

PHYSICAL AND CHEMICAL OCEANOGRAPHY

OF BAHRAIN SEA WATER

AT FASHT AL-JARIM

ABSTRACT

Physical and chemical oceanographic parameters were monitored at Fasht Al Jarim, north of Bahrain on 18-19 October, 1987. The data analysis shows that most of the parameters were of relatively low concentrations particularly the pollutants. The water at the sampling station therefore was of good quality.

I. INTRODUCTION

The current emphasis on monitoring oceanographic characteristics of Bahrain sea water stems from the fact that sea water is facing various kinds of pollutants from different sources; land reclamation, discharge of untreated effluent, offshore oil spillage, etc. All these affect the desired water quality and consequently pose threats to marine organisms.

Since the oceanographic data for Bahrain sea water are scarce it is almost inevitable to establish an oceanographic survey scheme to monitor the physical, chemical and biological properties of sea water. Therefore an oceanographic cruise was set out near Fasht Al Jarim; 26° 20' 30" N 50° 23' 50" E on 18-19 October, 1987 for 25 hours.

II. FIELD AND LABORATORY WORK

Depth, Temperature (air and water), pH, Dissolved Oxygen, Conductivity and Salinity were determined every hour at different depths (1, 2, 3, 4, 5, 10m and bottom) on board the ship, Danat Al Bahrain, using the Hydrolab Surveyor 11.

Surface and bottom water samples were collected using Niskin bottles with the exception of hydrocarbon sample. Alkalinity, Turbidity, Chlorophyll a, Total Suspended Solids and Total Bacteria were determined in the field. Filtered samples (collected every 6

hours) were stored in the fridge prior to laboratory analysis for nutrients (Ammonia, Nitrite, Nitrate, Phosphate and Silicates). Sediment and water samples were collected for hydrocarbon analysis.

III. RESULTS AND DISCUSSION

The oceanographic data are listed in Table 1. Table 2 shows the average values and the range of the parameters determined.

1. Meteorological Conditions

Although the prevailing wind at Fasht Al Jarim is NW, it was predominantly SE during the sampling period.

Wind speed varied from 5 to 12 knots with an average of 8.80 knots during the 25 hour.

Air temperature was 26.7 which is quite reasonable compared to summer temperature (May - October) which usually reach over 35 C.
Sea state was 1.2 feet.

2. Temperature

Average surface temperature was 28.9 while bottom temperature was 29.1 with less variation and obviously slightly higher than surface temperature. Usually surface temperature is higher but the opposite situation here is probably due to either the inconsistent temperature variation from surface to bottom or due to shallow water effect. However, the difference is very low, 0.2 C.

3. pH

Surface pH range from 8.1 to 8.3 with an average of 8.23. On the other hand bottom pH range from 8.2 to 8.3 with 8.27 average. This shows that the change in

pH from surface to bottom is negligible. This pH value fall within the range 6.5 - 9 in which marine organism can live safely.

4. Dissolved Oxygen (DO)

Oxygen is a vital gas and one of the most important species for water quality characteristics.

The DO value (mg/l) at the surface (9.15) was higher than that at the bottom (8.54.) These values are higher than those reported at Fasht Al Adhum; (5.56) and (4.77) respectively.

Oxygen is primarily dissolved physically in sea water. It is a valuable tracer for water masses and is a sensitive indicator for biological and chemical processes occurring in the sea.

5. Conductivity

The average conductivity at the surface was 67.2 mmhocm while it was 70.8 mmho cm at the bottom. The variation of surface conductivity was higher than that of the bottom.

The conductivity is a salinity indicator, it is directly proportional to it.

6. Salinity

Salinity is a critical parameter that affect water quality. Aquatic biota are sensitive to extremes of salinity. They cannot live in a media having salinity value that they are not adapted to.

Surface salinity (‰) was 46.1 ranging from 44.7 to 48.0, while it was 47.8 at the bottom with a lesser variation; from 47.2 to 48.3. Less salinity values were reported at Fasht Al Adhum while higher values were reported elsewhere at Bahrain sea water. Among other sources, industrial effluents producing inorganic salts, salt brines from oil wells are amenable for higher salinity.

