

Oil pollution in surface water of the Turkish side of the Aegean and Eastern Mediterranean Seas

Dođu Akdeniz ve Ege Denizi Trkiye kıyılarının yzey suyu petrol kirliliđi

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Abstract

Oil pollution of the South part of the Aegean Sea and Mediterranean Sea was investigated at 48 stations from the Bozburun Peninsula to İskenderun bay, during 17-28 August 2006.

The highly carbon concentration of the samples was determined by UVF by using Iraq crude oil and also chrysene as references materials. The oil pollution in examined sea water was 4.16 µg/L in Antalya Bay and 100.33 µg/L in Iskenderun through Iraq crude oil equivalent. The highest polluted areas are Iskenderun, Bozburun and Kalkan.

Keywords: Aegean Sea, Mediterranean Sea, oil pollution, surface water

Introduction

The Mediterranean Sea is virtually an enclosed sea surrounded by Europe, Africa and Asia. It has a surface area of 2.5 million km² (UNEP, 1996) which represents only 0.82% of the surface area of the world ocean (Bianchi and Morri, 2000). The Aegean Sea is a part of Mediterranean Sea. It is a semi-closed sea surrounded by Turkey and Greece and it is a sub area of the Mediterranean Sea. Its most important geographical peculiarity is the presence of numerous islands and islets (Zaitsev and ztrk, 2001).

Oil pollution is an important problem of seawater. There are several sources of petroleum hydrocarbons. They can be introduced into the marine

environment mainly by oil transport, discharge of tanker ballast, oil industries, shipping activities, municipal sewers etc.

The Mediterranean Sea traffic consists of some 250 mt/yr¹ of oil which are transported through the Mediterranean, with about 150 mt/yr¹ from North Africa to European ports. The Aegean Sea is also a busy way for oil traffic between the Mediterranean and Black Sea (Öztürk and Öztürk, 2003).

Oil pollution was investigated in the Mediterranean Sea South West of Turkey (Ehrhardt and Petrick, 1989, Guven *et al.*, 1998, Bildaci *et al.*, 2000) and in the Turkish part of the Aegean Sea (Balci, 1993, Kucuksezgin *et al.* 1995, Ozturk *et al.*, 2006, Guven and Yalcin 2006-2007 unpublished data). However, there is no regular data on the distribution of the petroleum hydrocarbons in the Eastern Mediterranean Sea.

The aim of this study is to determine the oil pollution amount in the surface water of the Turkish part of Aegean and Mediterranean Seas.

Materials and Methods

The surface seawater samples were taken in 2,8 L amber glass bottles and 15 ml dichloromethane (DCM) was added immediately for preservation.

The samples were taken on board of R/V YUNUS-S during the period between 17 and 28 August. The sampling stations are shown in Figure 1.

800 ml seawaters were extracted two times with 30 ml DCM. The extracts were combined and dried over anhydrous sodium sulphate, filtered and then distilled at 36°C. The residue was dissolved in hexane the volume adjusted to 10 ml and then analyzed by spectrofluorophotometer (Shimadzu RF 5301).

The oil measurement was made using two calibration curves plotted with Iraq crude oil purchased from BOTAS, Petroleum Pipeline Corporation in a concentration of 0,25-2 µg/ml and with chrysene in a concentration of 0,05-0,2 µg/ml (Aldrich). The intensity was measured by UVF (Shimadzu RF 5301) at 310/360 nm (ex/em). The equation of calibration curve was calculated by apparatus.

