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Hydrochemical characteristics of the United Arab Emirates waters along the Arabian Gulf and the Gulf of Oman

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Seawater samples were collected bimonthly from the United Arab Emirates territorial waters, which extend for more than 800 km along the Arabian Gulf and the Gulf of Oman. In this paper, the levels and distributions of temperature (20.0-34.5 °C), salinity (35.4-42.3psu), pH (7.21-8.38), transparency (4.0-26.0 m), dissolved oxygen (2.24-6.19 ml l^{-1}; 43.4 -155.5 sat. %), and permanganate value (oxidizability) of dissolved organic matter (0.1-30.8 mg $O_2 l^{-1}$) are presented. Temperature variations in both areas were as usual in the region, i.e., maximum in summer and minimum in winter. The distribution of temperature revealed higher values(27.7 °C) in the Arabian Gulf waters compared to the Gulf of Oman (26.3 °C) suggesting higher evaportic conditions. Due to the higher rate of evaporation, the Arabian Gulf waters showed also higher salinity (39.2 psu) compared to the Gulf of Oman (36.4 psu). Regarding the pH, the two regions displayed very limited seasonal and regional variations without significant differences. Transparency, however, showed wide variations in the two regions with higher values in the summer season than the winter season. The seawater in the Gulf of Oman was more transparent than the Arabian Gulf waters. In the meantime, the Arabian Gulf and the Gulf of Oman waters contained nearly similar concentrations of dissolved oxygen, with higher values in the winter season than the summer season. The concentrations of the permanganate value (oxidizability) of dissolved organic matter indicated higher values in the seawater of the Arabian Gulf than the Gulf of Oman, with higher values in the summer season than the winter season. Moreover, pronounced increase in the concentrations of permanganate value (oxidizability) of dissolved organic matter was observed with depth in the two regions. The amounts of oxygen that present after complete oxidation of organic matter in the Arabian Gulf and the Gulf of Oman were found to be 48.8 and 51.7 %, respectively.

Key words: hydrochemical characteristics, Arabian Gulf, Gulf of Oman, Strait of Hormuz

INTRODUCTION

The Arabian Gulf is a semiclosed sea with a surface area of about 240000 km^2 and an average depth of about 25 m which can reach a maximum of about 100 m near its narrow entrance at the straits of Hormuz. The Gulf of Oman, on the other hand, has a surface area of approximately 48000 km^2. It has its greatest axial depth close to the mountainous Arabian shore.

The United Arab Emirates (U.A.E.) have a coastline of more than 800 km along the Arabian Gulf and the Gulf of Oman. However, the country has witnessed a rapid economical development and expanded urbanization so that the marine environment is nowadays facing continuous threats from increasing quantities of chemical and biological pollutants (Table 1). Therefore, a proper understanding of physical, chemical, and biological conditions of the marine environment of the United Arab Emirates could be of great help to planners in deciding where to locate heavy industries, human settlements, marine conservation areas, controlled coastal engineering. Data on the hydrochemical characteristics and nutrients in territorial waters of the UAE are even scarcer and any conclusions on the fertility of the UAE marine environment depended on assumptions rather than actual observations.

The main objective of this study is to investigate the physicochemical properties of the coastal and offshore waters of the UAE.

Table 1. Chemical and biological pollutants and their sources in the Gulf region (PRICE, 1993; BONAT et al., 1993; HASSAN, 1993)

