Turkish J.Mar. Sci 4.51-60 (1998)

An Investigation on the oil pollution of the Eastern Mediterranean Coast of Turkey

(A note to the discussion on the export route of Caspian oil either by pipeline or tanker)

Türkiye doğu Akdeniz sahillerinde petrol kirliliği üzerinde araştırma

(Hazar Denizi petrolünün tanker veya boru hattı ile nakli üzerindeki tartışmaya ait bir not)

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Abstract

The oil pollution in seawater of East Mediterranean areas of Turkey was measured before and after service of Iraq - Yumurtalık (İskenderun) export pipeline. The higher oil concentration was found as 514.28 µg/L and 30.35 µg/L at Botaş before and after pumping respectively. The oil levels was varied before or after pumping. The findings show that oil transport by pipeline is a better export route. This investigation is a example which is supported the Turkish thesis of pipeline transport for Caspian oil thus recuding thc risk of dangerous oil pollution of Bosphorus, Sea of Marmara and Dardanelles.

Keyword: East Mediterranean, oil levels, before and after pumping.

Introduction

Oil is a main pollutant of seawater. There are several sources of petroleum hydrocarbons introduced to the marine environment by men from transport of oil and its products, discharge of tanker ballast, oil industries, shipping activities and municipal sewers etc. The oil pollutant is deposited on the sediment and along the coast.

The most important factor is transport of oil by tankers. The volume of oil released from tankers is significantly increased with cargo capacity. Meanwhile the probability of accident shall be increased with tanker's number and size. The potential environmental damage resulting by the introduction of increased volume of oil into the water column causes a toxic effect on marine organisms.

The transport of Caspian oil with tanker or pipeline is a daily topic in Turkey. The former case will cause considerable risk of serious oil spill in the highly sensitive Bosphorus and Sea of Marmara.

The selected area of investigation was a region in the Eastern Mediterranean where the export pipeline of Iraq-Yumurtalık petroleum reached the sea and an oil refinery existed.

The oil pollution in the eastern parts of the Mediterranean south of Turkey was reported as 0.6-5.6 µg/L in East Mediterranean area (Saydam *et al.*,1984), in Iskenderun at 1981: 11.8 µg/L, 1982: 25.2 µg/L, 1983: 5.7 µg/L, 1984: 1 µg/L, in Mersin at 1983: 3.8 µg/L, 1983: 1.4 µg/L, in Botaş at 1982: 260 µg/L (Sakarya, 1985), > 400 ng/L in East Mediterranean (Ehrhardt and Petric, 1989), and recently 1.25 µg/L, in Iskenderun 0.84 µg/L in Mersin (Yılmaz *et al.*,1998).

In this paper the results are given for oil pollution of Mersin-Iskenderun area in the Eastern part of Mediterranean Sea, before and after the Iraq petroleum was pumped.

Material

The seawater sample was taken in 3L amber glass bottles and 50 ml dichlormethane (DCM) was immediately added for preservation.

Collection dates were 24 July 1996 before and 18 May 1997 and 17-18 Sept. 1997 after the Iraq oil was pumped.

Sampling stations are shown in Fig 1.

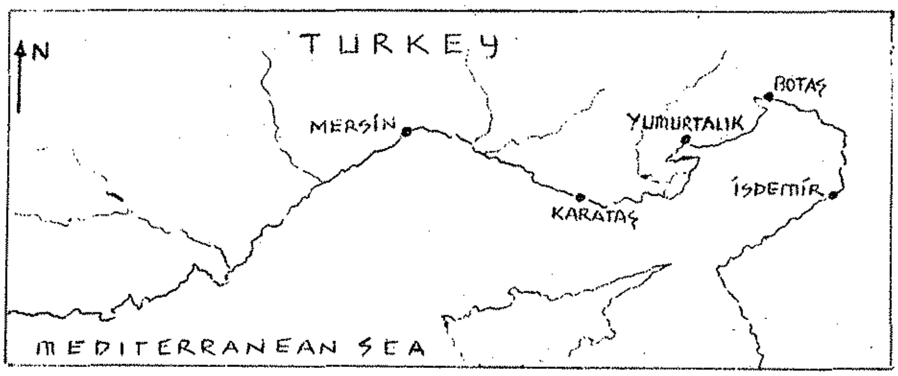

Fig. 1. Sampling stations

Methods

1. Extraction

3 L Seawater sample was extracted 3x50 ml DCM. The extracts were combined and dried with anhydrous sodium sulphates, filtered and distilled under vacuum. The residue was taken with hexane and the volume was adjusted to 10 ml and analysed by UVF and GC/MS.