7. Turbidity

Turbidity is caused by substances that are physically dispersed in water which reduces visibility and food gathering capacity of many animals.

Surface turbidity 0.40 NTU was lower than the bottom one 0.68 NTU. The transparency (Secchi disc) of sea water was about 8m. These values indicate that the water was clear.

8. Total Suspended Solids (TSS)

At the surface TSS (mg/l) was 4.78 ranging from 2.10 to 7.00 and at the bottom 3.78 ranging from 1.40 to 8.40. Generally TSS is influenced by weather conditions and current wave functions.

Various types of suspended solids are discharged into sea water, solids may be mineral wastes or insoluble finely divided organic solids, the later usually undergo slow biodegradation and cause a reduction of the DO. The settled TSS reduce the solar energy absorption and hence reduce the rate of photosynthesis.

9. Alkalinity

At the surface alkalinity (ug/l) varied from 124 to 138 with an average of 133. The bottom alkalinity was almost similar; 134 ranging from 128 to 140. The slightly higher bottom alkalinity was consistent with pH reading. Excess alkalinity are frequently introduced due to weathering.

10. Total Coliform Bacteria (TCB)

Nil value was reported indicating the absence or rather negligible pathogenic micro-organisms.

TCB test is performed to indicate the presence or absence of coliform bacteria which are generally not pathogenic, yet they are usually present when pathogens are present.

11. Chlorophyll a

During the 25 hour sampling period the surface Chlorophyll a concentration was quite low; 0.68 ± 0.17 mgm , varied from 0.45 to 1.00 mgm .

As a universal photosynthetic transducer of light energy Chlorophyll a is determined as a means of phytoplankton biomass assessment.

12. Nutrients

Chemical nutrients are substances that are required by plants and animals for maintaining their growth and metabolism. These are Ammonia, Nitrite, Nitrate, Phosphate and Silicates. Ammonia in μgl was 7.55 at the surface ranging from 0 to 14.0 while it was nil at the bottom. Nitrites (μgl) at the surface was in the range of 0 to 0.7 average to 0.14 and 0.32 at the bottom varied from 0 to 0.29. Nitrates (μgl) at the surface was 0.83 while it exhibited a higher value at the bottom, 7.72. Phosphates (μgl) was 4.38 ranging from 1.25 to 9.69 at the surface and 2.31 ranging from 0.63 to 5.00 at the bottom. Silicates (μgl) was 67.4 ranging from 55.6 to 82.7 at the surface while it was 75.8 ranging from 66.2 to 90.2 at the bottom.

Generally the nutrient concentrations were low eventhough zero values were reported, some little high values were found. Ammonia was of zero concentration

at the bottom, this indicates an occurrence of oxidation process to nitrite and/or nitrates.

13. Hydrocarbons

At the surface the hydrocarbon concentration was 7.2 ug/l and at the bottom 8.6 ug/l. Hydrocarbons are present in sea water from various sources; tanker ballasting and cleaning, offshore production, refineries and petrochemical plants, oil waste and accidental spills. The oil entering the marine environment is subjected to different processes; evaporation, solubilisation, flusing, emulsification, oxidation, uptake by living organisms and absorption by sediments. Within a few days about 25% of the volume of the oil spill are lost through evaporation. Beside its unpleasant presence, oil cause reduction in light transmission, reduction in DO and damage to living organisms.

14. Current Speed and Direction

Current direction changed from NE to NW with an average speed of 0.167 ms ranging from 0.05 ms to 0.45ms .

IV. CONCLUSION

Despite the high salinity value, the parameters exhibited low concentrations.

The absence of TCB, accompanied by high DO indicates a minimum oxidation process occurred although ammonia was nil at the bottom.

With the exception of DO, TSS, Ammonia and Phosphate, the bottom concentrations of the determined parameters were higher.

Cautiously speaking the water at Fasht Al Jarim was of good quality as far as the pollutants are concerned.

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