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SEA WATER & COASTAL SOIL ANALYSIS FROM SELECTED COSTAL AREAS OF BHAVNAGAR DISTRICT, GUJARAT, INDIA.

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ABSTRACT

In India, Gujarat is the only State having the largest coastal area spread around 1600 km. Bhavnagar is developed on the gulf of Khambhat; with coastal areas such as Ghogha, Kuda, Koliyak, Hathab, Mithiviradi, Zanzmer, Gopnath. The Quality of Sea Water depends on the coastal diversity about soil quality, due to that it also affects the diversity of plants and animals of the coastal region. The sea water analysis is performed for parameters such as pH, Temperature, Electrical Conductivity, Salinity, Total Dissolve Soild, Acidity, Alkalinity, Chloride, Total Hardness, Ca^{+2}, Mg^{+2}, Dissolve Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand and soil from coastal area also subjected for soil analysis parameter such as pH, Temperature, Electrical Conductivity, Salinity, Chloride, Ca^{+2}, Mg^{+2}, Soli texture, Soil moisture, Soil porosity, Soil buffering capacity, Water holding Capacity, and Organic Carbon. It is making the impact on our finding gives us the knowledge of Seawater and coastal soil richness and diversity at a particular location; such as sandy, rocky and muddy. The coastal area affects the diversity of plants such as xerophytes and halophytes, which is dependent on the quality of the coast. Due to that, the analysis result gives us a beautiful scenario for habitat impact on seawater and coastal / tidal region soil.

Keywords: *Qualitative Analysis, Seawater, Coastal area Soil, Abiotic factor*

INTRODUCTION

Sea water is the biggest water resource on the earth and coastal area is the most dynamic parameterof the sea water. The quality of sea water is influenced by the coastal area and its components. Those will help to understand the effect of the abiotic parameters on the biotic parameters such asflora and fauna of the coastal region. (Bhadja, P., Kundu, R. 2012; Efe. S. T. 2001 and Xiaojun Y.2008)

Present study was carried out for analysis of water and soil like abiotic factors from the coastal area of places Ghogha, Kuda, Koliyak, Hathab, Mithiviradi, Zanzmer, Gopnath; which is directly affects the coastal biodiversity. The pH, Temperature, Electrical Conductivity, Salinity, Total Dissolve Solid, Acidity, Alkalinity, Chloride, Total Hardness, Ca^{+2}, Mg^{+2}, Dissolve Oxygen, Biological Oxygen Demand and Chemical Oxygen Demand from water and pH, Temperature, Electrical Conductivity, Salinity, Chloride, Ca^{+2}, Mg^{+2}, Soli texture, Soil moisture, Soil porosity, Soil buffering capacity, Water holding Capacity and Organic Carbon of coastal soil. The variationin above mention parameters gives us a clear scenario for the viability of biodiversity. That will help us to understand the diversity of life at coastal area.

MATERIALS AND METHODS

Soil and Water sample has been collected from the coastal area from approachable locations of a places Ghogha, Kuda, Koliyak, Hathab, Mithiviradi, Zanzmer, Gopnath and subjected for

theanalysis (Fig. 1). The Potential of Hydrogen (pH) was measured by using the pH meter, by calibrating pH meter with the help of buffer tablet of pH 7.0, 4.0 and 9.2. After that all the samplespH was measured at the room temperature (Maiti, 2001; Pandya et al. 2015). The temperature is measured by thermometer. The conductivity of the water samples was measured by the conductivity meter. The conductivity cell is calibrated by using the chemical 0.01 N KCl and the specific conductance is 1.0 constant. The specific conductance is measured at room temperature inthe laboratory (Maiti, 2001; Pandya et al. 2015). Salinity is measured with the reflexive index method (Maiti, 2001). Total dissolve solids a well-mixed, 100 ml sample was analyzed by digital TDS meter, which counted in the unit of mg/L (Pandya et al. 2012, 2015). The alkalinity was estimated by the titration method. Water samples were titrated against 0.02N sulphuric acid, usingphenolphthalein as an indicator (Saxena, 1998). The acidity was estimated by the titration method.Water samples were titrated against 0.02N NaOH solution, using methyl orange as an indicator (Maiti, 2001). The hardness of the Calcium and Magnesium were measured by the titration method.EDTA was added to water containing both Ca and Mg, it combines first with Ca. Calcium can bedetermined by EDTA, when the pH is made sufficiently high so that Mg is largely precipitated asthe hydroxide and an indicator is used that combines with Ca only. Indicators give a color changewhen all of the Ca has been complexes by EDTA. (Maiti, 2001) Dissolve oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) is measured by the methods described by Maiti, 2001. Soli texture is analysed by sieve tube method. Soil buffering capacity is measured by titration method, Water holding capacity, porosity and Soil moisture is measured bygravimetric method as described by Benton Jones, Jr. J. (1930).

