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Physio-Chemical Analysis of Soil and Water to Assess the Impact of Anthropogenic Activities on Mangroves.

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Abstract: The mangrove ecosystem is one of the most important ecosystems on earth. It saves the land from heavy floods, wind, and soil erosion with ample benefits. The mangrove ecosystem helps groundwater recharge, provides habitat for flora and fauna, and helps in maintaining moisture for mudflats. Despite having lots of benefits mangrove ecosystem faces many threats, one of the major threats is urbanization and increasing human activities. Samples were collected from the Gulf of Cambay near Vadgam Village, which is an estuary region where Sabarmati River water meets the seawater. Various parameters pH, E.C, acidity, alkalinity, total hardness, calcium hardness, TSS, COD, BOD, Nitrate, sulphate, fluoride, phosphate, and DO were analyzed for assessment of water quality. For soil quality analysis various soil physical and chemical properties were analyzed. Values of parameters shows greater impacts on mangrove ecosystem.

Key Words: Mangrove ecosystem, Water, Soil, Human activities

I. INTRODUCTION:

Mangrove ecosystem is one of most important ecosystem on earth. It provides various ecosystem services. Mangrove ecosystem helps for ground water recharge, provides habitat for flora and fauna, helps in maintaining moisture for mudflat. Mangrove reduces soil erosion and impact of tides on coastal zone. Hydrological characteristics of wetland and untreated municipal water waste local industries, electronics waste from dump site of these compounds recorded presence of PBDEs which will accumulate in various compartments of wildlife and human food webs (Binelli *et al.,* 2007). At least 35% of the area of mangrove forests has been lost in the past two decades, losses that exceed those for tropical rain forests and coral reefs, two other well-known threatened environments (Valiela *et al.,* 2001). Due to mismanagement and implementation gaps mangrove habitats are damaged severely. There is indirect Impact on humans. Extracts from mangrove and mangrove dependent species have proven activity against human and plant pathogens. Fishery and ecotourism industry can be great option as commercial point of view (Kathiresan and Bingham, 2001).

II. STUDY AREA:

Gulf of Khambhat lies between the latitude 20.31 81˚N and longitude 72.61 90˚E. This Gulf area is characterized by the estuaries, like the Sabarmati, the Mahi, the Narmada, the Kim, the Dhandhar and the Tapti; extensive mud flats, dunes, scattered sandy beaches which makes this Gulf very much diverse ecotype. Because of the diverse nature and number of estuaries, these zones are also known as "estuarine delta". Vadgam is located estuary of Sabarmati river. It is one of important village for mangroves in Khambhat taluka as well as famous tourist spot due to presence of Sikotar Mata temple. There is chance of humidity in air, with an average of 33. 33 degree Celsius may is the warmest month. Average rainfall for Vadgam is 730. Data shows about 4.52% average rain.

2.1 Map of study area:

Figure:2.1.1: Map of Gujarat

Figure:.2.1.2 : Map of Khambhat

Figure:2.1.3: Map of Vadgam
(Image source: Google map)

III. MATERIAL AND METHODS:

Water Samples were collected in BOD Bottles and soil samples collected in zip bags sent to laboratory for further analysis of physio-chemical parameters. Samples were collected and analyzed by standard collection and analysis method given in APHA, (2005) for water and Basu, (2011) for soil.

IV. RESULT AND DISCUSSION:

Vadgam is estuaries region of Sabarmati. Due to presence of GIDC and other anthropogenic activity Sabarmati. Marine water as well as mangroves at Vadgam is exposed to Sabarmati water.

4.1 Physiochemical parameters of water:

4.1.1. Water pH: pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. The pH level of samples collected were well within the permissible limits. . Mangroves achieve maximum root growth at an alkaline pH of 6 and maximum shoot growth at an alkaline pH of 10. Lower than 6 retards mangrove seedling growth and is a cause of mangrove death. Samples collected were well within the permissible limits i.e. 6.8. Sample is in acidic nature.

