P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-III, July-2015
E: ISSN No. 2349 - 9443
Asian Resonance

A Comparative Study of Physico-Chemical Properties and Bacteriological Analysis of Narmada River at Mandla Town, Near Jabalpur City Madhya Pradesh, India

Manju Dubey
Professor,
Deptt.of Zoology
Rani Durgawati Govt. Post Graduate Collage,
Mandla, M.P.

Abstract

A systematic investigation has been carried out to study the physico-chemical charactestics of Narmada river at Mandla city, Madhya Pradesh, India. The study was carried out by collecting samples from different sites of Narmada river where the Sewage effluent drained to Narmada river. The water samples were analyzed for their physico-chemical characteristic. The parameters namely temperature, pH, Hardness, TDS, Chloride, alkalinity, free carbon dioxide, D.O and bacteriological test were analysed and compared with ISO- 10500 standard of drinking water quality of India. An attempt has been made to find the quality of river water is suitable for drinking purpose in Mandla city, India. The quality of water samples under study were above the desirable limit at some stations but within tolerance level. Mandla city and number of villages are settled on the bank of river Narmada. The load of Pollutants is increasing day by day in river Narmada. The quality of water source with reference to various parameters, extent of pollution stress on the river and potable water quality has been assessed.

Keywords: River Water, Physico-Chemical Parameters, Drinking Water Quality Parameters, Correlation Analysis.

Introduction

The social and industrial advancement of any country is not possible without sufficient and safe water supply. The basic problem of keeping out water resource free from pollution therefore, assumes greater importance in the present context. Due to industrialization and increase in town ships, the water needs of the growing population and rapidly growing industries have tremendously increased.

The source of surface water can be rain and river water, reservoirs, lakes or irrigation canals and sea/estuarine water. In general, such sources of water shows a characteristic seasonal changes in water quality and changes are more gradual and less dramatic in nature, although sometimes it can shows rapid changes in water quality due to natural process like rainfall, soil erosion etc. accidental or industrial discharges. Surface water is susceptible to algal blooms; if carbonate, nutrients and temperature conditions are favorable and such algal bloom can cause changes in water quality parameters like Turbidity, pH, odour etc. On the other hand ground water is more consistent in composition and shown almost no seasonal variation. However water quality variation taken place as location changes these dependent on chemical nature of surface strata though which percolation of water taken place.

Mandla is a District place in central Madhya Pradesh situated near Jabalpur city. It is geographically lies in the center of India at 22^0-30^0 N longitude and 80^0-30^0 E longitude. Average rainfall is about 1000 mm. Present population of the city including adjoining areas of gram khairy, is 72,000. It occupies an area of 17.04 square kilometer. Thus populationdensity into 24 wards for management of civic services and administration. The important commodities manufactured of around Mandla as steel utensils, PVC Pipe, Conductor, BC Cables etc. these has been fast developments in the area & population of city in last decade. About 60% of water of Narmada river water requirement for the population and

other small industries, and remaining water resources are well, bore wells and hand pump. Due to improper sanitation, waste disposal and faulty water resources creats illness and deformities. More than 40% of disease outbreaks were attributed to polluted water. It has created a serious question for human health as well as for aquatic life and aquatic resource disturbances and good quality, water is resticted only certain locations.

Mandla city is surrounded by Narmada river passing through the city. The water supply scheme is impleted from 1974 in the city. Pollution is befouling the environment by anthropological activities particularly by the disposal of solid, gaseous and liquid waste products. Most of our water bodies, rivers and streams have become polluted and unfit of human use. River Narmada in Mandla is no exception in this tribal region. Mandla city and number of villages are settled on the bank of river Narmada. The load of Pollutants is increasing day by day in river Narmada and this poses formidate challenge to water quality. The quality of water source with reference to various Parameter, extent of pollution stress on the river and potable water quality has been assessed.