Sources	Chemical and biological pollutants
Shipping and transport shipping ports	Oil spills; anchor damage. Coastal reclamation and habitat loss; dredging, sedimentation, oil and other pollution
Residential and commercial	Coastal reclamation and habitat loss; dredging, developments sedimentation; sewage (pathogenic microorganisms, eutrophication), fertilizer and other effluents; eutrophication; solic waste disposal
Industrial development, Oil and petrochemical industry	Oil, refinery and other effluents containing heavy metals; drilling muds and tailings; air pollution
Mining	Sedimentation and elevated heavy metal levels
Desalination and seawater treatment plants	Effluents with elevated temperatures, salinities and sometimes heavy metals and other chemicals
Power plants	Various effluents; air pollution, increasing greenhouse gases and global warming; acid deposition
Fishing and collecting	Population decline of target and non-target species and changed species composition of fish, shrimp and other biota; habitat degradation (including anchor damage)
Recreation	Some reef degradation from anchor damage and collecting.
Agriculture	Local eutrophication (e.g. from fertilizers); only low levels of insecticides such as DDT, aldrin, dialdrin and lindane recorded in marine sediments and biota; saline intrusion and possible effects c coastal ecosystems.

MATERIALS AND METHODS

Seawater samples were collected bimonthly from sixteen hydrographic stations selected at the Arabian Gulf and the Gulf of Oman to cover the coastal and offshore waters of the UAE (Fig.1).

Water samples were collected during the period from October 1995 to September 1996.