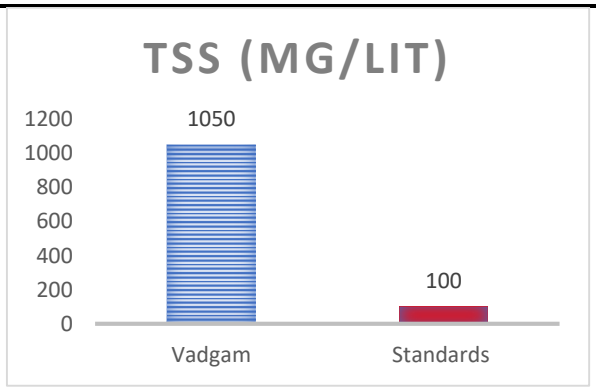
4.1.2. Acidity: Acidity is about 250mg per liter. Study reveals very low acidy.

4.1.3. Electric conductivity (E.C): Conductivity is a measure of waters capability to pass electric flow. This ability is directly related to the concentration of ions in water. The result of water sample show that the electric conductivity of the water is higher. i.e. 150.

4.1.4. Alkalinity: Alkalinity refers to capacity of water to nitriles acid (Scarpa *et all*., 1992). It's is also known as buffering capacity. Alkalinity of water sample is 45 mg per liter which is considerably low.

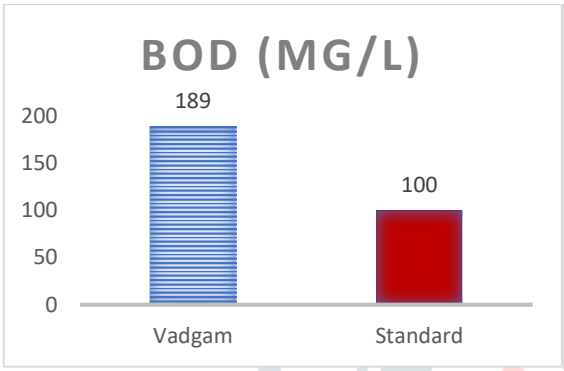
4.1.5. Total hardness and calcium hardness: The low solubility of the carbonates in the sea serves us well. We have it to thank for coral reefs, for the numerous pleasant tropical islands made from these reefs, and for the storage of many, many millions of tons of CO_2. The CO_2 now locked up under water in marine carbonates sudden. Current study reports total hardness 14000 ppm, Ca hardness 800 ppm. Results shows sample is very hard water.

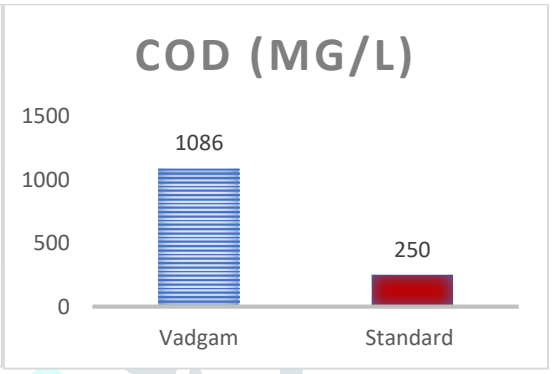
4.1.6. Total Suspended Solids (TSS): Suspended solids are the undissolved particles that are found in a state of suspension in the water. Such particles affect the optical clearness of water which is very necessary for the marine ecosystems**.** TSS of water sample is high than given standards, which clearly represent human activities near sea area.



Graph 1: Total Suspended Solids

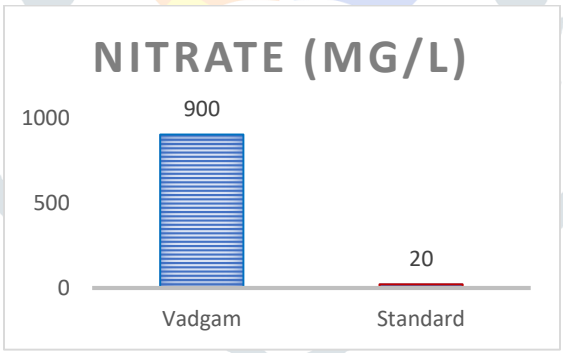
4.1.7. COD and BOD: COD is the amount of dissolved oxygen required to cause chemical oxidation of the organic material in water, while biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample.





