a TDS concentration of 450-2000 mg/L
- Severe restriction for irrigation water with an EC of greater than 3000 µS/cm or a TDS concentration of more than 1000mg/l.

The EC for rainy samples varies from 1200 µS/cm to 4000 µS/cm and from 4000-14,200 µS/cm in winter season. It is observed that all the samples have EC more than 700 µS/cm which is not safe for irrigation. In case of rainy season, samples $S_1$and S_3 contains EC greater then 3000 µS/cm hence surface water of S_1 and S_3 come under severe restriction for irrigation water. All the samples in case of winter season have EC much more than 3000 µS/cm hence the surface and ground water samples come under third category that is severe restriction for irrigation.

Another important chemical factor for judging the degree of suitability of water for irrigation is Sodium Hazard (or) Alkali Hazard which is express in sodium adsorption ratio (SAR). The SAR is computed, where the ion-concentration are expressed in meg/l as

$$SAR = \frac{Na^+}{(Ca^{+2} {}_{+} Mg^{+2}/2)^{0.5}}$$

There is a close relationship between SAR values in irrigation water and extent to which Na^+ is absorbed by soils. If water used for irrigation is high in Na^+ conc and low in Ca^{+2} concentration, the ion exchange may become saturated with Na^+ which destroy the soil structure, because of dispersion of clay particle. As a result the soil tends to become deflocculated and relatively impermeable. Such soils can be very difficult to cultivate.

The sodium hazard is expressed in terms of classification of irrigation of water as low (SAR<10) and medium (10-18) high (18 to 26) and very high > 26.

SAR varies from 2.72 to 10.18 in rainy season of ground and surface water samples. The S_5 sample only come under medium SAR sodium hazard. SAR varies from 18.0 to 32.16 in winter season of ground and surface water sample S_3, have low sodium hazard, S_4 have medium sodium hazard, S_1, S_5, S_7, sample have high sodium hazard. The samples S_3, S_6 are come under very high sodium hazard. The higher the SAR values in the water, the greater the risk of sodium.

The US salinity Laboratory's diagram (US Salinity Laboratory staff 1954) is used widely for rating the irrigation water. SAR is plotted against EC. It uses SAR(Vertical axis) and conductance (horizontal axis).

C1 (EC < 25µS/cm) low salty water. It can be used for each type soil and plant. C2 (250<EC<750µS/cm) medium salty water. It is suited for all plants. C3 (750- <EC<2250 µS/cm) high salty water, some plants tolerate. C4 (EC>2250 µS/cm) very high salty water, soil should be permeable and drainage should be rich. In addition to this, plants tolerating salinity should be chosen. S_1 has low sodium content water. It can be used in each type soil. S_2, S_3 - medium and high Sodium content water. It may be dangerous to soil. S_4 -very high sodium content water. It is unsuitable for irrigation.

IN GENERAL	STATUS FOR IRRIGATION
C_1 S_1, C_2 S_1, C_3 S_1	Suitable
C_4 S_1, C_3 S_2	Suitable in specific conditions
C_4 S_2, C_4 S_3	Unsuitable

The plot of chemical data of the surface and ground water samples of rainy samples of the area in the US Salinity Laboratory's diagram is illustrated in fig. 2 and for winter samples in fig 3. The surface and the ground water sample points, as shown as a cluster, samples S_3, S_4, S_7, S_8, S_9 fall in C_3S_1, samples S_2, S_6 fall in C_3S_2, samples S_1 fall in C_4S_2 and sample S_5 fall in C_4S_3.The samples S1 and S5 are unsuitable for irrigation in rainy season. The surface and ground water samples of winter season as shown in cluster in fig.3. S_2 sample fall under C_3 S_3 and samples S_1, S_3, S_4, S_5, S_6, S_7, S_8, S_9 fall under

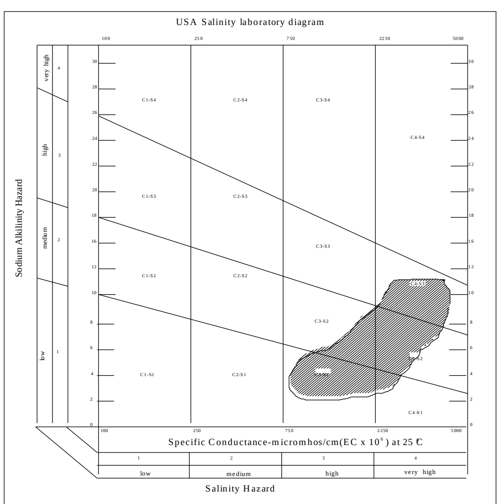

Figure 2: Classification of irrigation waters(after US Salinity laboratory staff 1954) rainy season. All Surface and ground water samples fall in the cross hatched area