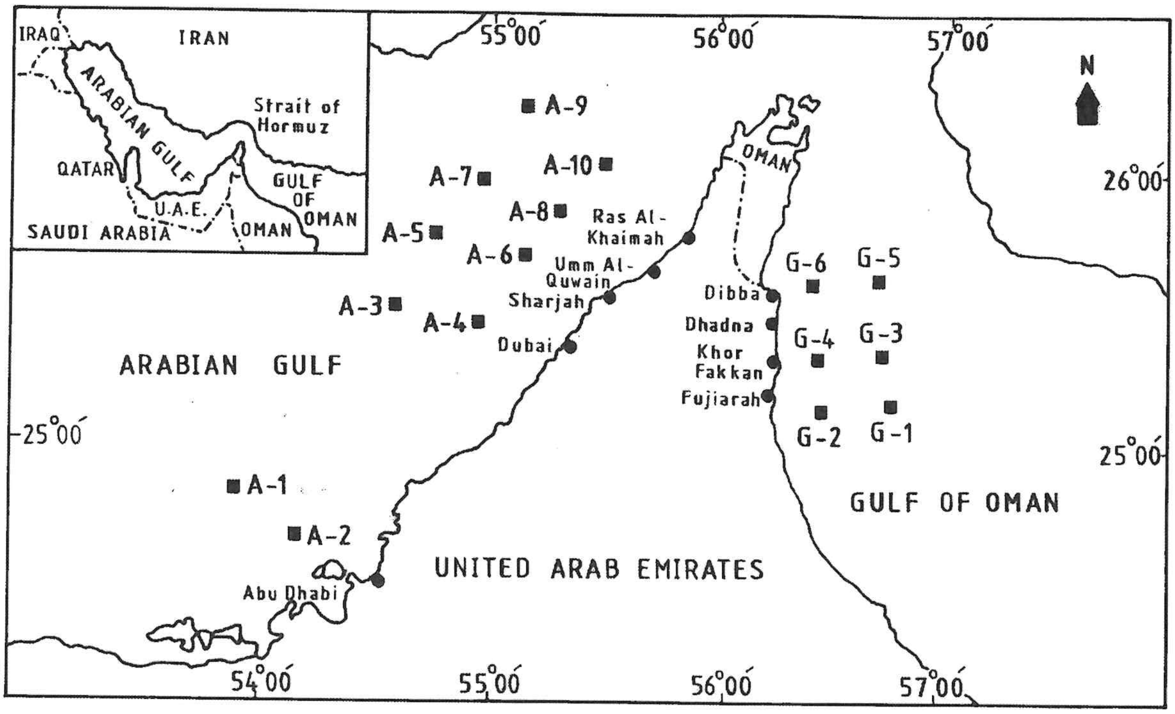

Fig. 1. Location of sampling stations

The samples were collected from different water depths by means of a Hydro-Bios plastic water sampler and analyzed for temperature, salinity, transparency, pH, dissolved oxygen, and permanganate value (oxidizability) of dissolved organic matter. Air temperatures were measured by using an ordinary thermometer graduated to 0.1 °C. Seawater temperatures were measured by using a protected reversing thermometer with a scale ranging from -5 to 31 °C. Salinity measurements were carried out by using a labcomp model SCT-1000 salinometer after calibration with a standard seawater (S=35 psu). Hydrogen ion concentration (pH) by means of a portable pH-meter (HANNA HI 8314 membrane pH-meter) after calibration using buffer solutions of pH 7 and 9. Dissolved oxygen (DO) was determined according to GRASSHOFF (1976 a) . The oxygen percentage saturation was calculated on the basis of the International Oceanographic Tables (UNESCO, 1973). Permanganate value (oxidizability) of organic matter was done using potassium permanganate according to FAO (1976).

RESULTS AND DISCUSSION

Temperature

Temperature variations in both areas were as usual in the region, i.e., maximum in the summer season and minimum in the winter season (Table 2). Highest average temperature values for the Arabian Gulf (31.5 °C) and the Gulf of Oman (28.7 °C) were measured in the summer season when air temperatures were at maximum (36.5 °C). Whereas, lowest averages (23.5 and 23.5 °C) were observed in the winter season when air temperatures were at minimum (18.1 °C) indicating that seasonal temperature variations were directly affected by solar radiation and monthly changes in air temperature. Spatial variations, on the other hand, showed insignificant differences between stations A-1 to A-10 at the Arabian Gulf as well as between stations G-1 to G-6 at the Gulf of Oman (Table 3). However, the annual average seawater temperatures revealed higher temperatures at the Arabian Gulf (27.5 °C) compared to the Gulf of Oman (26.3 °C) indicating higher rate of eva-