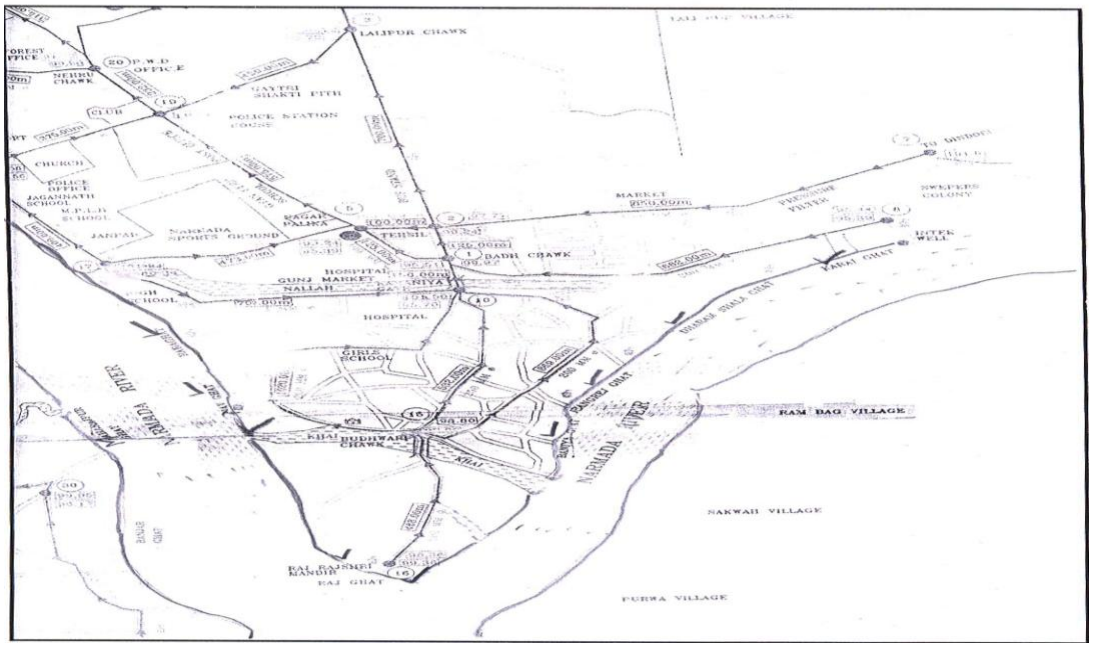
Ground water has been used for drinking for a long time and its purity had made it a well known source of potable water. Advancement of human civilization has put serious question to the safe use of ground water for domestic uses. There are several reports of pollution, increase in organic and inorganic contents like nitrate (Handa 1983, 1986[2], Bulusu et al 1990[3], Majumdar et al 2000[4]). Similar reports had appeared at different places for different physico-chemical constituents (Kakar, 1988[5], Gupta, 1991[6], Ozha 1993[7], Mussaddiq 2000[8],) occurrence of coliform is reported (Naraina Rai 1995[9]).

The discharge of various effluents and the domestic performed by the localities situated at the bank of Channel (Narmada river) may result the increase in the organic matter as well as rise the temperature of water. Increase in various Pollutants have degraded the precious water resources enormously, therefore is necessary to assess the quality of river water through different parameters. The water samples were collected from different sources and studies the physico-chemical and bacteriological quality of surface water. The aim of present study to find out the extent of stress on aquatic ecosystem caused by increasing amount of domestic waste (Sewage) and anthropogenic influence.

Material and Methods

The samples were colleted in clean and dry Plastic canes of two liter capacity without any air bubbles. Water samples were colleted from November 2010 to October 2011. The temperature and the pH value of the samples were noted at the sampling Point itself. The samples were put to examination in the laboratory to determine the physical, chemical parameters. Analysis was carried out for various water quality parameters i.e. TDS, Hardness, total carbon di-oxide, Alkalinity and DO using standard methods by APHA (1995[10]). The temperature is measured using the thermometer and pH is measured by pH meter on the spot. The total dissolved solids are measured by using TDS meter. Total corban dioxide, Hardness and Alkalinity are measured by using titrimetric method. Dissolve oxygen is measured directly from DO meter. The bacteriological test analyzed by Bacto-H_2S test procedure in selected months.

