JCBPS; Section D; February 2018 – April - 2018, Vol. 8, No.2; 084-090. E- ISSN: 2249 –1929

[DOI: 10.24214/jcbps.D.8.2.08490.]

Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at*www.jcbsc.org

Section D: Environmental Sciences

CODEN (USA): JCBPAT Research Article

Screening and characterization of coastal water quality at sandspit, Karachi, Pakistan

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Received: 20 February 2018; **Revised:** 10 March 2018; **Accepted:** 14 March 2018

Abstract: Marine pollution is now considered as a worldwide issue due to the continuous industrial and domestic discharge. These discharges seriously damage the marine habitat and affect the aesthetic view. In this research samples were carried out using conventional method from marked locations. Screening was carried out using various biochemical tests.. The comparative analysis of the water quality and spatial variation of Sandspit was done. Sandspit is influenced greatly by industrial waste water. The sampling point's closer to waste discharge indicated higher incidence of total heterotrophic bacteria, coliforms, *Staphylococcus aureus, Bacillus spp* and *Salmonella spp .Escherichia coli and Pseudomonas aeruginosa* was dominant in Sandpit's water samples. Chemical parameters such as COD and BOD, result indicates water bodies are being highly polluted with waste water effluent of the city.

Keywords Coastal water, Karachi, Sandspit, Microbes, heavy metals

1. INTRODUCTION

Marine contamination due to the human activities has nowadays become a universal environmental matter [1].Serveral researchers has previously reported for the impact of industrial and domestic discharge on coastal area of Karachi. Especially Manora Channel, is severely polluted due to industrial wastewater and Metropolitan municipal mess which are indiscriminately discharged into coastal waters over Layari and

Malir rivers. According to a report [2], only 20 percent of yearly wastewater produced in Karachi is treated and rest is discharged directly into coastal waters body [3].This discharge produces intense loads of fecal wastes in natural waters. In this circumstance, the extent of pollution causes increases in fecal bacteria and may contain pathogenic microorganisms in high numbers afar the assimilation ability of the receiving water [4]. This is a potential threat to the life of people of that area and to the marine life.

Marine environments are huge unexploited source for the isolation of new microorganisms with ability to produce dynamic secondary metabolites[5]. These microorganisms are well adapted to the salinity, humidity and the atmospheric conditions of the marine mangrove ecosystem. The receipt water therefore becomes unhealthy for various purposes such as recreation[6]. It is well known that enteric pathogens do not perish quickly once exposed to the seawater as they tend to persist with survival time varying from a few minutes to countless days depending upon the marine Environmental situations e.g. nutrient availability, inactivation by sunlight predation, parasitism, sedimentation, temperature, osmotic stress, or toxic chemicals and therefore pose several health jeopardies to humans [7,8].Diverse groups of bacteria that get nurtured by the detritus and in turn, help the mangrove ecology in different ways[9]. Dissemination of bacteria depends, salinity, temperature and other physico-chemical parameters of water[10]. The present study focus on determining the bacterial load in the natural water body of Karachi i.e. Sandspit.

MATERIAL AND METHODS

Sampling The water samples were collected from the sampling sites into the autoclaved glass non-reactive bottles. 200 ml sample approximately was collected for the study and brought immediately to the laboratory and kept at 6-10 ºC .These samples were taken in a systematic manner linearly though the distance between the sampling sites approximately 50 meter. Two drops of sodium thio sulphate solution was poured into the bottles so as to preserve the bacteria in the samples. The samples were taken very carefully from the sampling site to avoid contamination from the air flora. The samples were then taken to the Institute of Environmental Studies where they were inoculated into saline and broth tubes within 24 hours.

Table 1: Sampling Points for Water of Sandspit

Sites	Longitude	Latitude
SS-9	66°51'22.52"E	24°51'45.88"N
S-10	66°51'33.30"E	24°51'44.34"N
S-11	66°52'58.47"E	24°51'11.30"N
S-12	66°53'49.92"E	24°50'44.05"N
S-13	66°54'37.90"E	24°50'34.24"N
S-14	66°54'40.50"E	24°50'33.55"N
S-15	66°54'59.12"E	24°50'16.68"N
S-16	66°55'21.33"E	24°50'8.01"N

Figure 1: Representation of sampling points on Google Earth

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Parameter Analysis Isolation of these bacteria to get single colony was done by using serial dilution followed by streaking method. Besides these, gram staining and biochemical tests were performed for identification. [11]. The pH of all water samples was measured at the time of sample collection by using portable pH meter. The sample temperature was recorded at the same time, using mercury filled Celsius thermometer. Salinity, total dissolved solids and conductivity of all the samples was measured by the calibrated TDS 7meters, Chemical Oxygen Demand (COD) and Biological oxygen demand done by method[12,].