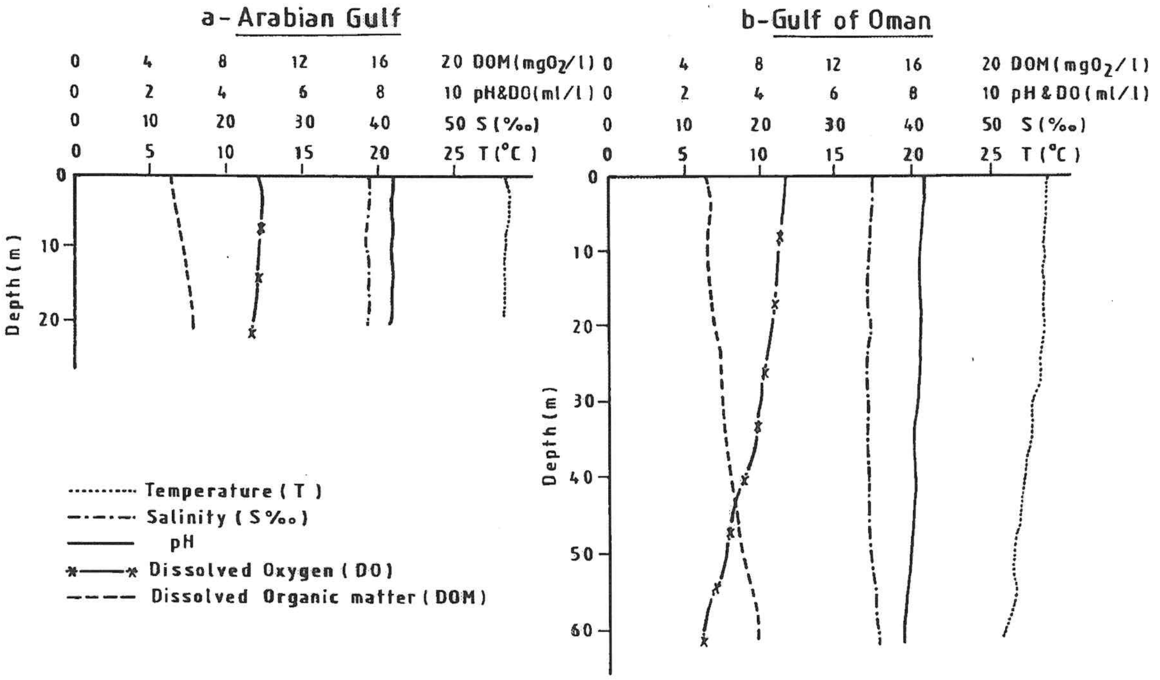

Fig. 2. Annual average values of physicochemical parametres un the marine environment of the United Arab Emirates along (a) the Arabian Gulf and (b) the Gulf of Oman during the period of investigation.

poration. Due to the heating effect of the sun on surface layer, the vertical distribution (Fig. 2) of seawater temperature indicated a decrease with depth at the Gulf of Oman. However, the insignificant differences between surface and deeper waters at the Arabian Gulf were due to the shallowness of the area and turbulence of the water column (Fig. 2).

Salinity

Salinity varied in the Arabian Gulf waters between 36.9 and 43.6 psu and fluctuated between 35.4 and 37.6 psu at the Gulf of Oman, without significant differences between seasonal average values in both two regions during the winter season and the summer season (Table 2). The relatively high values found in the winter season were related to the scarcity of rainfall and the increased rate of evaporation from the sea due to the higher surface water temperature compared to the air temperature during the winter season, i.e. resulting from the large evaporation-precipitation ratio. In the Arabian Gulf, evaporation is high in winter as well as summer, maintaining raised salinity in the southern embayments of the Gulf. It has been stated (SHEPPARD, 1993) that evaporation in the Gulf region exceeds combined rainfall and freshwater input from the rivers by a factor of 10 at least. Spatial variations at the Arabian Gulf (Table 3) revealed higher values at stations A-1 and A-2. Whereas lower values were measured at stations A-9 and A-10 indicating an increase in the salinity values towards the innermost parts of the Arabian Gulf. It is worth to note that lower salinity values measured at stations A-9 and A-10 were due to the inflow of a less saline surface water from the Gulf of Oman into the Arabian Gulf, through the straits of Hormuz. Water enters the Gulf at a salinity of 36.5-37 psu through the Strait of Hormuz, and drifts generally along the Iranian coast. Later, in the southern embayments, evaporation raises its salinity by about 2 psu to around 40 psu. There is a tendency for this denser water to sink and flow towards both the Iranian coastline and towards the entrance, where it exists beneath the incoming water (GRASSHOFF, 1976 b; BREWER and DYRESSEN, 1985). Based on the circulation pattern of surface seawater in the Arabian Gulf, this inflowing water could reach the northeast coast of the U.A.E. (HUNTER, 1984, 1986). At the Gulf of Oman, limited regional variations were observed (Table 3). The more saline (39.2 psu) waters at the Arabian Gulf were observed and compared to the Gulf of Oman (36.4 psu) due to the higher rate of evaporation (ALI and CHERIAN, 1983). Thus suggesting different water types in the two regions which are due to the slow rate of water exchange between the Arabian Gulf and the Gulf of Oman (up to 5 years). The turnover time in the Gulf due to circulation, defined as the time needed for all Gulf water to come within the influence of the open sea boundary, estimated by HUNTER (1984, 1986) is about 2.4 years. Actual flushing time is estimated to be about 3 to 5.5 years, and is longer because the effects of vertical mixing and other turbulent processes. The volume of inflowing and outflowing water through the Straits of Hormuz is given as 3365 $km^3\ yr^{-1}$ and 3310 $km^3\ yr^{-1}$, respectively (HARTMANN *et al.*, 1971). Vertical distribution (Fig. 2) of the salinity in the Arabian Gulf waters showed insignificant increase with increasing depth due to the shallowness of the area. Important also is tidal turbulence over the seabed which mixes the water column vertically (SHEPPARD, 1993). However higher subsurface salinity values were measured at the Gulf of Oman (Fig. 2) due to the lower high saline current flow near the bottom from the Arabian Gulf to the Gulf of Oman (GRASSHOFF, 1976 b; BREWER and DYRESSEN, 1985) and the sinking of the more saline waters due to water evaporation (SHEPPARD, 1993).