Map Showing Sampling Stations on river Narmada



P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-III, July-2015
E: ISSN No. 2349 - 9443 Asian Resonance

Observation

Table- 1
Physical Features of River Narmada at the Sampling Stations Surface Water

S. No.	Name	Characteristic of Station
1	Ghat of Badi Khairi Village	River enters into the city, domestic sewage enter through nullah, human activities- Bathing, Washing Clothes, Turbid water etc.
2	Ghat of Chhoti Khairi Village Mehtar Mohalla, Phool Badi	More anthropological activities, sewage enter through nullah in to the Narmada River.
3	Peepal Ghat, Swami Sitaram ward near temple.	Anthropological activities present hydrilla plants presents at the bank of Narmada River.
4	Ghat of Dhimar Mohalla Ayodhya nagar near agrawal dharmshala	nullah is enter to river more anthropological activities, Dirty place, fishing, roasting movements of Dongi / Nav.
5	Rangrej ghat , Near Munni Bai Dharmashala	A large canal of city sewage enter in to the Narmada river, activity of construction work, Dirty Place, Bridge construction .
6	Vaidhya Ghat	A large canal of city sewage enter in to Narmada river Anthopological activities.
7	Kila Ghat, near Raj Rajeshawari Mandir	More anthropological activities, movements of dongi /naav, water use for drinking purpose , Juction of Banjar and Narmada river
8	Naav Ghat Near Temple	Sewage canal enter in to Narmada river, anthopological activities.
9	Jail Ghat, Near Nehru Park, Temple and Mosque situated	Sewage water enter through nullah into the Narmada river

Result and Discussion

The Average temperature of the samples taken from winter, Summer and Rainy seasons were 23.6, 30.1 and 30^{o}c respectively (Chart-1). Higher temperatures was noted 34^{0}c in June and 20^{0}c noted lowest temperatures in January recorded. From our study suddenly rise in temperature was not recorded due to the addition of sewage or anthropological activities. The pH of water considered as an important ecological factors. The average value of Ph taken from winter, summer and rainy were 8.5 , 9.0 and 8.8 respectively. From our study the average highest value of pH was 9.0 in the Summer Season and lowest pH was 8.5 in month of November (Chart-2). It was noted that pH value is increased in the summer season. The total dissolved solid (TDS) in an indication of the degree of dissolved substances. The TDS in water are composed mainly of carbonates, bi-carbonates, chloride, phosphates, nitrate, organic matter, salt and other particles. The standard for TDS is proposed as 500mg/liter. The data colleted from the sample are 142.2 mg / lit in winter, 155.2mg / lit in summer and 96.8 mg/lit in Rainy season, which are under desirable limit (Chart-3). It is noted that TDS decreased in rainy season (July, August, and September) and it increased maximum at the summer season (March). The permissible limit for the chlorides in the drinking water is 250 mg/lit. The chloride concentration in water taken from different seasons was 49. 72 mg/lit in winter, 25.8 mg/lit in summer and 17.22 mg/lit in Rainy seasons (Chart-4). People consume higher Chloride water areas, subjected to Laxative effects. In our study it is within the permissible limit. The Dissolved oxygen or DO is most important parameter in water quality assessment. Aquatic ecosystem is totally depends on dissolved oxygen and various biochemical changes and its effects on metabolic activities of microorganism were very well documeted. The value of DO is 6.73 ppm in winter, 6.44 ppm in summer and 6.46 ppm in Rainy season. Mitra (1982)[12]. reported the recommended value of DO in normal drinking water was 8mg/lit. Devi (1980)[13]. reported that high DO value in Rainy season and low during summer in Asmaan sagar lake. Mahan (1980)[14] .recorded DO range as 4.61 mg/lit to 6.68 mg/lit in the winter season. In our study the value of DO was highest in winter season and lowest in summer season. Hardness is the Property of water which prevents the lather formation with soap and increases the boiling point of water. The hard water is not suitable for domestic use in washing, cleaning and loundering. In our present study the hardness value of water sample was 80.41 ppm in winter, 21.53 ppm in summer and 15.16 ppm in Rainy season which shows the maximum value in winter and minimum value in Rainy season . Free carbon dioxide is acidic in nature and its excessive prevalence makes the water corrosive, causing colour, odour and turbity problems. It is frequently appears in the polluted water, as a result of decomposition of organic matter. The higher concentration of carbon dioxide is indicative of pollution of water from the domestic and industrial wastes. In our present study seasonal average value of carbon di-oxide is 24.56 mg/lit in winter, 14.57 in summer and 17.22 mg/lit in Rainy season. Which shows the maximum value in winter season and lowest value in summer season. Alkalinity in natural waters is due to free hydroxyl ions and hydrolysis of salts formed by weak acids and strong bases. The water supplies with the less then 100 mg /lit are desirable for domestic use. In our present study average value of Alkalinity was 24.56 mg/ lit in winter 14.57 mg/lit in summer and 17.22 mg/lit in Rainy season, it shows the value are within permissible limit.