Fig. 1 Bhavnagar Dist. Coastal Area. Sample collection sites on the Map of Gujarat, India.

RESULT

1. SEA WATER ANALYSIS:

During Seawater analysis the water from Mithiviradi coast shows highest **pH** among all the coastwhich is 8.87 followed by Ghogha, Zanzmer, Gopath, Hathab, Kuda where pH is 8.14, 8.09, 8.06,8.04, 8.01 respectively. The sea water from Koliyak coast shows lowest pH 7.90. the range of pHis from 7.90 to 8.87 which shows basic nature (Table No.1).
The **Temperature** of sea water also varies with the region. As the pH value, the sea water of Mithiviradi is also highest in the temperature which is 27.9 °C followed by 26.6 °C in Kuda. The lowest temperature of sea water is fund in Hathab, which is 25.2°C (Table No.1).

Electric Conductivity of sea water in high to low ratio Mithiviradi, Zanzmer, Gopnath, Hathab, Koliyak, Kuda and Ghogha are 36.7 X 10^{-3} ms, 35.2 X 10^{-3} ms, 35.1 X 10^{-3} ms, 34.9 X 10^{-3} ms,
34.7 X 10^{-3} ms, 33.4 X 10^{-3}ms, 33.0 X 10^{-3} ms respectively (Table No.1).

The **Salinity** of sea water in different coast are 34.7 ppt, 34.1 ppt, 33.8 ppt, 33.8 ppt, 33.6 ppt, 33.6ppt and 33.5 ppt in Mithiviradi, Hathab, Ghogha, Gopnath, Kuda, Koliyak, and Zanzmer respectively, while the highest saline water is found in Mithiviradi and lowest saline water found in Zanzmer (Table No.1).
Sea water of Zanzmer consist highest **Total Dissolve Solid** which is valued 195.3 (mg/L). On theother hand, the lowest TDS found in the water of Koliyak which is 101.5 (mg/L). while the TDS of other sea water sample from coastal regions are as follows 190.5 mg/L in Gopnath, 167.1 mg/Lin Kuda, 159.6 mg/L in Ghogha, 146.3 mg/L in Mithiviradi and 119.5 mg/L in Hathab (Table No.1).
The highest **Acidity** found in Koliyak region is 97.5 mg/L which is followed by 91.5 mg/L in Hathab. The lowest acidity found in sea water of Ghogha and Gopnath is 82.5 mg/L. While in others coast like Kuda, Zanzmer, Mithiviradi the acidity of sea water is 85.5 mg/L, 84.5 mg/L,
83.25 mg/L respectively (Table No.1).

The highest **Alkalinity** found in 245 mg/L in sea water of Mithiviradi while lowest found in 195 mg/L in sea water of Hathab coast. Descending order of alkalinity in other areas are as follows: 230 mg/L, 225 mg/L, 215 mg/L, 215 mg/L, 210 mg/L in Zanzmer, Gopnath, Ghogha, Koliyak, and Kuda respectively (Table No.1).
The highest amount of **Chloride** content found in Mithiviradi which is 15.97 %, while the lowestfound 13.03 % in Hathab. The second highest value found is 15.59 % in Gopnath coast. In other coast like Kuda, Zanzmer, Koliyak and Ghogha, the chloride content of sea water is 15.14 %, 15.02
%, 14.69 %, 13.41 % respectively (Table No.1).

The **Total Hardness** in sea water as different coastal regions are as follows 121 mg/L, 114 mg/L,112 mg/L, 100 mg/L, 98 mg/L, 95.4 mg/L, 80 mg/L in Ghogha, Kuda, Gopnath, Mithiviradi, Zanzmer, Hathab, and Koliyak respectively (Table No.1).
Ca2+ content in sea water is the descending order like 19.38 mg/L, 19.15 mg/L, 18.42 mg/L, 16.02mg/L, 14.97 mg/L, 13.61 mg/L and 12.49 mg/L in Mithiviradi, Gopnath, Zanzmer, Hathab, Ghogha, Koliyak respectively (Table No.1).
In sea water of Ghogha, Kuda, Gopnath, Mithiviradi, Zanzmer, Hathab, and Koliyak shows **Mg2+**content 106.9 mg/L, 100.3 mg/L, 92.85 mg/L, 80.7 mg/L, 79.58 mg/L, 79.39 mg/L, 67.51 mg/L respectively (Table No.1).
The **Dissolved Oxygen** in sea water of Mithiviradi is in highest amount (8.90 mg/L), the sea waterof Gopnath have 7.70 mg/L dissolved oxygen. While sea water of Ghogha, Hathab and Zanzmer have similar value of dissolved oxygen in it which is 7.29mg/L. On the other hand, Sea water of Kuda has 6.48mg/L dissolved oxygen (Table No.1).
The highest **Biological Oxygen Demand** of sea water found in Mithiviradi which is 5.8 mg/L, while the lowest BOD is found in the sea water of Zanzmer which is 4.45 mg/L on the other hand,in Koliyak, Hathab, Kuda, Ghogha, Gopnath, the values of BOD are 5.67 mg/L, 5.66 mg/L, 4.86 mg/L, 4.85 mg/L, 4.8 mg/L respectively (Table No.1).