RESULT AND DISCUSSION

The isolation and characterization of bacterial strains from different places of and Sandspit regions were undertaken in this study. Bacterial growth rate depends upon numerous physiochemical conditions such as media, pH, temperature, incubation period, carbon source, salinity etc**.** Numerous of biochemical examination was carried to study the characteristics of bacterial strain. Fermentation test is used to differentiate the microorganisms that ferment carbohydrate such as lactose, Manitol salt agar, sucrose, glucose. The biochemical tests were very helpful in identifying various bacterial species. Nine bacterial species were isolated from 15 samples of the two sampling points. Among them the pathogenic and non-pathogenic bacteria were identified. The presence of the *Enterococcal* and *Enterobacillus* species showed the presence of the faecal contamination of the water bodies. Some non-pathogenic species include *Staphylococcus* species, *Pseudomonas* species and *Bacillus subtilis*. Pathogenic bacteria can cause adverse human impacts on the marine life. The quality of the water bodies starts to degrade and

deteriorate. The bacteria which have been isolated from the sampling sites are capable of prevailing in the water with high salinity. A large number of fecal coliforms were found on Sandspit. This clearly indicates the bacteriological water quality of this area. Our results is same as the previously studies of Shaheen *et.al* [14] . However, *Escherichia coli* are found on almost all the sampling points of the water body. The water of Sandspit is subjected to both industrial and waste water pollution.

The physical parameters measured were turbidity, conductivity, total dissolved solids, pH and salinity. The temperature of the water samples ranges from 25°C to 31°C. Further details of physical parameters show in **Table 2**. Salinity of the water the water samples from S-9 to S-16 has high values of salinity. Salinity fluctuation with the tides and fresh water movement into the estuary. It is one of the major factor of what lives where. Estuarine ecology highly affected by the turbid of suspended solid. If an estuary is excessively turbid over long episodes, its productivity can be significantly weakened. In case of Conductivity, water is exaggerated by the occurrence of inorganic dissolved solids such as sulfate, chloride, and nitrate sodium, magnesium, calcium, iron. As the concentration of salts in the water increases, electrical conductivity raises the greater the salinity, the higher the conductivity. Its mean they have direct relationship. The distribution of each microbe on the sampling sites can be better seen with the help of Google earth images**.** *Escherichia coli*, commonly called as *E. coli*, is a member of organisms known as coliforms. Its presence *is used as an indicator* to monitor the potential manifestation of other more unsafe microbes, such as norovirus, Cryptosporidium and Giardia, Shigella[13].

Table 2: Physical parameters of water samples

S.no.	Sample code	Turbidity (NTU)	Conductivity (S/m)	TDS (mg/l)	pH	SALINITY
1	S-9	25.8	87.2	151666.6	8.3	56.2
2	S-10	16.31	60.8	157333.3	7.85	38.9
3	S-11	36.6	82.4	159666.6	7.76	53.8
4	S-12	24.5	64.5	160000	7.25	41.3
5	S-13	42.6	64.4	45666.6	7.57	42.3
6	S-14	20.1	69.7	140666.6	7.63	36.8
7	S-15	30.8	56.8	58000	7.96	34.3
8	S-16	29.9	69.2	95000	7.55	45.9

A chemical parameter was selected to evaluate pollution extent of the sampling sites. For this purpose Chemical Oxygen Demand (COD) values of each sampling point have been taken. The COD is a measure of the oxygen equivalent of the organic matter in a sample that is susceptible to oxidation by a strong oxidizing agent. These values show high level of pollution in Water samples S-5, S-7, S-7 and S-15 shows in **Figure 1.** COD is determined to analysis the measure the oxygen corresponding of all the organic matter content of the samples. The analysis value of the entire tested sample is between 240-13600mg/whereas the NEQS limits for industrial discharge is 400 mg/l and 150 mg/l for domestic discharge. The lowest COD were analysis is the sample of SS-14 on the other hand the highest COD recorded in the sample of SS-10 6240 mg/L.In contrast to the Biological Oxygen demand (BOD) the NEQS allowable limit is 80 mg/l in both the industrial and domestic discharge. In sandspit all the samples

are surpassed the NEQS standards. The large amount of organic material in the water is the fact of high quality of microorganism which degrades waste.