For making the water safe and Potable, only pathogenic bacteria are requires to be destroyed. These Pathogenic bacteria caused several diseases in human being i.e. bacillary dyesentry, Gastro-enteritis, Cholera, Typhoid and Enteric Fever, paratyphoid fever etc. In our study the presereve of bacteria observed through Bacto-H_2S testing procedure. In the Month of November, December (winter), March (summer) and August (Rainy) bacteriological test of water observed throught Bacto-H_2S testing procedure and presence of bacteria is noted. It is observed that at station no.3 and 7; water sample did not showed the presence of bacteria. The station no. 1,2,4,8 and 9 showed the presence of bacteria. Station no.7 of Narmada river at mandla is healthy station with fairly clear water, because no sewage water enter in to this station. The station no 1,2,3,4,5,6,8 and 9, when water runs through the city, it gets polluted because of anthropoligical activity as well as sewage discharge. The station 1,2,4,8 and 9 showed the positive reaction for bacteria, so the water may not suitable for drinking purpose but for other activities i.e. washing and bathing etc [15].

Conclusion

Narmada river is considered lifeline of the entire Mandla State Mandla is situated at the bank of River Narmada. Presently the waste water comprising of sewage water flows in to river Narmada, without any proper treatment. The Municiple waste water, the quantity of sewage and its characteristics shows, a marked range of variation, hence peak, average and minimum flow are important. At Present time about 3-4 MLD sewage is flowing in Narmada river The bitter truth is that according to the Indian standard organization (IS0) the pH value of the Narmada waters has been. recorded at 9.2 while drinking water pH levels must remain between 6.5 to 8.5[16].

Being a major district place, it is very necessary that the city should have the proper sewage system, the treated water reuse in various other purposes i.e. Agriculture, horticulture , watering of lawns, fire protection etc. It was noted that the dirty filth laden water and sewage of Mandla town drains in to river water , through 16 Nullahs or small canals from various ghats. Dirty filth laden water from at least 16 nullahs is falling in to the Narmada river which causes contamination an alarming stage. Solid waste such as human excreata, chemical fertilizers, and pesticides are also contaminating the water.Today farmers are using large quantity of chemical fertilizers and insecticides. The crop is irrigated at least 5 to 7 times, due to which the drained off excessive water that is now heavily mixed with the lethal chemicals seeps in to the earth of fields. During monsoons the same polluted earth mixed with rain water flows torwards the Narmada. According to a survey conducted by the water Resources Department contaminated and dirty water from residential colonies, small and large villages along the banks of the river are also a huge contributing factor towards the contamination of the great river. Human activities are common in ghats and water is used for washing, bathing, fishing, boating, and vehicle cleaning. Water is polluted by adding worship material, flower, fruit, remaining foods, ashes of human being after their last ceremony etc. It is suggested that all the sewage water is not added to direct in Narmada river but used as after treatment with the help of municipal corporation, Mandla and awareness of people. It is also suggested that the divert the flow of all the Nullahs that are at present flowing right into the river. Build a sewer system to divert domestic waste. Tightening the laws around the river banks for punishing those errant people who throw polyethene, coconut husk and other articles that are not water soluble.[19] There is an increasing awareness among the people of the town to maintain Narmada river water at their highest quality and purity levels and the present investigation prove to be useful in achieving the same said above.