2. Analysis

2.1. UVF

The oil measurement was made by calibration curve plotted for Iraq and Iranian crude oil in concentration of 0.25-1.5 µg/ml.The intensity was measured by spectrofluorophotometer (Shimadzu, RF-1501) at 310/360 nm (ex/em) according to Ehrhardt and Burns (1993) (Fig.2-3).

2.2.GC/MS

GC/MS analyses were run on a HP 6890 capillary GC connected to a Hewlett Packard Mass Selective Detector (MSD), contolled by a HP Chem Station. Operating conditions were; 53.6 mx0.50 µm i.d. fused HP

PONA, Methyl siloxane, glass capillary column; oven temperature programme: from 110-290 °C at 10 °C min. Splitt; 50/1, Injector temperature; 250°C, Carrier gas; helium, Flow; 1.2 ml/min.

Result and Discussion

The calibration curves of Iraq and Iranian crude oil shown in Fig.2 and 3. The oil concentration was measured by using the standard curve plotted for Iranian and Iraq crude oils. The oil concentration values in examined stations are shown in Table 1.

Table 1. The oil concentrations according to standard curves of Persian and Iraq crude oil

Sampling Stations	Iranian Crude Oil (µg/L)			Iraq Crude Oil (µg/L)		
	A	B	C	A	B	C
KARATAŞ	59.64	28.21	16.78	60.35	22.32	17.12
ARSUS	38.57	28.57	7.50	37.14	23.92	7.54
İSDEMİR	73.57	29.82	38.57	72.85	23.85	58.34
BOTAŞ	514.28	30.35	16.78	488.28	24.42	17.08
YUMURTALIK	82.85	17.50	16.42	83.21	11.10	16.60
MERSİN	348.21	-	214.28	330.35	-	204.46

Sampling Date: A: 24.07.1996, B: 19.05.1997, C: 18.09.1997

As can be seen in this Table the oil level in stations varried before pumping as 38.57-514.28 µg/L and after pumping as 7.50-214.28 µg/L.

The oil levels in the examined area differ sliqhtly (except at. Botaş) depending on the calculation by the standard curve of Iranian and Iraq crude oils.

A generally accepted method is the utilization of the crude oil that is predominantly pollutant in the area concerned.

The oil concentration were high at all the stations before the pumping of Iraq oil started and noticeably decreased following the pumping, prior to Iraq petroleum pumping. The oil from many sources was imported before pumping by tankers to the refinery (ATAŞ, thereform to Kırıkkale) thus increasing the pollution of the region. Increase in pollution was recorded as high as 3-20 fold when the tankers carried the oil.

Unresolved Complex Mixture (UCM) hump is characteristic for to detect petroleum contamination which is recent. The importance of the UCM signal is that it clearly indicates the presence of a very complex mixture of hydrocarbon in the sample. UCM hump was observed in GC/MS chromatogram of seawater sample extract (Fig 4). The presence of UCM signal on chromatogram indicated a recent oil contamination of the area examined.

Pyristane and phytane ratios (Pr/Ph) for Iranian crude oil, Iraq crude oil and the extract of seawater sample taken from Botaş area shown in Table 2. Pr/Ph ratio is lower than 1, indicate a petrogenic imput.

Table 2. Pr/Ph ratio of examinated samples

Iranian crude oil	Iraq crude oil	Botaş sample
0.92	0.88	0.32

Conclusion

The results of this work showed that the oil pollution of the sea was high when it was transported by tankers whereas pipeline route polluted less. This finding is also important to support the Turkish thesis since pipeline route will reduce the risk of a serious oil spill in the highly sensitive Bosphorus, Sea of Marmara and Dardanelles. The better export route of Caspian oil is definitely with pipeline from Baku, across Turkey to Iskenderun on the Mediterranean coast.

Özet

Bu çalışmada Mersin-İskenderun sahillerinden rafineri boru hattı açılmadan önce ve sonra alınan yüzey suyunda bulunan petrol kirliliği miktarlarının mukayesesi yapılmıştır. Bu kirliliğin miktarı rafineri boru hattı devreye girmeden önce Botaş'ta 514.28 µg/L boru hattı devreye girdikten sonra 30.35 µg/L arasında bulunmuştur. Bu sonuçlar değerlendirildiğinde petrol naklinin boru hattı ile yapılmasının tanker ile yapılmasından daha avantajlı olduğu ve çevreyi daha az kirlettiği saptanmıştır. Bu husus Hazar denizi petrolünün tanker ile taşıma yerine boru hattı ile taşınmasının İstanbul ve Çanakkale Boğazları ile Marmara denizine yapacağı petrol kirliliği riskini azaltacağı hakkındaki Türk tezini destekler.