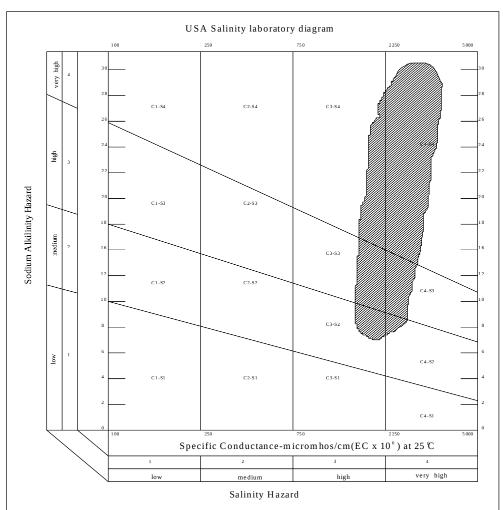

Figure 3: Classification of irrigation waters(after US Salinity laboratory staff 1954) winter season. All Surface and ground water samples fall in the cross hatched area

C_4S_4. C_3S_3 and C_4S_4 water are bad for irrigation. The percentage of good water decreases in winter season.

Percent sodium (% Na^+) is also widely utilized for evaluating the suitability of water quality for irrigation (Wilcox 1948). The % $Na^+$is computed with respect to relative proportions of cations present in water, where the concentrations of ions are expressed in meg/l, using the following formula

$$\% Na^+ = \frac{Na^+ + K^+}{Ca^{+2} + Mg^{+2} + Na^+ + K^+} \times 100$$

Excess Na^+, combining with carbonate, leads to formation of alkaline soils, where as with Cl^- saline soils are formed. Neither soil will support plant growth. Generally % Na^+ should not excess 60% in irrigation water. Samples S_4 and S_8 and S_9 have % Na^+ less than 60 all other samples have above 60% Na^+ in rainy season. The % Na^+ ranges from 72.8-90.4% in winter season for ground and surface water samples. All the samples have % Na^+ above 60 in winter season and is not fit irrigation.

Wilcox's diagram (Wilcox 1948), it uses present sodium ratio (vertical axis) and conductance (horizontal axis). Data of rainy season samples of the area are plotted in fig 4 and winter samples in fig 5. Samples S_2, S_4, S_6, S_7, S_8 and S_9 are can fall under the area of permissible to doubtful and samples S_3 under doubtful to unsuitable, and samples S_1 and S_5 under unsuitable quality of irrigation in rainy season. In winter season S_2 come under permissible to doubtful quality and remaining all the samples fall in unsuitable for irrigation.

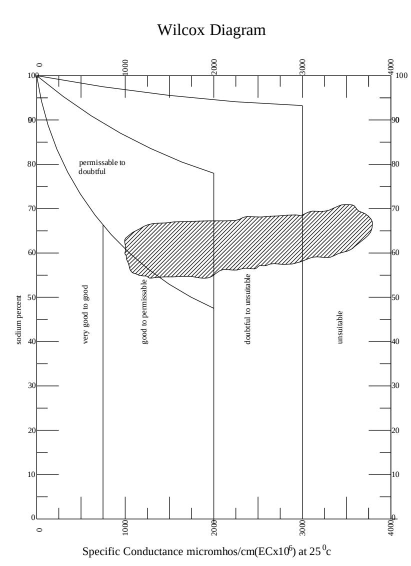

Figure 4: Classification of irrigation waters(after Wilcox 1948) Rainy season. All Surface and ground water samples fall in the cross hatched area

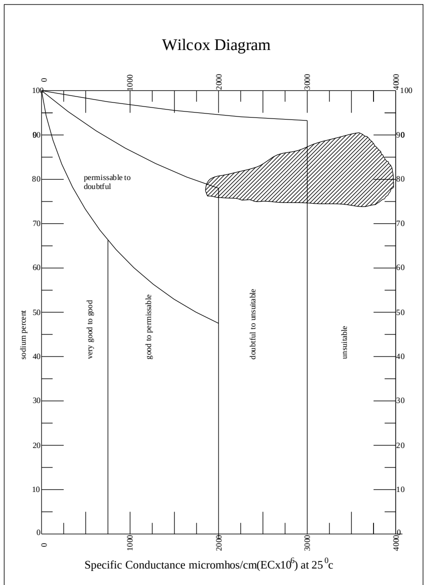

Figure 5: Classification of irrigation waters(after Wilcox 1948) Winter season. All Surface and ground water samples fall in the cross hatched area

Residual sodium carbonate (RSC), which is a frequently need parameter to assess the water quality for irrigation purpose the RSC is computed, where the ions are expressed in meg/l as show below.

$$\mathbf{RSC = (Co_3^{-2} + Hco_3^-) + (Ca^{+2} + Mg^{+2})}$$

The Residual Sodium carbonate (RSC) was reported to be 0.00. RSC does not adequately consider two factors in the chemical behavior of carbonate species (Hem 1991). $CaCo_3$ tends to precipitate independently and two leaves Mg^{+2} in solutions and production of Co_2 in soil by plants, which is a major source of Hco_3^-. Although irrigated soils might favors deposition of mixed carbonates, this does not seem to be source of $CaCo_3$. Eaton et al (1968) have reported that RSC is not a suitable index for determining the quality of irrigation water.