Table 2. Seasonal variations of temperature, salinity, pH, transparency, dissolved oxygen (DO), and permanganate value (oxidizability) of dissolved organic matter (DOM) in the investigated area during the period of investigation

	The Arabian Gulf				The Gulf of Oman			
Parameters	The summer season		The winter season		The summer season		The winter season	
	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD
Temperature (°C)	26.0-34.5	31.5±2.6	20.0-27.9	23.5±2.1	22.0-34.0	27.7±2.1	22.7-26.2	23.5±1.1
Salinity (psu)	37.4-42.3	38.8±1.3	36.9-43.6	39.5±1.6	35.6-37.2	36.5±0.4	35.4-37.6	36.3±0.4
pH	7.95-8.38	8.14±0.1	7.21-8.25	8.11±0.03	7.91-8.33	8.12±0.08	7.92-8.28	8.11±0.1
Transparency (m)	4.00-14.0	9.5± 2.3	4.5-14.5	7.7±1.8	8.25-26.0	16.4±2.8	5.5-18.0	11.08±3.0
DO ($ml\ l^{-1}$)	2.42-5.75	4.36±0.5	2.91-5.83	4.79±0.5	2.24-5.56	4.12±0.6	2.91-6.19	4.50±0.9
DOM ($mgO_2\ l^{-1}$)	0.10-30.8	7.50±4.3	0.10-22.68	5.40±2.9	1.36-13.8	5.80±1.6	0.20-10.08	4.88±2.8

Hydrogen ion concentration (pH)

The pH values showed nearly similar values throughout the year (Table 2). Moreover, a comparison between pH values in the two regions indicated no significant differences (Table 3). Vertical distribution (Fig. 2) of pH values showed insignificant differences with depth at the Arabian Gulf due to the shallowness of the area so that almost all parts of it lie within the photic zone (JONES, 1985). The effects of vertical mixing and other turbulent processes such as tidal turbulence over the sea bed which mixes the water column vertically. At the Gulf of Oman, a decrease was observed in deeper (30 m) waters (Fig. 2) due to the high rate of photosynthetic activity at the surface as a result of a maximum in primary production (QASIM, 1977 and SHARAF, 1995), which reduced the amount of carbon dioxide at the surface and in the photic zone, the decrease in dissolved oxygen concentration (EMARA, 1990) due to the decomposition processes of the descending planktonic remains, and the relatively high organic load in the bottom water (EMARA, 1998; SHRIADAH, 1999a,b) and surface sediments (AL-GHADBAN *et al.*, 1994). High positive associations (=0.001) found between pH and dissolved oxygen in the surface water at Gulf of Oman (r=0.78) justifying the important role of photosynthetic activity in the elevation of pH values by supplying the surface water by dissolved oxygen and revealing that the increase in pH values coincides with an increase in oxygen contents (SHRIADAH and AL-GHAIS, 1999).

Transparency

Transparency showed higher values at the Arabian Gulf and the Gulf of Oman in the summer season (Table 2) and lower values in the winter season due to the high turbidity caused by turbulence of water in the winter season. With respect to spatial variations, more transparent waters in both areas were observed at most offshore stations (Arabian Gulf: 9.3 and Gulf of Oman: 16.1 m) and less transparent ones that were observed at near shore stations (Arabian Gulf: 7.4 and Gulf of Oman: 11.4 m). Generally, the Gulf of Oman water was more transparent than the Arabian Gulf waters (Table 3).