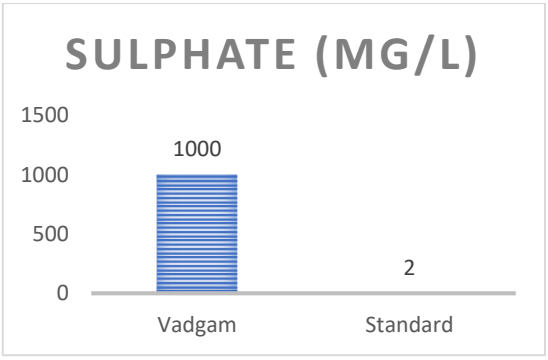
Graph 2: Biological Oxygen Demand **Graph 3: Chemical Oxygen Demand**

4.1.8. Nitrate: Nitrate content in the water and stream acts as a nutrient provider. Result shows high amount of nitrate in marine water. This can be due to effluents released in water.



Graph 4: Nitrate

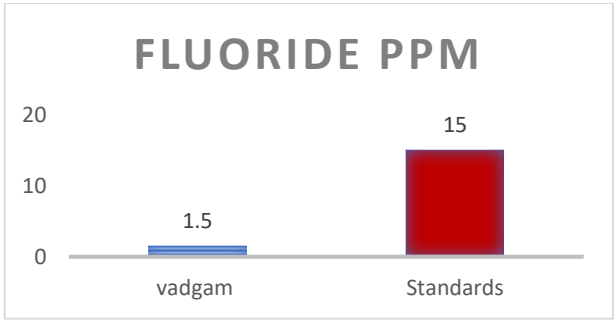
4.1.9. Sulphate: Sulphate content is higher in the water sample of Vadgam. Sulphate content is exceeding limit very drastically.



Graph 5: Sulphate

4.1.10. Fluoride

Culture solution experiments demonstrated a synergistic interaction between acidity and fluoride. It is suggested that this occurred because fluoride is in non-ionic form at low pH, hence more readily taken up by cell membranes. **(**Maiti *et all*.**,** 2013**).** Fluoride at Vadagam is within permissible limit of CPCB.



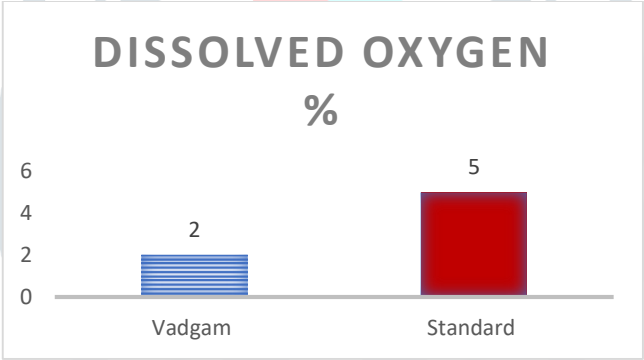
Graph 6: Fluoride

4.1.11. Phosphate

Coastal ecosystems such as mangroves are an important sink which can trap significant quantities of Phosphorus. The phosphorus as such deposited in sediments is not available to the organisms, but is converted to bioavailable forms as dissolved orthophosphate through a series of biogeochemical reactions (Singh *et all*., 1975). Phosphate recorded at Vadgam is 3.29, g per lit. there is no specific limits (as per standards) mentioned for marine costal area.

4.1.12. Dissolved oxygen

Dissolved oxygen is most important parameters its correlation with water body gives direct and indirect information e.g. Bacterial activity, photosynthesis, availability of nutrients, stratification, etc. dissolve oxygen should be 5.0 mg per liter. Vadgam site shows less Dissolved oxygen.



Graph 7: Dissolved oxygen

4.2 Physiochemical parameters for soil:

There are not any standards available for soil hence we have taken pristine location for comparison.

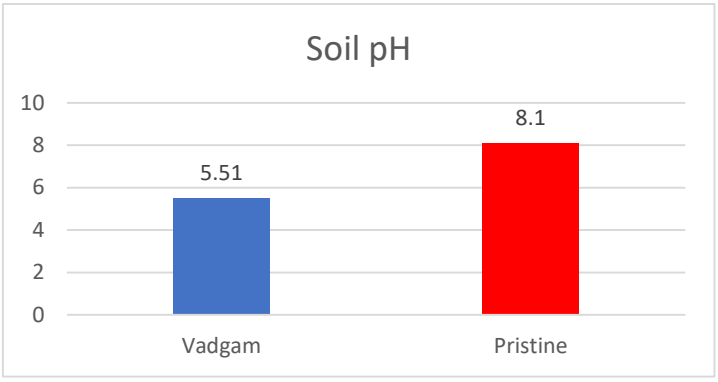
Table 4.2.1: Soil Physical Properties:

Sr. No	Parameter	Results
1	Moisture content	7.7 %
2	Water holding capacity	70%
3	Bulk density	1.1gm/cm^2
4	Soil porosity	44.44

Table 4.2.2: Chemical Composition of Soil:

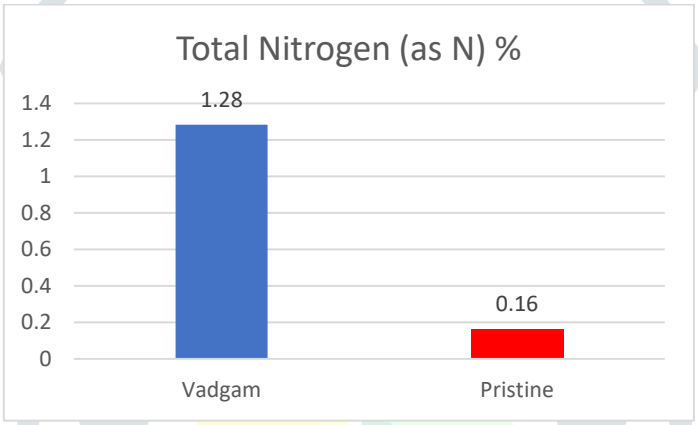
Sr. No	Parameter	Results
1	Chloride	844.9 ppm
2	Total hardness	400 ppm
3	Calcium hardness	160 ppm
4	Magnesium	1.16 %
5	Alkalinity	40 mg/lit
6	Carbonate content	Medium effervesces ++ CO_3

4.2.1. pH: Mangroves especially in the germination stage cannot tolerate extreme pH conditions. The pH values above 7.5 cause iron, manganese, copper, zinc and boron ions to be less available to plants. Soil pH is about 6.6 with the limit. Soil acidity is which is considerably high.



Graph 4.2.1: pH

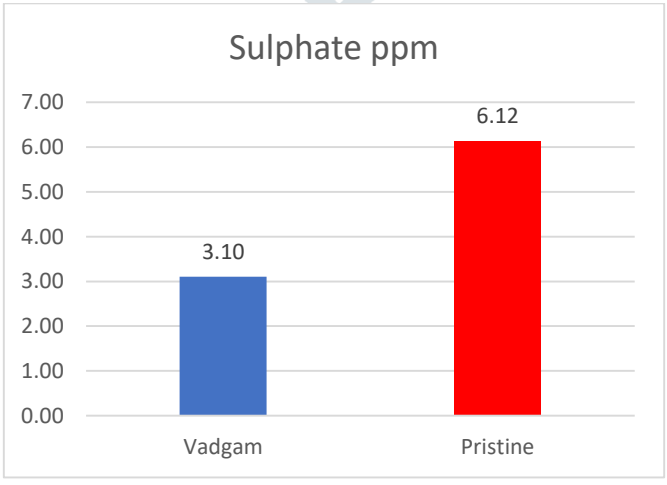
4.2.2. Nitrogen: Nitrogen is an essential element of all amino acids. Amino acids are the building blocks of proteins. Nitrogen is also a component of nucleic acids, which form the DNA of all living things and holds the genetic code. Nitrogen is a component of chlorophyll, which is the site of carbohydrate formation (photosynthesis). ultimately lack of nitrogen leads to less growth in plants. Nitrogen content is high as compared to pristine location.