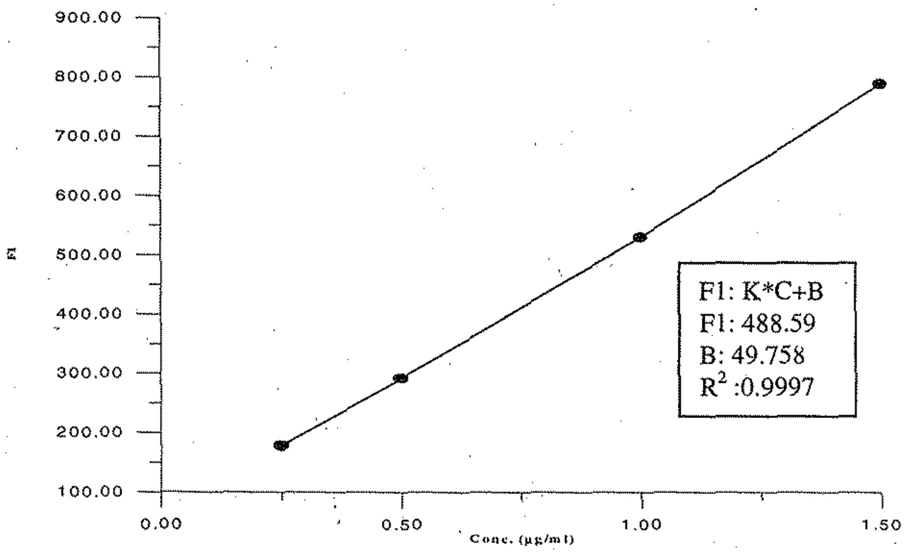

Fig. 2. Standard curve of Iraq crude oil

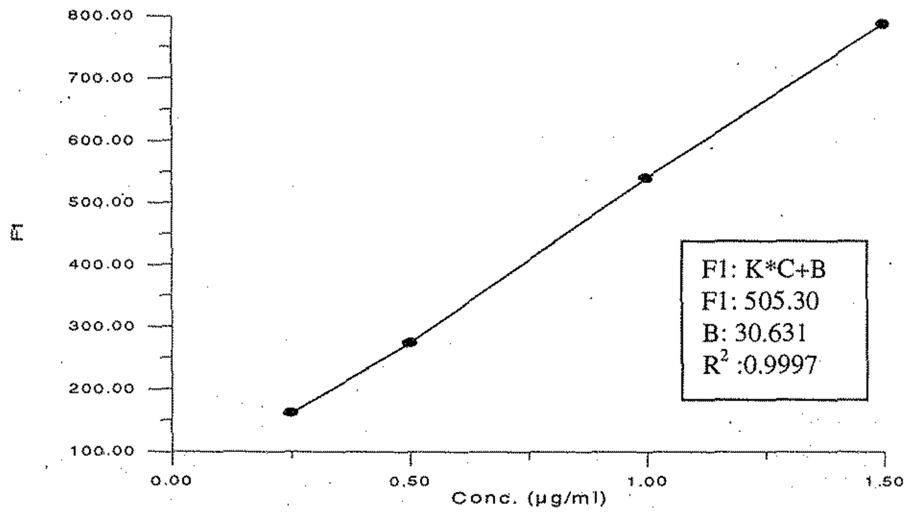

Fig. 3. Standard curve of Iranian crude oil

File : C:\HPCHEM\1\DATA\BTS3.D
Operator :
Acquired : 27 Oct 98 10:07 am using AcqMethod TT2
Instrument : GC/MS Ins
Sample Name: botas deneme
Misc Info :
Vial Number: 1

