Water Quality Assessment in Lengehport, Hormozgan Province, Iran

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Abstract: The temporal and spatial distribution of biological oxygen demand (BOD), chemical oxygen demand (COD), turbidity, total suspended solids (TSS) and total dissolved solids (TDS) of surface and depth water collected from different points of Lengeh Port basin were analyzed during the period from August 2010 to August 2011. The results of sampling stations at Port basin were compared with sampling stations in offshore, out of the Port basin. The COD, BOD, Nutrients (NO$_3^-$, NH$_4^+$ and NO$_2^-$), NO$_3^-$, TSS increased toward the offshore parts as compared to the stations located in the part basin. In general, TDS in both surface and depth samples and PO$_4^{3-}$ in surface samples exhibited decreasing trend from Port basin to the offshore region. TDS values were high in the offshore samples. The concentrations of PO$_4^{3-}$, NH$_4^+$ and NO$_2^-$ were very different between port basin and the offshore stations. The sediment grain size analysis indicated that clay content shows an increasing trend from Port basin to the offshore samples but Silt content follows a reverse trend.

Key words: Lengeh Port % Water Quality % Sediment % Pollution % Persian Gulf

INTRODUCTION

Water quality is the main factor controlling healthy and diseased states in both humans and animals [1]. Surface water quality is an essential component of the natural environment and a matter of serious concern today. The variations of water quality are essentially the combination of both anthropogenic and natural contributions. In general, the anthropogenic discharges constitute a constant source of pollution, whereas surface runoff is a seasonal phenomenon which is affected by climate within the water catchment basin. Among them, because of the intensive human activities, the anthropogenic inputs from a variety of sources are commonly the primary factors affecting the water quality of most rivers, lakes, estuaries and seas, especially for those close to highly urbanized regions. Within the context of assessing water quality in Iran, some studies have addressed the water quality in wetlands[2] and others have addressed the Imam Khomeini port water quality due to its strategic importance [3] but there are no published documents about the study area. In addition, some studies have addressed the heavy metals present in coastal parts of the southern Iran [4]. Most of these studies have indicated varying levels of pollution and others have emphasized the importance of designing and implementing a complete water policy (Iranian Ports and Maritime Organization 2011). Some other studies had been carried out in other parts of the world for example coastal water quality of Port Blair Bay was investigated based on the principal component analysis and cluster analysis and results indicated that Port Blair Bay in India is vulnerable to anthropogenic activities [5].

The studied area has strategic importance with regard to international trade and marine culture. For instance cockles and shrimps farming form the main farming activities at the study area. Sea turtles, coral reefs and diverse fauna of the fishes give importance to its biological diversity. Therefore water pollution will have very destructive effects on biological diversity and sea food quality as well. Our aim was to detect that how much the port water pollution is different with offshore, based
on specific water quality parameters and suggesting environmental management strategies to improve the site water quality.

**MATERIALS AND METHODS**

**Study Area:** Lengeh Port (Bandar Lengeh) is located at the extreme southern border of Persian Gulf in Hormozgan province, Iran (54°, 52’ E and 26°, 33’ N) (Fig. 1). Bandar Lengeh has a hot and humid, but dry climate. Maximum temperature in summers can reach up to 50°C while in winters the minimum temperature drops to about 5°C. The annual rainfall is around 230 mm and the relative humidity is about 65% (Institute of Whether & Climatology, Lengeh 2011). Lengeh Port basin area is about 10 ha that connects to the open sea water through a 600 meters length channel.

**Sampling and Laboratory Procedures:** Sampling was carried out by using the research boat, at eight stations in spit and two isolated stations in offshore (Fig. 1). The sampling was replicated each two months and totally five replicates were taken at each station. Station positioning was carried out using the Garmin GPS (Global Positioning System). Surface water samples as well as samples from eight meters below the water surface were collected using Niskin bottles and parameters such as NO₃, NO₂, PO₄, NH₄, TDS, TSS, BOD and COD were analyzed [5]. Nitrate was measured based on its reduction to nitrite in a copper activated cadmium reduction column. Nitrite was determined through formation of a reddish purple azo dye produced at pH 2.0 to 2.5 by coupling diazotized sulfanilamide with N-(1-naphthyl)-ethylenediaminedihydrochloride (NED dihydrochloride). For dissolved oxygen fixing Manganese Sulfate solution and Alkaline Potassium Iodide Azide were added to samples. Secchi disk was used for measurement of light penetration. PH was recorded by a pH-sensitive Micro-electrode. A 0.04 m² lead weighted Van Veen grab with hinged, lockable, rubber-covered inspection flaps of 0.5 mm mesh was used. Samples showing inadequate or uneven penetration, or a disturbed sediment/water interface were rejected. The samples were gently washed through a circular 1 mm diameter round-mesh screen immersed in running sea water and fixed in 15-20 % borax-buffered formalin. Samples were rinsed in the laboratory using 1 mm round mesh sieves immersed in running fresh-water to remove formalin. A reference collection was kept of all species identified. Cluster analysis was applied to find out the similarity groups between the sampling stations. ANOVA analysis was used for comparing stations with regard to measured variables mean [6, 7].

**RESULTS AND DISCUSSION**

The finding of this study indicated that COD, BOD, Nutrients (NO₃, and NH₄, NO₂, NO₃, TSS) decreased toward the offshore parts as compared to the stations located in the Port basin. In general, TDS in both surface and depth samples exhibited decreasing trend from port basin to the offshore region. The concentration of PO₄ and NO₃ showed the biggest difference between port basin and the offshore stations respectively (Fig. 2). The greatest concentration of nutrients was recorded in the nearest stations to the vessels stop positions, which are stations 8, 3 and 5. The sediment grain size analysis indicated that Clay content shows an increasing trend from Port basin to the offshore samples but Silt shows the reverse trend. Cluster analysis produced a dendrogram, grouping all 10 sampling stations into two statistically meaningful clusters. So the sampling stations at the port basin were separated from the other two sampling stations. ANOVA showed that there is a significant difference between eight sampling stations with the other two stations which were located out of the port basin. Meanwhile the most differences was showed for PO₄ parameter (F₉, 20= 927.28, P<0.001). Aggregation of the vessels at the Port basin and ballast water discharged by ships is the main cause of the pollution. Meanwhile, nearly all runoff from Lengeh city discharged to the port basin, so it is fed by different kind of pollutions from Lengeh city. Some other studies in Port basins indicated the same results [5]. Since sediments have an important role in the monitoring of the environment as they are considered as the final sink of most contaminants, we suggest that exact sediment study should be done there. Since the turbidity analysis showed that turbidity in the port basin is more than offshore area
we suggest that to the use of environmentally acceptable and approved mechanical dredges, such as bucket and clamshell dredges.

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REFERENCES