Referencas

1. Handa B.K. - Effect of fertilizer on ground water quality in india “Int. Sym. On ground water development” A Perspective for the year 2000 AD, University of Rookee India **(1983)**
2. Handa B.K. - Pollution of ground water by Nitrates in India. *Bhu-Jal News*. 1:16- 19 **(1986)**
3. Bulusu K.R., Pandey S.P.Nitrates a serious threat to ground water pollution. *Bhu-Jal news* .5.39-43 **(1999).**
4. Majumdar and Gupta Narindu: - Nitrate Pollution of ground water and associated human health Disorder. *Indian. Journal. Env. Hlth*. 42(1)28-39**(2000).**
5. Kakar V.P.-Ground water quality monitoring in India. *Jal Vigyan Sameeksha*.13, 52-63 **(1988).**
6. Gupta S.C. :- Chemical character of ground water in Nagaur Ditrict (Rajasthan), *Indian Journal Env. Hlth*. 33(3), 341 – 349 **(1991).**
7. Ozha D.D., Varshney, U.P., Bohra J – Nitrate in ground water of some Districts of Rajathan. *Indian J. Env. Hlth*. 35(1) 15-19 **(1993).**
8. Mussaddiq M.Surface water Pollution of Morna River at Akola. *Pollution Research*. 19(4). **(2000)**.
9. Naraina Rai and Sharma H.C.–Bacterial Contamination of ground water in rural areas of North West U.P. *Indian J. env. Hlth*. 37(1) 37-41 **(1995).**
10. APHA: - Standard methods for the examination water and waste water, American Public Health Association, washington, DC. 2005, 19th Edition. **(1995).**
11. T. Senthilnathan, Parvatha varthini K.V. and Santhi M. George. Assessment of Ground water quality of Maraimalai Nagar town Near Chennai, *J.Envior Res.Develop* Vol 5 (4) 943-947, April – June **(2011).**
12. Mitra A.K.:- Chemical characteristic of surface water at selected gausing station in the river Godavari, Krishna, Tungabhadra *Indian. J. Eve. Hlth* 24(2) 165-179 **(1982).**
13. Devi. s: - Ecological studies of limon Plankfon of three fresh water body at Hyderabad. Ph.- D. thesis, os mania university, Hydrabad **(1980).**

14. Mohan K.S.T. A limnology of the of manorman orman sugar mill alomlack, PhD, thesis, Osmania University, Hyderabad.
15. Dubey, Manju. "Comparative study of Physico–Chemical and Bacterological quality of Surface and Ground water at Mandla city M.P." Minor Reseach, Project funded by UGC **(2009-2011).**
16. The HITVADA (News Paper). Sunday article, August 5, **(2012)**

Chart -1	
Season	**Average Temperature °C**
Winter	23-6 °C
Summer	30-1 °C
Rainy	30-4 °C

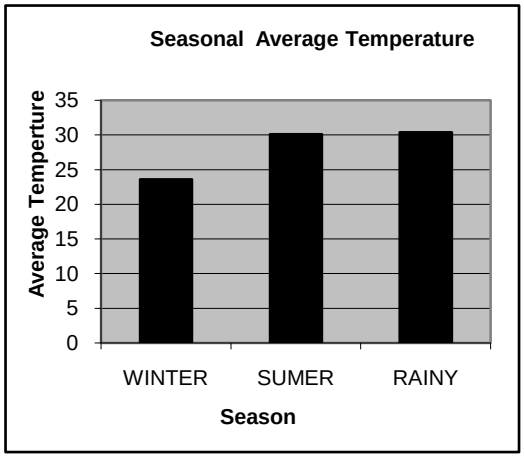


Chart :2	
Season	**Average pH Value ppm**
Winter	8-5 ppm
Summer	9 ppm
Rainy	8-8 ppm