The highest **Chemical Oxygen Demand** of sea water found in Mithiviradi which is 189.6 mg/L, while the lowest COD is found in the sea water of Ghogha which is 178.8 mg/L. On the other hand,in Kuda, Hathab, Zanzmer, Gopnath, Koliyak the values of COD are 187.2 mg/L, 184.6 mg/L,
183.6 mg/L, 180.4 mg/L, 180.0 mg/L respectively (Table No.1).

2. COASTAL SOIL ANALYSIS:

The **pH** of soil on different coast is ranging between 7.7 to 8.48. The highest pH value found

in soil of Zanzmer while lowest value of soil found at Ghogha (Table No.2).
The soil **Temperature** in all coast is ranging between 21.3 to 26.9 °C. Lowest found in Kuda, on the other hand, highest found in Mithiviradi (Table No.2).
The lowest **Electric Conductivity** found is 1.75 X 10^{-3} ms in the soil of Ghogha while the highestfound is 4.93 X 10^{-3} ms in the soil of Zanzmer. The range of Electric conductivity of all places is 1.75 X 10^{-3} to 4.93 X 10^{-3} ms (Table No.2).
The **Salinity** of soil ranges between 31.5 ppt to 34.6 ppt. The highest salinity found is 34.6 ppt in the soil of Mithiviradi and the lowest salinity found is 31.5 ppt in Ghogha region (Table No.2).
Chloride content found in soil of coastal regions is in the range of 0.110 to 0.205 %. The lowest amount found in the soil of Ghogha and the highest amount of Chloride found in Koliyak (Table No.2).
The presence of **Ca^{2+}** found in the range of 0.2082 to 0.5047 mg/L. the lowest calcium content found in the soil of Hathab and highest amount found in the soil of Zanzmer (Table No.2).
The Highest content of **Magnesium** ion found is 2.49 mg/L in the soil of Gopnath while the lowestamount found is 1.47 mg/L in the soil of Ghogha. The overall range of Mg2+ in all the coastal region is between 1.47mg/L to 2.49 mg/L (Table No.2).
The overall range of **Soil Moisture** of all coastal areas is between 2 to 6 %. The highest moisture content found in the soil of Ghogha and lowest in the soil of Gopnath (Table No.2).

The Highest **Soil Porosity** found in the soil of Gopnath while lowest soil porosity found in soil ofMithiviradi. Soil porosity ranges in 9 to 15.5% (Table No.2).
The **Water Holding Capacity** of the soil is ranges between 13.58 to 27.40. The Highest was foundin the soil of Gopnath while the lowest was found in Mithiviradi (Table No.2).
The **Organic Carbon** content found in the all coastal regions. The assortment of organic content is between 31.5 to 36.3. The lowest amount of organic content distributed in the soil of Zanzmer while the highest was found in the soil of Ghogha (Table No.2).
The **Basic Buffering Capacity** of soil is ranging between <12.9 to <13.6. The lowest basic buffering capacity is found in the soil of Zanzmer while highest was found in the soil of Koliyak.
The **Acidic Buffering Capacity** of soil is ranging between >1.9 to > 4.2. The lowest acidic buffering capacity found in the soil of Koliyak while highest was found in the soil of Mithiviradi.(Table No.2)
The amount **Corus** in soil found in the range of 8.5 g in Gopnath to 95.3g in Ghogha.

Amount of **Gravel** ranges between 4.2 g to 69.6 g. Lowest amount of Gravel found in the soil of Ghogha while highest found in the soil of Gopnath.
Fine Sand ranges between 0.1g to 18.9g. Highest amount found in the soil of Zanzmer. On the other hand, lowest amount of fine sand found in Ghogha.
Lowest amount of **Slit** found in the soil of Ghogha as well as Zanzmer while highest amount of slitfound in the soil of Gopnath. Slit ranges between 0.2g to 4.4g.
Clay ranges between 0.1 to 1.6 g in all the types of coastal regions. The lowest amount of clay found in the soil of Mithiviradi and highest amount of clay found in the soil of Kuda, Koliyak. (Table No.3)