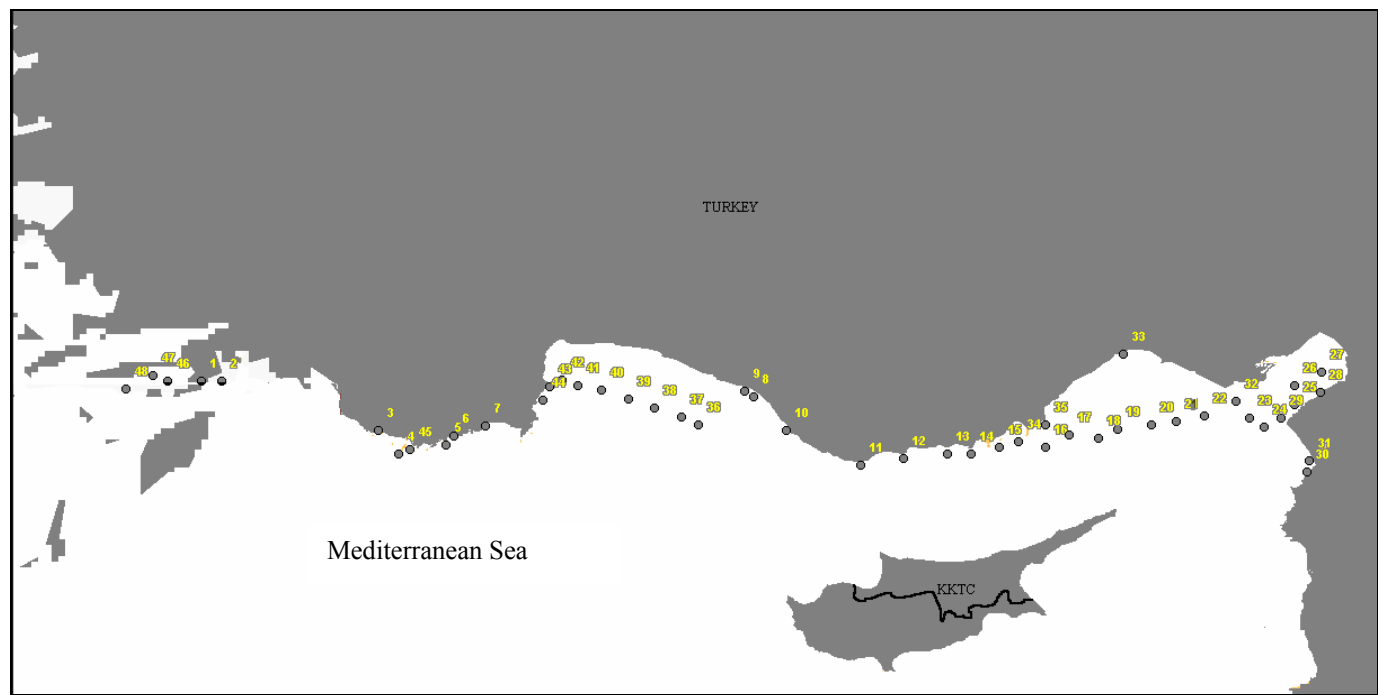


Figure 1. The sampling stations

Results and Discussion

The equation of calibration curves are

1-for Iraq crude oil:

$$F_1 = 427,5005x C + 2,3783 \quad r^2 = 0,99$$

2- for chrysene :

$$F_1 = 1517,3x C + 37,383 \quad r^2 = 0,99$$

F1 : intensity

The oil concentrations ($\mu\text{g/L}$) obtained for the surface water samples are summarized in Table 1.

Limit value of oil in sea water is reported as $2.5 \mu\text{g/L}$ by WHO. Oil level of the samples varied between $4.16\text{--}100.33 \mu\text{g/L}$ calculated from Iraq crude oil. The lowest value was $4.16 \mu\text{g/L}$ (station 40 and station 42) in the samples which were taken from Antalya Bay and the highest detected value was $100.33 \mu\text{g/L}$ in the samples (station 29) which was taken in İskenderun - İnci Headland. Oil level of sample varied between $0.88\text{--}25.38 \mu\text{g/L}$ calculated from chrysene reference. The lowest value $0.88 \mu\text{g/L}$ was found in the station 42 and the highest value $25.38 \mu\text{g/L}$ in the station 29.

According to our findings the pollution level of examined area are higher than the limit value given by WHO.

As seen in Table 2 oil concentration of Eastern Mediterranean Sea surface water decreased from 1999 to 2006.

Table 1. The oil concentrations according to the standard curve of Iraq oil and chrysene.

Sampling Stations Number:	Sampling Stations:	Coordinates	Conc. Iraq Crude Oil (µg/L):	Conc. Chrysene (µg/L):
1	Bozburun Peninsula	36° 33.041 N 28° 12.594 E	68.61	16.45
2	Off Bozburun Peninsula	36° 35.019 N 28° 40.881 E	67.65	17.62
3	Kalkan Harbour	36 ° 15.583 N 29 ° 24.560 E	55.88	14.30
4	Off Meis Island	36 ° 01.141 N 29 ° 30.148 E	56.71	14.53
5	Off Demre	36° 07.500 N 29° 57.000 E	13.59	3.54
6	Demre	36° 12.787 N 29° 57.511 E	9.15	2.29
7	Finike Harbour	36 ° 17.683 N 30 ° 08.983 E	44.08	10.98
8	Alanya Harbour	36 ° 32.362 N 32 ° 00. 065 E	11.66	3.00
9	Alanya Coast	36 ° 32. 371 N 32 ° 00.496 E	8.44	2.09
10	Gazipaşa	36° 13.200 N 32° 18.537 E	10.36	2.63
11	Anamur Harbour	36° 03.573 N 32° 52.445 E	10.73	2.73
12	Akyaka	36° 05.573 N 33° 13.499 E	9.61	2.42
13	Off Sancak Headland-Yılan Island	36° 05.750 N 33° 24.842 E	31.64	6.03
14	Off Sulusalma Headland	36 ° 07 360 N 33 ° 36 094 E	14.48	3.79
15	Dana Island Coast	36 ° 11 722 N 33 ° 45 643 E	11.88	3.06
16	Off Kızılbaz	36° 09.514 N 34° 03.235 E	11.22	2.87
17	Off Yemişkumu	36° 09.896 N 34° 15.300 E	8.89	2.22

Table 1 continued.