Table 3: Chemical parameter of Sandpit

Sample Code	COD (mg/l)	BOD (mg/l)
SS-9	1680	790
SS-10	6240	540
SS-11	3120	480
SS-12	2400	530
SS-13	2880	270
SS-14	240	1180
SS-15	5520	900
SS-16	3880	500

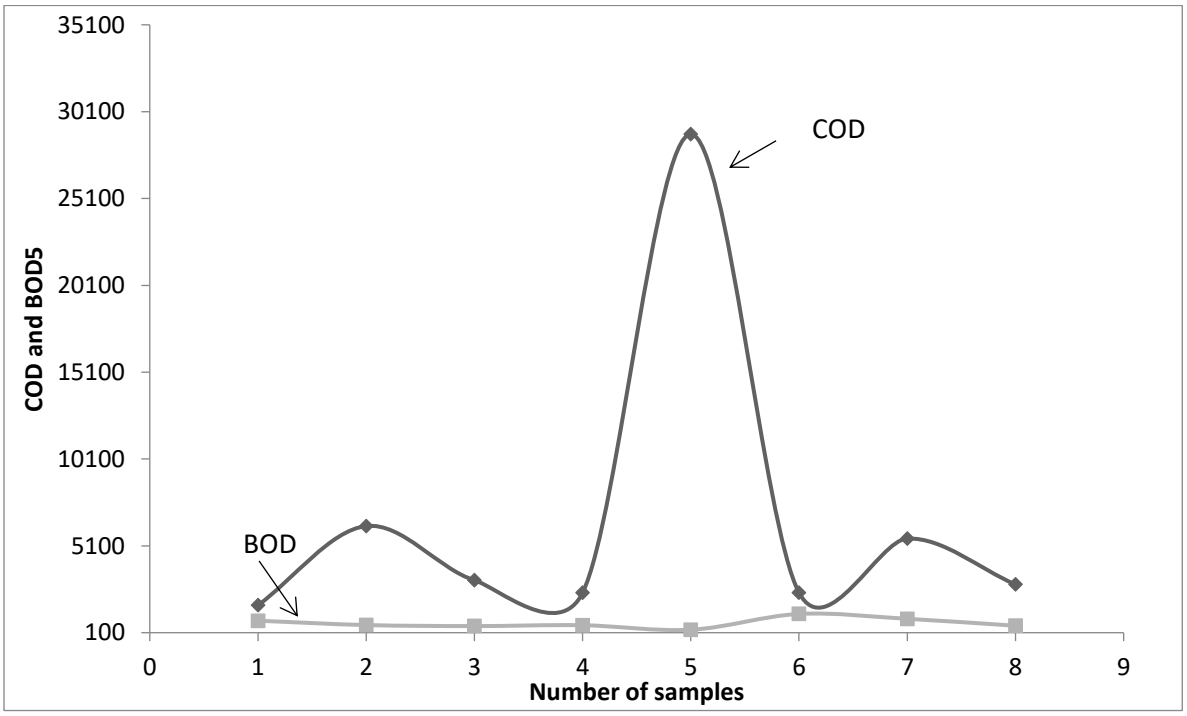

Figure 2: Comparative representation of BOD_5 and COD of sandspit water samples

CONCLUSION

In the view of exponential increase of marine pollution in Karachi coast this study was undertaken. Karachi is the largest industrial and highly populated area of Pakistan. The water characteristic found in this study clearly shows that the situation of coastal water is very alarming because of fecal bacteria pollution in the sampling sites with plentiful pathogenic species. This poses the danger of enteric illnesses where the water is used for recreational dedications or through the consumption of contaminated seafood such as fishes, crabs and other. It may also be toxic to the different organism.

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Online publication Date: 14. 3.2018