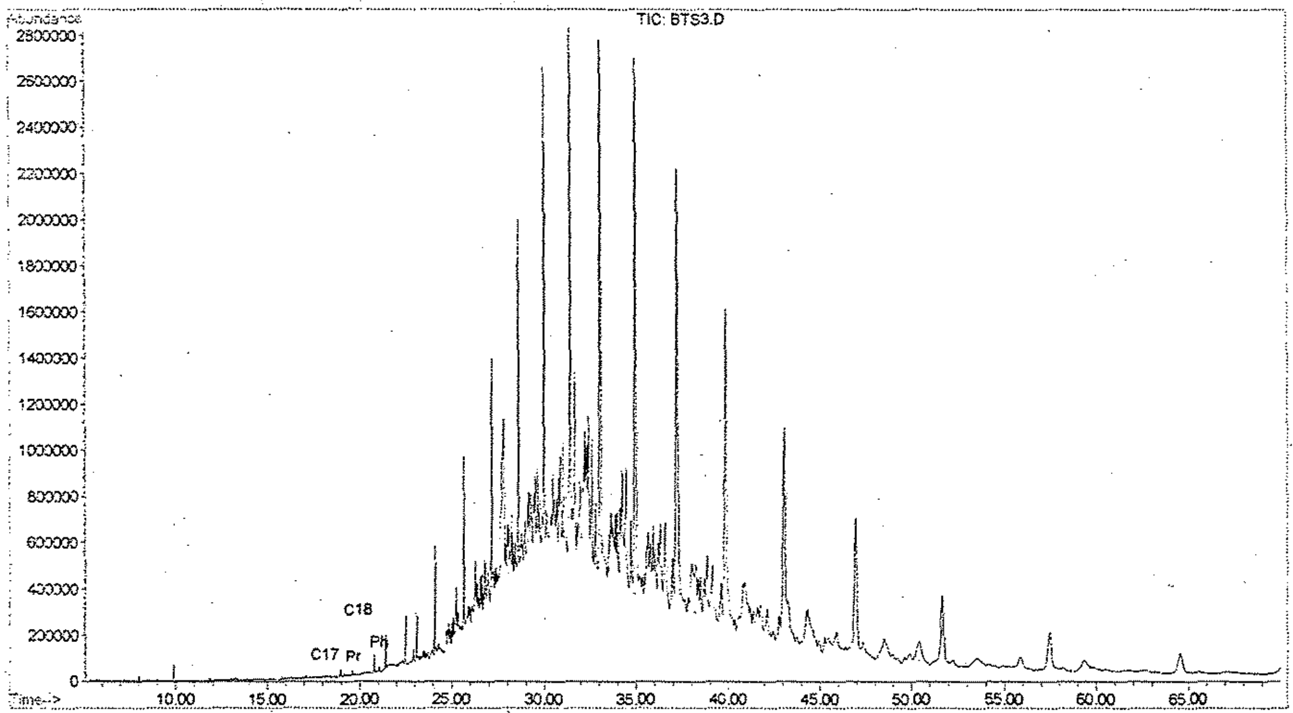

Fig.4. GC/MS Chromatogram of Botaş sample

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File        : C:\HPCHEM\1\DATA\IRANHP.D
Operator    :
Acquired    : 27 Oct 98    3:24 pm using AcqMethod TT2
Instrument :   GC/MS Ins
Sample Name: IRAN Ham Petrolu
Misc Info   : 27/10/1998
Vial Number: 1
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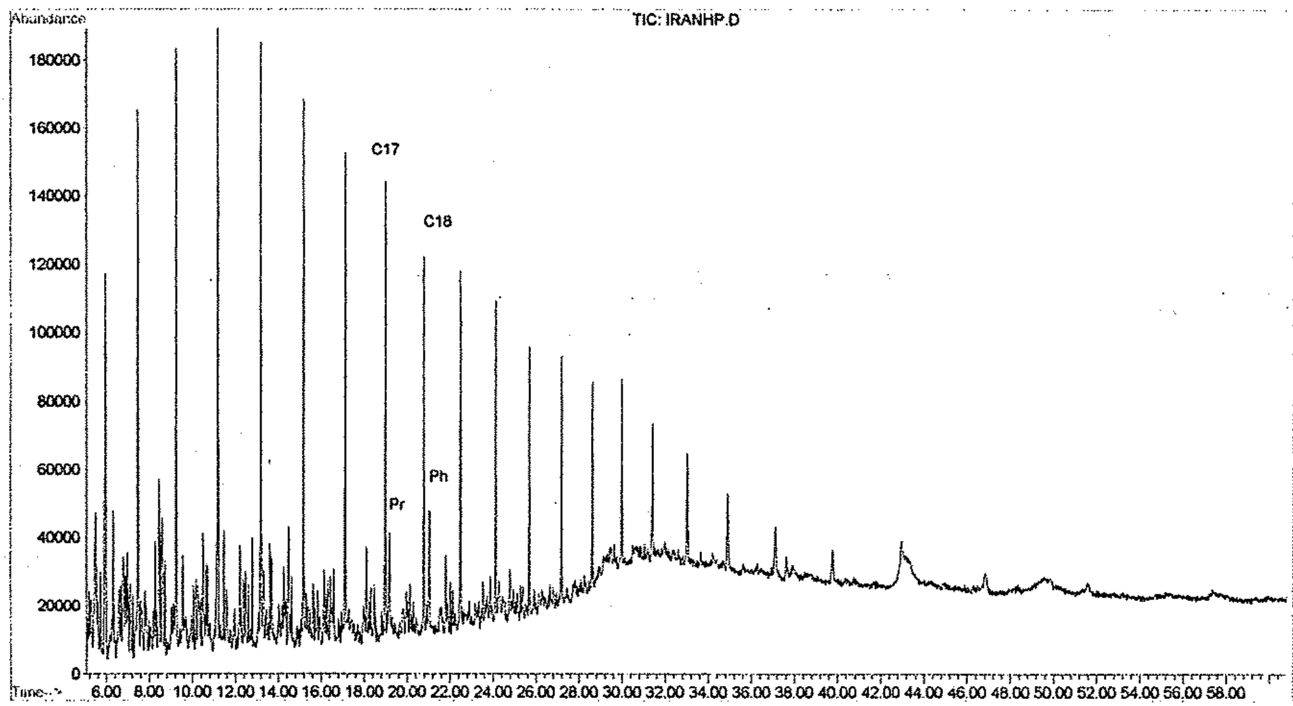