Graph 4.2.2: Total Nitrogen

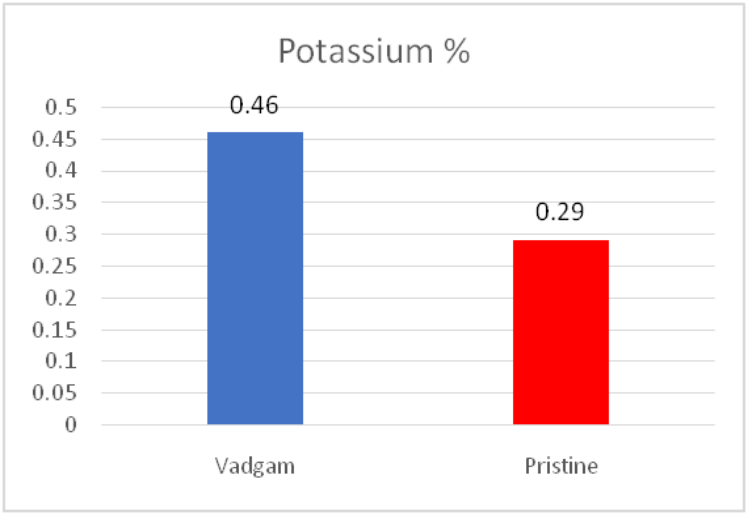
4.2.3. Total organic carbon: Presence of carbon and other nutrients in soils emulate several ecosystem processes like primary production, decomposition of organic matter, abiotic conditions like temperature, moisture, oxidation status, soil texture in addition to the biotic functions like microbial and faunal activities. Total organic carbon is 3.20 percent.

4.2.4. Sulphate: Sulphur is an important nutrient for optimal plant growth: it is one of the key microelement essential for plant growth. Sulphur is taken up from the soil solution by the plant in the sulphate form (SO_4^{2-}). Sulphur is also a component of key enzymes and vitamins in the plant and is necessary for the formation of chlorophyll. Reduction in Sulphur leads to Growth of plants. Sulphate is less as compared to pristine location.



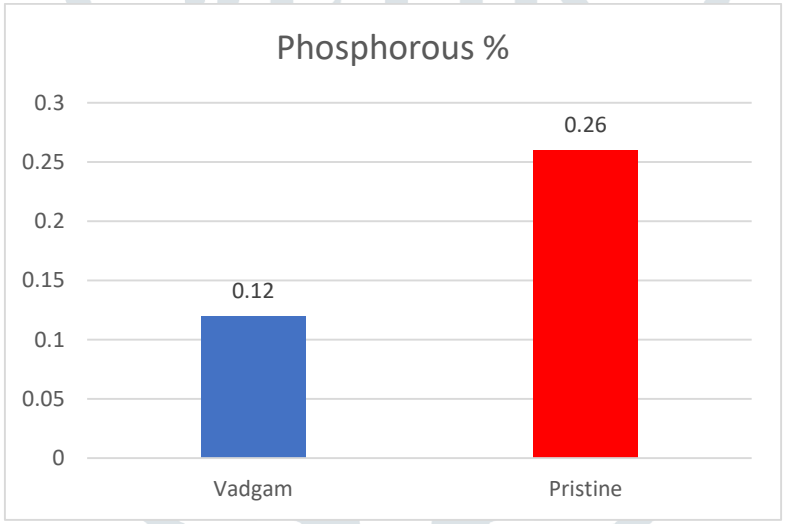
Graph 4.2.3: Sulphate

4.2.5. Potassium: Potassium is vital to many plant species enzyme activation, photosynthesis, stomatal activity. Lack of potassium always hampers plants growth. Potassium content is higher than the pristine location.



Graph 4.2.4: Potassium

4.2.6. Phosphorous: Phosphorus is one of most important nutrient for the vegetative growth along with nitrogen and potassium. Phosphorus is a vital component of DNA, the genetic "memory unit" of all living things. It is also a component of RNA, the compound that reads the DNA genetic code to build proteins and other compounds essential for plant structure, seed yield, and genetic transfer. The structures of both DNA and RNA are linked together by phosphorus bonds. Phosphorus is a vital component of ATP, the "energy unit" of plants. ATP forms during photosynthesis, has phosphorus in its structure, and processes from the beginning of seedling growth through to the formation of grain and maturity. Phosphorous of Vadgam site is less as compared to Pristine site.



Graph 4.2.6: Phosphorous

CONCLUSION:

Physiochemical parameters of water and soil are essential for understanding mangrove ecosystem. Parameters like Fluoride, Dissolved oxygen, pH, Phosphate, Dissolved oxygen of water are within permissible limits. Parameters like total suspended solids, BOD, COD are exceeding permissible limits due to presence of human activities. Nitrate and Sulphate are high amount due to influence of effluent discharged by GIDC. Soil parameters are compared to pristine condition. parameters like pH, Sulphate, E.C, Phosphorus shows relevance to pristine site. Some parameters like Nitrogen and Potassium are high as compared to pristine location.

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