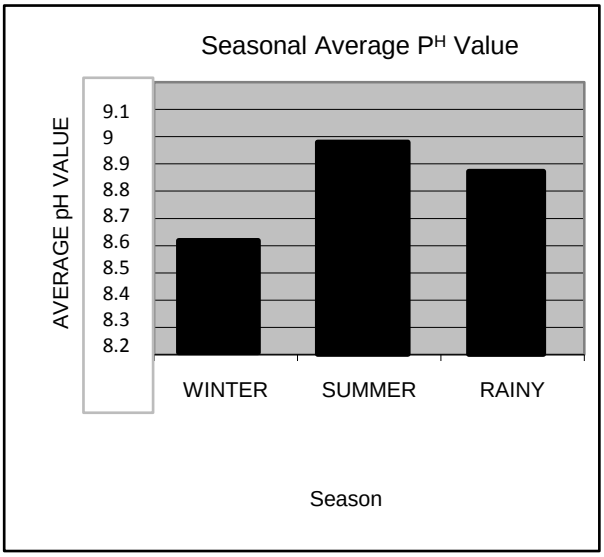
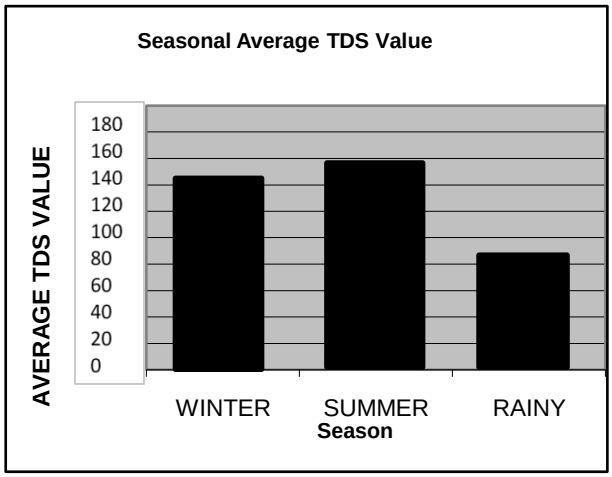
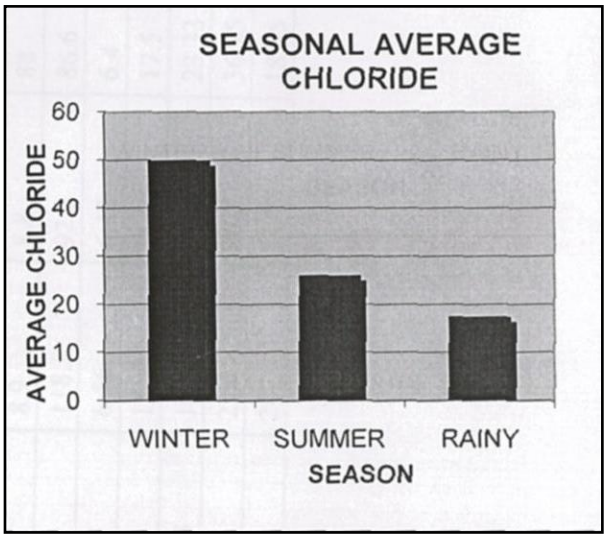


Chart :3	
Season	**Average Tds Value ppm**
Winter	142-29 ppm
Summer	155-27 ppm
Rainy	84-62 ppm