Fig.5. GC/MS Chromatogram of Iranian crude oil

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File        : C:\HPCHEM\1\DATA\IRAKHP.D
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Acquired    : 27 Oct 98   2:20 pm using AcqMethod TT2
Instrument  :   GC/MS Ins
Sample Name: IRAK Ham Petrolu
Misc Info   : 27/10/1998
Vial Number: 1
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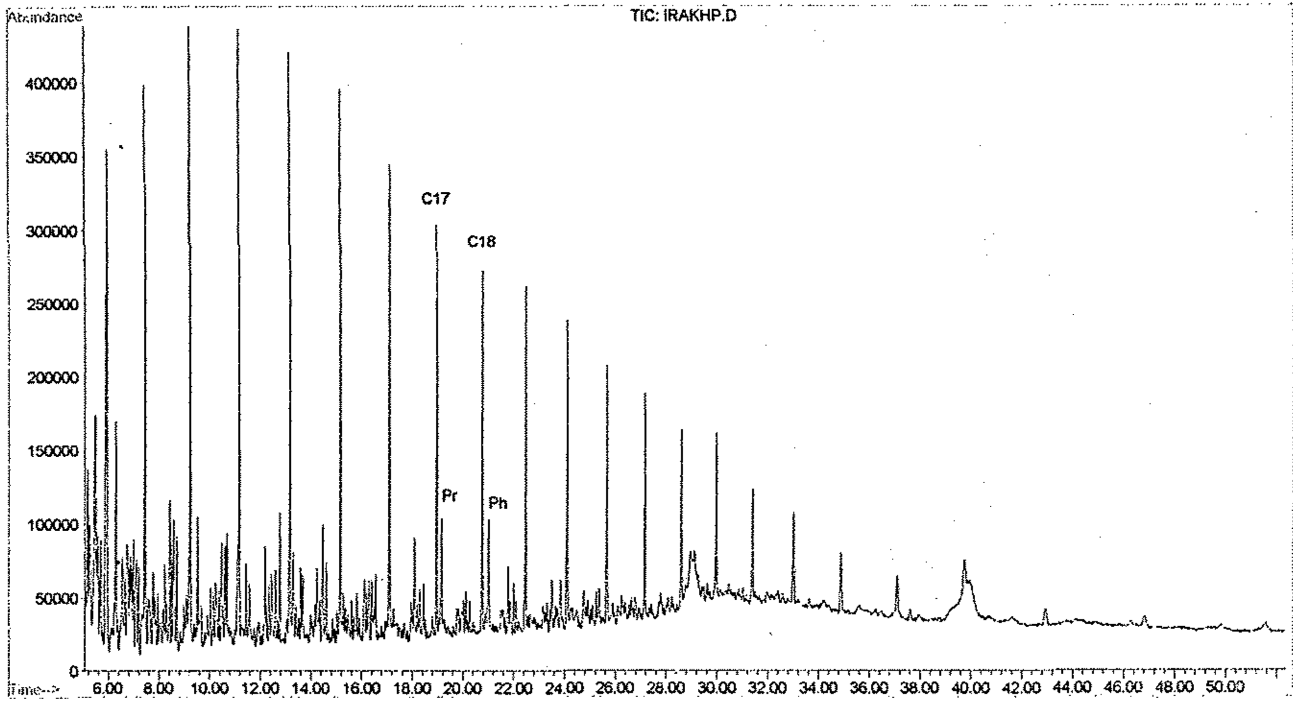

Fig.6. GC/MS Chromatogram of Iraq crude oil

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Received 15.6.1998
Accepted 15.9.1998