Dissolved Oxygen (DO)

Distributions of dissolved oxygen in the two regions indicated, as normal, more oxygenated water in the winter season and less oxygenated in the summer season (Table 2). The high values measured in the winter season were due to a decrease in the temperature and water agitation. However, the decrease during the summer season was due to the rise of water temperature, increased bioactivity and respiration of organisms (SHARAF, 1995), and increased decomposition of organic materials due to higher temperature. Regional variations, on the other hand, indicated similar values (4.76 ml l^{-1}; 104.0 sat. %) in the Arabian Gulf and the Gulf of Oman up to the upper 20 m layers (4.55 ml l^{-1}; 99.7 sat. %). However, in deeper water a significant decrease in the concentrations of dissolved oxygen at the Gulf of Oman was observed. Similarly, EMARA (1990) found a more or less homogeneous distribution in the water column in the upper 30 meters. In general, the Arabian Gulf and the Gulf of Oman contained nearly similar concentrations of dissolved oxygen (Table 3). Moreover, insignificant differences were observed between offshore stations (4.55 and 4.06 ml l^{-1}; 102.6 and 88.9 sat. %) and inshore ones (4.62 and 4.41 ml l^{-1}; 103.1 and 95.3 sat. %). Vertical distribution of dissolved oxygen, on the other hand, indicated pronounced decrease with depth at the Gulf of Oman compared to the Arabian Gulf (Fig. 2). The higher values at the surface water were mainly due to the photosynthetic activity especially in the photic zone and increased aeration on account of active winds. Meantime, the low oxygen contents at the bottom layers were due to the decomposition of organic materials near the bottom.

Permanganate value (oxidizability) of dissolved organic matter

The concentrations of the permanganate value (oxidizability) of dissolved organic matter showed higher concentrations in the summer season than the winter season (Table 2) due to the increase in water temperature. Spatial distributions revealed higher values at the Arabian Gulf than the Gulf of Oman (Table 3). Moreover, higher average values (mean: 7.9 and 6.2 mg O_2 l^{-1}) were observed at offshore areas of the Arabian Gulf (stations A-1, A-3, A-5, A-7, A-9) and the Gulf of Oman (stations G-1, G-3, G-5) than inshore (mean: 4.9 and 4.4 mg O_2 l^{-1}) ones in the Arabian Gulf (stations: A-2, A-4, A-6, A-8, A-10) and the Gulf of Oman (stations: G-2, G-4, G-6). A slightly increase in the concentrations of permanganate value (oxidizability) of dissolved organic matter was observed in the two regions with increasing depth (Fig. 2) due to the higher contents of

Table 3. Regional variations of temperature, salinity, pH, transparency, dissolved oxygen (DO), and permanganate value (oxidizability) of dissolved organic matter (DOM) in the investigated area during the period of investigation