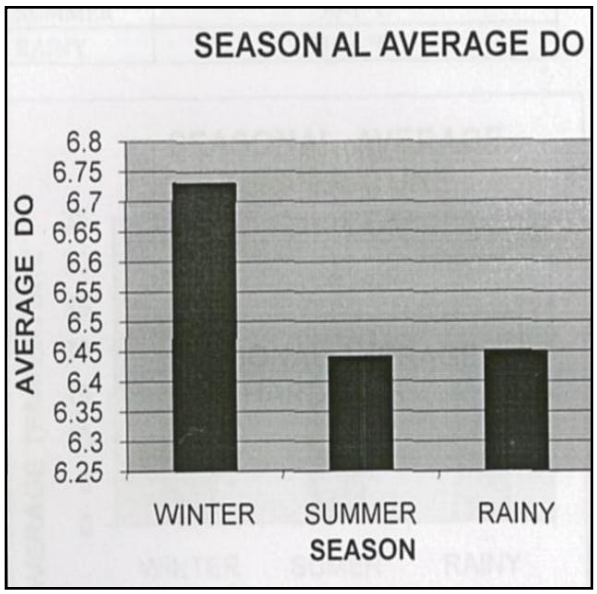


SEASON	AVERAGE CHLORIDE ppm
WINTER	49-72 ppm
SUMMER	25-82 ppm
RAINY	17-22 ppm

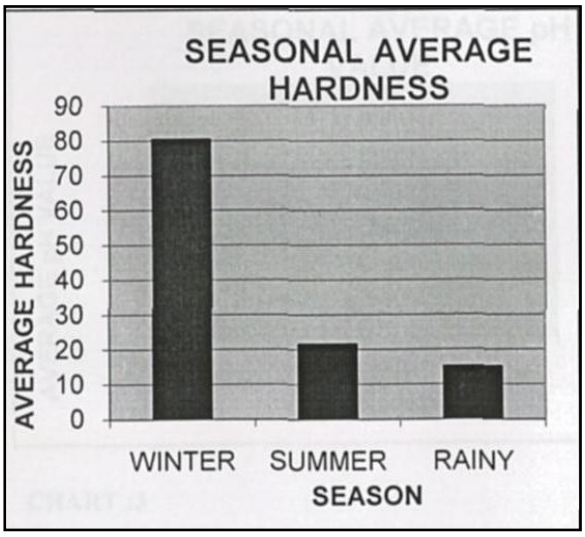


SEASON	AVERAGE DO ppm
WINTER	6-73 ppm
SUMMER	6-44 ppm
RAINY	6-45 ppm

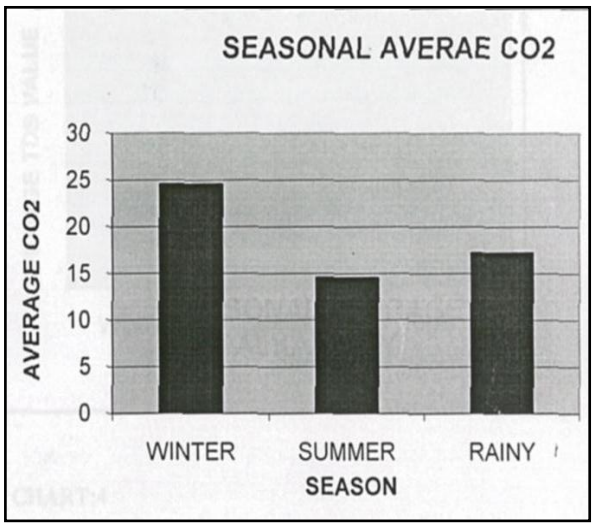
P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-III, July-2015
E: ISSN No. 2349 - 9443
Asian Resonance



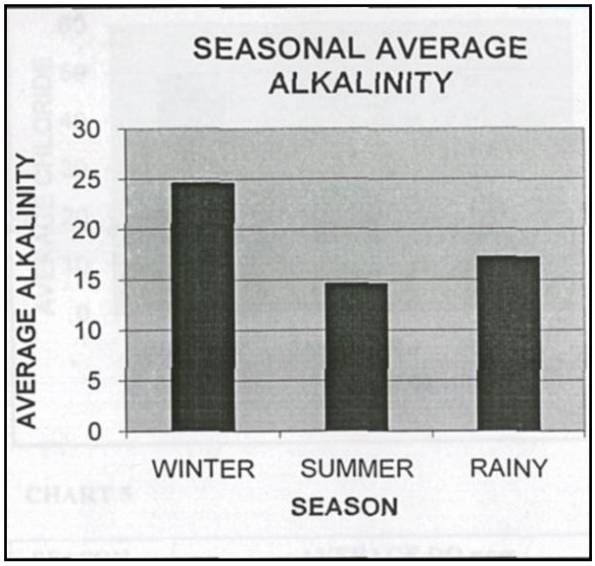
SEASON	AVERAGE HARDNESS ppm
WINTER	80-41 ppm
SUMMER	21-53 ppm
RAINY	15-16 ppm