18	Karapınar Stream	36 ° 11.831 N 34 ° 27.604 E	17.22	4.56
19	Mersin	36 ° 14. 755 N 34 ° 40.120 E	9.22	2,31
20	Tarsus	36 ° 17.295 N 34 ° 51.676 E	18.23	4.85
21	Tuz Gölü	36 ° 19.959 N 35 ° 04.566 E	24.86	6.71
22	Akyatan Lake	36° 21.614 N 35° 15.666 E	12.06	3.11
23	Bahçeköy	36 ° 23.265N 35 ° 27.497 E	42.96	10.66
24	Off Akıncı Headland	36 ° 26.092 N 35 ° 40.057 E	8.99	2.25
25	Uluçınar	36 ° 28.760 N 35 ° 50.512 E	14.49	3.79
26	Off Akıncı Headland	36 ° 33.973 N 36 ° 00.488 E	5.82	1.35
27	İskenderun	36 ° 35.896 N 36 ° 10.559 E	22.41	6.03
28	İskenderun - Büyükdere	36 ° 31.350 N 36 ° 01.456 E	11.24	2.88
29	İskenderun - İnci Headland	36 ° 19.944 N 35 ° 44.482 E	100.33	25.38
30	İskenderun – Kamışlık Bay	35 ° 57.679 N 35 ° 55.627 E	12.22	3.15
31	İskenderun - Asi River İnet	36 ° 02.855 N 35 ° 56.814 E	9.50	2.39
32	Off Karataş Headland	35 ° 27.274 N 35 ° 25.333 E	8.86	2.21
33	Mersin Harbour	36 ° 47.455 N 34 ° 38.340 E	5.39	1.23
34	Taşucu Gulf- Güvercin Island	36 ° 15.175 N 33 ° 48.802 E	14.54	3.81
35	Taşucu Gulf	36 ° 18.135 N 33 ° 51.746 E	15.86	4.18
36	Off Alanya Lighthouse	36° 17.974 N 31° 38.945 E	19.26	5.14
37	Antalya Bay	36° 20.799 N 31° 31.743 E	14.05	3.67

Table 1 continued.

38	Antalya Bay	36° 24.605 N 31° 20.943 E	8.57	2.13
39	Antalya Bay	36° 28.400 N 31° 09.634 E	5.67	1.31
40	Antalya Bay	36° 32.049 N 30° 58.330 E	4.21	0.90
41	Antalya Bay	36° 34.011 N 30° 48.180 E	10.18	2.58
42	Antalya Bay	36° 35.774 N 30° 41.287 E	4.16	0.88
43	Kemer	36° 33.547 N 30° 36.060 E	9.51	2.39
44	Üç Adalar	36° 37.041 N 30° 36.041 E	13.90	3.63
45	Bayındır Harbour	36° 11.734 N 29° 38.581 E	7.01	1.69
46	Minas-Rodos	36° 36.011 N 27° 55.500 E	5.66	1.30
47	Hisarönü Bay	36° 42.990 N 27° 49.600 E	8.39	2.07
48	South of Datça Peninsula	36° 35.608 N 27° 37.082 E	7.37	1.79

In earlier studies the pollution in this area was reported as 400 ng/L (Ehrhardt and Petrick, 1989) and 9.33-623.32 µg/L (Bildacı *et al.*, 2000, Saydam *et al.*; 1988).

When we compare the oil pollution results obtained earlier with our results we found that the oil concentration decreased in Mersin but increased in İskenderun Bay.

As seen in Table 1 the values of pollution are higher when crude oil is used as reference material. Similar findings were reported in earlier work (Bildacı, *et al.*, 2000).

Özet

Bu çalışmada Ege Denizi ve Akdeniz'de Bozburun yarımadasından İskenderun'a kadar 48 istasyonda yüzey suyunda 17-28 Ağustos 2006 tarihleri arasında petrol kirliliği araştırılmıştır.

Petrol miktarları, Irak ham petrolü ve krizinin referans madde olarak kullanılarak UVF ile tespit edilmiştir. İncelenen deniz suyu örneklerinde Irak ham petrolüne göre en düşük miktar 4.16 µg/L olarak Antalya körfezinde, en yüksek miktar 100,33 µg/L olarak İskenderun'da bulunmuştur. En kirli bölgeler İskenderun, Bozburun ve Kalkan'dır.

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