Area	Temperature (°C)		Salinity (psu)		Transparency (m)	
St.	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
A-1	21.1-34.5	27.5±4.9	39.3-42.6	41.3±1.0	5.0-14.0	9.1±2.7
A-2	21.0-34.5	27.9±5.0	40.3-43.6	41.8±1.03	5.0-11.0	6.9±2.0
A-3	21.0-33.4	27.6±4.12	37.0-41.5	9.0±1.339	7.0-11.0	9.5±2.0
A-4	20.0-33.4	7.2±4.327	38.0-39.7	.3±1.139.	6.0-11.5	8.8±1.1
A-5	21.1-32.9	.6±4.927.	37.6-41.4	0±0.938.9	6.0-14.5	10.7±3.39
A-6	21.3-33.0	4±4.827.6	38.1-40.2	±0.938.6±	6.5-13.5	.0±2.81
A-7	21.9-33.0	±4.127.5±	37.6-39.4	0.738.5±0	4.0-12.0	8.3±2.7
A-8	21.9-33.0	4.227.6±4	37.6-39.5	.537.8±0.	4.0-10.5	7.3±2.3
A-9	21.9-33.0	.127.5±4.	36.9-39.0	537.8±0.5	5.5-13.0	9.1±2.7
A-10	22.0-33.4	3	36.9-38.6		4.5-8.5	6.6±1.4
G-1	22.0-33.5	25.6±2.9	35.6-37.2	36.3±0.6	2.5-26.0	19.5±5.2
G-2	23.2-32.1	26.8±2.8	35.9-36.5	36.2±0.33	5.5-17.0	12.2±4.1
G-3	22.8-32.9	25.7±2.9	35.4-37.2	6.4±0.4	8.0-22.0	15.1±5.2
G-4	23.0-32.0	27.0±2.9	36.1-37.2	36.4±0.3	8.0-16.0	12.4±3.1
G-5	22.8-32.0	26.0±2.8	36.6-37.2	36.5±0.5	10.0-21.5	13.8±3.2
G-6	23.1-33.0	26.7±2.9	36.1-37.4	36.6±0.4	6.0-13.0	9.6±2.3

Area	pH		DO (ml l^{-1})		DOM (mgO$_2$ l^{-1})	
St.	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
A-1	7.95-8.20	8.10±0.06	4.10-5.29	4.62±0.4	0.06-17.48	4.25±2.33
A-2	.7.98-8.20	8.12±0.08	4.04-4.92	4.50±0.3	0.01-11.52	.98±1.910
A-3	8.02-8.30	8.14±0.10	2.95-6.16	4.52±1.0	1.56-20.48	.1±4.15.3
A-4	7.99-8.38	8.17±0.1	2.91-5.68	4.51±0.8	0.02-17.68	9±3.76.52
A-5	7.97-8.26	8.12±0.08	2.42-5.60	4.42±0.7	0.07-22.68	±3.24.57±
A-6	7.14-8.22	8.05±0.3	3.38-5.83	4.47±0.8	0.07-16.56	2.211.7±4
A-7	7.99-8.36	8.16±0.09	3.47-5.78	4.56±0.7	0.68-30.80	.8
A-8	8.04-8.35	8.17±0.078.	3.52-5.80	4.83±0.6	0.01-21.0	7.87±3.36
A-9	8.01-8.33	12±0.10	3.43-5.68	4.64±0.6	0.02-16.8	.71±2.3
A-10	8.01-8.25	8.12±0.10	3.53-5.44	4.57±0.4	0.04-8.40	2.83±1.3
G-1	7.97-8.33	8.09±0.118.	2.42-6.31	4.31±1.0	0.01- 8.64	6.54±1.2
G-2	7.92-8.18	10±0.06	2.30-5.99	4.41±1.0	0.02- 6.34	5.10±1.26
G-3	7.92-8.36	8.12±0.10	2.49-5.95	4.19±1.1	0.04-13.8	.72±4.3
G-4	7.91-8.23	8.11±0.07	2.24-6.10	4.32±1.0	0.03-5.21	4.20±1.35
G-5	7.95-8.36	8.12±0.11	2.84-5.95	4.12±1.2	0.01-10.08	.54±3.1
G-6	7.98-8.40	8.18±0.10	2.53-5.99	4.45±1.1	0.20- 6.71	3.94±1.1

organic materials near the bottom (EMARA, 1998; SHRIADAH, 1999a, b). As a result of the oxidation processes for these organic materials a decrease in the oxygen content is expected in more deep waters. According to REDFIELD *et al.*, (1963) the normal oxidation of organic materials in oxygenated waters is represented by the following equation:

$$(CH_2O)_{106}(NH_4)_{16}H_3PO_4 + 138\ O_2\ \ 106\ CO_2 + 122\ H_2O + 16\ NHO^3 + H_3PO_4$$

This equation enables one to calculate the amount of oxygen necessary for complete oxidation of organic materials in the two regions. The amounts of oxygen that is present after complete oxidation of organic matter (Table 4) in the Arabian Gulf and the Gulf of Oman were found to be 48.8 and 51.7 %, respectively. By comparison, the amount of oxygen present after complete oxidation of organic matter was found to be 47% in the Arabian Gulf (EMARA, 1998).