Table No. 1 Sea Water Analysis

Parameter	Collection Site						
	Ghogha	Kuda	Koliyak	Hathab	Mithiviradi	Zanzmer	Gopnath
pH	8.14	8.01	7.90	8.04	8.87	8.09	8.06
Temp.[°C]	25.9	26.6	26.4	25.2	27.9	26.2	26.5
EC [ms × 10^{-3}]	33.0	33.4	34.7	34.9	36.7	35.2	35.1
Salinity [ppt]	33.8	33.6	33.6	34.1	34.7	33.5	33.8
TDS [mg/L]	159.6	167.1	101.5	119.5	146.3	195.3	190.5
Acidity [mg/L]	82.5	85.5	97.5	95.1	83.25	84.5	82.5
Alkalinity [mg/L]	215	210	215	195	245	230	225

Chloride [%]	13.41	15.14	14.69	13.03	15.97	15.02	15.59
Total Hardness [mg/L]	121	114	80	95.4	100	98	112
Ca^{+2}[mg/L]	14.97	13.61	12.49	16.02	19.38	18.42	19.15
Mg^{+2} [mg/L]	106.9	100.3	67.51	79.39	80.7	79.58	92.85
DO [mg/L]	7.29	6.48	6.89	7.29	8.90	7.29	7.70
BOD [mg/L]	4.85	4.86	5.67	5.66	5.8	4.45	4.8
COD [mg/L]	178.8	187.2	180.0	184.6	189.6	183.6	180.4

Table No. 2 Coastal Soil Analysis

Parameter		**Collection Site**						
		Ghogha	**Kuda**	**Koliyak**	**Hathab**	**Mithiviradi**	**Zanzmer**	**Gopnath**
pH		7.7	8.05	8.15	7.8	8.1	8.48	8.11
Temperature [℃]		21.5	21.3	22.4	22.5	26.9	25.7	25.1
EC [ms]		1.75	3.86	2.08	1.98	4.83	4.93	4.59
Salinity [ppt]		31.5	32.2	32.6	32.9	34.6	33.2	33.7
Chloride [%]		0.110	0.187	0.205	0.174	0.149	0.159	0.153
Ca^{+2} [mg/L]		0.3043	0.3684	0.2403	0.2082	0.2422	0.5047	0.4806
Mg^{+2} [mg/L]		1.47	1.68	1.21	2.00	2.16	2.16	2.49
Soil moisture [%]		6	5.5	5.6	5.9	4.5	2.5	2
Soil porosity [%]		10	10	10.5	11.5	9	12.5	15.5
Water holding Capacity		20.21	18.81	18	19.16	13.58	25.99	27.40
Organic Carbon		35.7	33	32.4	33.6	36.3	31.5	33.9
Soil buffering Capacity	**NaOH**	<13.6	<13	<13.5	<13.2	<13.2	<12.9	<13.2
	HCl	>2.5	>3.5	>1.9	>2	>4.2	>2.5	>2.6

Table No. 3 Coastal Soil Texture

Soli texture [gm]	**Collection Site**							**Sieve Size (mm)**
	Ghogha	**Kuda**	**Koliyak**	**Hathab**	**Mithiviradi**	**Zanzmer**	**Gopnath**	
Corus	95.3	51.2	83.4	74.5	84.3	16.7	8.5	60
Gravel	4.2	29.2	5.8	14.3	7.3	63.5	69.6	120
Fine Sand	0.1	15.7	7.4	10.2	8.0	18.9	17.3	240
Slit	0.2	2.3	1.8	0.7	0.3	0.2	4.4	350
Clay	0.2	1.6	1.6	0.3	0.1	0.7	0.2	Lid

DISCUSSION

Any ecosystem is a composition of organism and physiochemical (abiotic) factors. The pH of seawater is in the range of 7.90 to 8.87 it shows minute variations as the location changes but as the all coast touches the Arabic there is no such fluctuation found in the pH value and the values of alkalinity and acidity which shows the resemblance with results of Bhadja *et. al.* (2011). As the result of pH the other parameters like temperature, TDS, Salinity, Dissolved oxygen, BOD, COD,Ca^{2+} concentration and Mg^{2+} concentration are also match with the results of Bhadja *et. al.* 2011. The coastal soil or marine soil is studied as an important component of marine ecosystem. It influences the growth, replica and metabolic actions of biotic components including microbes (Manikandan R, 2016). The pH of soil is ranges between 7.7 to 8.48 which is similar to the resultsof Sajitha S. S. *et. al.* (2017). The results of electric Conductivity, Organic Carbon, Ca^{2+} and Mg^{2+} show the similarities with the results of Manikandan R, 2016. The soil of different coast regions shows different type of soil texture due to various type of soil components like sand, slit, clay (Manikandan R, 2016 and Ming He *et. al.*, 2004) (Table No.3).

CONCLUSION

The present study reveals that the effect of abiotic components of coastal soil structure and its components are making direct impact on the quality of the sea water. That will also affect on the flora and fauna present on the intertidal zone of the coastal area. On the basis of the present study,the farming or the culture of the marine algae, halophytes and mangrove cultivation can be plan for the further study.

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