Excessive iron in waste water can reduce the dissolved phosphorous component through precipitation; therefore, phosphorus might not be readily available for plant up take in the presence of excessive iron. The concentration of iron ranged from 0.50 mg/l to 3.79 mg/l for surface and ground water samples in rainy season and from 0.80 to 6.2 mg/l in winter season. The WHO recommended maximum concentration of iron for crop production is 5mg/l, the samples S_1, S_3, S_5, S_6, S_8 and S_9 have iron concentration above the permissible limit.

CONCLUSIONS:

Surface and ground water pollution have had a direct impact on crop field and the food cycle. High total dissolved solids as it was found in rainy and winter season and chemical intermediate have degrades the soil. Yield may suffer due to the increase in salinity, loss of living structure of the soil complex and change in the physical and chemical properties of the soils. The effluents generated by industries are channeled into drains and into the lake consequently, the amount of pollutants and wastes generated by industries pose significant stress on the crops grow on the bank of these lakes, since the polluted lakes are used for irrigation to water crops along the lakes farm lands.

EC found to be very high in winter season, due to this the potential yield of crop may be reduced to 50% (R.S. Ayers). Sodium hazard calculated based on SAR values suggested that most of the samples in winter season have very high Sodium hazard, which is unsuitable for use of water for irrigation. Sodium in irrigation can also cause toxicity problems for crops. About 80% of the samples collected in rainy seasons and 100% samples collected in winter season have % Na^+ exceeding the limit of 60. On the basis of the U.S. Salinity laboratories diagram, about 50% of the samples fall under low category C_3 S_1, 25% of samples comes under C_3 S_2 moderate quality and 25% of samples falls under very bad quality for irrigation in rainy season, almost all the samples of winter season fall under C_4S_4 category i.e. bad quality for irrigation. According to Wilcox's diagram most of the samples in rainy season belongs to doubtful to unsuitable and it belongs to unsuitable in winter season. Since the surface water and ground water quality in the study area has been deteriorated, the following steps is suggested for sustainable development.

- The water already present in the lakes must be completely drained.
- Dredging of the sediments in the lakes has to be carried out. The sediments so removed must be transported elsewhere after de-watering to prevent them from re-entering the lake.
- The water should be let into the lake only after treating it suitably.
- The lake bottom should be covered with some material (could be fresh mud) to prevent recontamination of the water by contact with the already existing soil.
- The weeds should be removed and fishes, native species of plants introduced in their place.

REFERENCES :

1. Agarwal V, Jagetia M (1997) Hydrogeochemical assessment of ground water quality in udiapur city, Rajasthan India, proceedings of national conference on dimensions of environmental stress in India, dept. of Geology, M.S university Broda India, PP – 151-154)
2. Agemian H. and hau. A.S.Y. (1975) an atomic absorption method for determination of 20 element in the lake sediments after acid digestion Anal chem.. acta 80, 61 – 66.
3. APHA (1992) Standard methods for the examination of water and waste water, American public health association Washington
4. Ayres R.S and D. Westcot 1994. Water quality for agriculture FAO irrigation and drainage paper 29 Revision 1, Rome Italy: FAO)
5. Eaton FM, Mclean GW, Bredell GS Doner HE (1968) Significance of Silica in the loss of magnesium from irrigation water Soil Sci 105: 260-280
6. Hem J D (1991) Study and interpretation of the chemi9cal characteristics of natural water Book 2254, 3rd Edn, Scientific publishers, Jodhpur, India
7. Jeffery G.H. 1996 Vogel’s textbooks of quantitative chemical analysis (5th Edition). Addison Wesley, Longmann Ltd, Harlow England.
8. Jeffery P.K(1992) Environmental Toxicology London Edward Arnold limited 68-78.
9. Maiti Tc(1982) the dangerous acid rain sai report 916): 316-363.
10. Majumdar D. Gupta M(2000) Nitrate pollution of ground water and associated human health disorder. Indian Environ health 52 (11-28-29)
11. Moore J.W and Ramamoorthy.S (1984) Heavy metals in Natural Waters: Applied monitoring and impact assessment, Springer-Verlag: New York, 28-246.
12. R.S Ayers Quality of water for irrigation, Journal of irrigation and Drain, Div ASCE Vol 103, NO IRZ, June 1977 P140
13. Rainwater, F.H and Thatcher L.L 1960 Methods for collection and analysis of water samples U.S Govt. Print office Washington DC. U.S.A.
14. Subba Rao N (1993) Environmental impact of industrial effluents in ground water regions of Vishakapatnam Industrial complex Indian K Geol 65(1): 35-43.
15. Throne DW, Peterson HB (1954) irrigated soils, constable and company limited London.
16. U.S salinity laboratory staff (1954) Diagnosis and improvement of saline and alkali soils. US Department of Agricultural handbook, 60 Washington
17. WHO (1984) Guidelines for drinking water quality world health organization Geneva
18. Wilcox CV (1948) the quality of water for irrigation use. US department of agricultural Technical Bulletin 1962,Washington.