SEASON	AVERAGE CO2 ppm
WINTER	24-56 ppm
SUMMER	14-57 ppm
RAINY	17-22 ppm



SEASON	AVERAGE ALKALINITY ppm
WINTER	24-56 ppm
SUMMER	14-57 ppm
RAINY	17-22 ppm



P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-III, July-2015
E: ISSN No. 2349 - 9443
Asian Resonance

SEASONAL DATA FOR VARIOUS PARAMETERS PERTAINING VARIOUS STATION

SEASONAL DATA FOR VARIOUS PARAMETERS PERTAINING VARIOUS STATION

SEASONAL DATA FOR VARIOUS PARAMETERS PERTAINING VARIOUS STATION

	WINTER SEASON										SUMMER SEASON								
PARAMETERS	S1	S2	S3	S4	S5	S6	S7	S8	S9	AVG	S1	S2	S3	S4	S5	S6	S7	S8	S9
TEMP.	23.6	22.2	23	23.1	23.6	23.5	25.8	23.8	24.2	**23.6**	30.11	29.9	30.7	30.1	30.1	29.8	30	29.5	30.5
pH	8.7	8.7	86	8.6	8.4	8.5	8.6	8.6	8.6	**8.5**	9.2	9.2	9	8.9	8.9	9.1	9.1	9	9.1
TDS	128.3	131.25	167.3	138.3	179.2	151.1	126.5	133.6	125.1	**142.29**	140.2	142.25	147.3	178.3	203	147.7	160	141	135.7
DO	6.31	6.35	6.95	7.11	6.72	6.95	6.66	6.71	6.83	**6.73**	6.72	6.65	6.28	6.25	6.13	6.31	6.48	6.47	6.66
HARDNESS	90	82.5	68.75	80	73.75	90	87.5	92.5	58.75	**80.41**	20	20	18.75	26.25	27.5	22.5	21.25	18.75	18.75
CO2	30	26.25	26.25	27.5	27.5	32.5	25	25	28.75	**24.56**	16.2	11.25	15	20	22.5	18.35	18.75	16.2	11.25
ALKALINITY	77.5	82.5	81.25	78.75	81.25	78.75	80.25	53.75	90	**79.33**	31.25	27.5	26.25	26.25	25.3	22.3	28.75	30	17.5
CHLORIDE	77.5	70	80	47.5	52.5	75	50	52.5	49.72	**49.72**	31.25	26.25	27.5	25	22.5	22.5	23.7	27.5	26.25

	RAINY SEASON									
AVG	S1	S2	S3	S4	S5	S6	S7	S8	S9	AVG
30.1	31.6	23.5	31.1	31	31	31.5	31.4	31.5	31.3	**30.4**
9	8.9	8.9	8.9	8.8	88	8.7	9	8.9	8.9	**8.8**
155.27	88.3	88.5	118.5	92.2	86.6	104	130.6	85.5	77.1	**96.8**
6.44	6.77	6.6	6.56	6.42	6.4	6.3	6.33	6.45	6.27	**6.46**
21.53	15	15	15	11.25	17.5	16.25	175	13.75	15	**15.16**
14.58	16.6	18.33	16.6	16.66	23.33	16.66	6.66	18.33	13.33	**17.34**
26.66	27.5	27.5	23.75	26.5	36.25	27.5	27.5	28.75	21.25	**27.38**
25.82	17.5	15	20	21.23	18.75	15	17.5	17.5	12.5	**17.25**