CONCLUSIONS

The study of some oceanographic variables during an annual cycle at a number of stations in the Arabian Gulf and the Gulf of Oman revealed the presence of two different water types on both sides of the straits of Hormuz. The first one represents the semi-enclosed Arabian Gulf and characterized by its higher water temperature, salinity and organic matter. The second one, on the other hand, represents the Gulf of Oman which is an extension of the Indian Ocean and characterized by its higher transparency, pH and dissolved oxygen in the upper 20 m layers. The distribution of these variables shows more or less homogenous distribution in the Arabian Gulf due to the shallowness of the area and the mixing processes. At the Gulf of Oman, on the other hand, a decrease in seawater temperature, dissolved oxygen, pH values and an increase in the salinity and organic matter was observed in the layers deeper than 20 m depth.

Table 4. Concentrations of dissolved oxygen (DO) necessary for oxidation of dissolved organic matter (DOM) and the concentration

Area	DOM ($mgO_2\ l^{-1}$)	DO ($mg\ l^{-1}$)	Oxygen necessary for complete oxidation ($mg\ l^{-1}$)	Original oxygen concentration ($mg\ l^{-1}$)	% of oxygen present after complete oxidation
ArabianGulf	6.39	6.50	6.82	13.32	48.8
Gulf of Oman	5.34	6.10	5.70	11.80	51.7

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Hidrokemijska svojstva voda Ujedinjenih Arapskih Emirata duž Arapskog i Omanskog zaljeva

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SAŽETAK

Uzorci mora su uzimani dvomjesečno u teritorijalnim vodama Ujedinjenih Arapskih Emirata, koje se protežu na više od 800 km duž Arapskog i Omanskog zaljeva. U ovom radu su izneseni podaci koje se odnose na raspon i raspodjele temperature (20.0 – 34.5°C), saliniteta (35.4 –42.3 psu), pH (7.21-8.38), prozirnosti (4.0 –26.0 m), otopljenog kisika (2.24 – 6.19 ml l^{-1}: 43.4 – 155.5 %) i vrijednosti hipermangata (oksidacije) otopljene organske tvari (0.1 – 30.8 mgO_2l^{-1}). Varijacije temperature u obje regije su bile uobičajene tj. maksimalne ljeti i minimalne zimi. Mjerenja raspodjele temperature pokazala su da su vode Arapskog zaljeva toplije (27.7 °C) od voda Omanskog zaljeva (26.3 °C) ukazujući na snažnije uvjete evaporizacije. Zahvaljujući većoj evaporizaciji, u vodama Arapskog zaljeva pronađena je veća stopa saliniteta (39.2 psu). Obje regije su imale vrlo male sezonske varijacije pH faktora. Kolebanja prozirnosti bila su izrazitija, s većim vrijednostima ljeti nego zimi. Vode Omanskog zaljeva prozirnije su od voda Arapskog zaljeva. Međutim, vode oba zaljeva su imale podjednake koncentracije otopljenog kisika (veće vrijednosti zimi nego ljeti). Koncentracija permanganata (oksidacija) otopljene organske tvari bila je viša u Arapskom zaljevu u usporedbi s Omanskim zaljevom, s višim vrijednostima u ljetnom nego u zimskom periodu. Osim toga, u obje regije je zapažen značajan porast oksidacije otopljene organske tvari s dubinom. Vrijednosti kisika nakon potpune oksidacije organske tvari iznosile su u Arapskom zaljevu 48.8% odnosno 51.7% u Omanskom zaljevu.

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