

The Pollution of Zeytinburnu Port, Istanbul, Turkey

İstanbul, Zeytinburnu Limanındaki Kirlilik Durumu

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Abstract

The pollutants of sediment of Zeytinburnu Port were determined. The pollutant amounts were found high for organic as oil (3.8 mg/g), chlorinated pesticides (9.55 ng/g), phenol and anorganic as Zinc, hydrogen sulphide, ammonium, nitrite, nitrate. The degradation products of DDT were determined as DDE and DDD. According to these results Zeytinburnu Port is a highly polluted area.

Keyword: Pollution, Zeytinburnu Port

Introduction

Zeytinburnu is a small port of Istanbul. It has small export and import activities. Many pollutants come from ships, industrial and urban waste into this port which is transported by the streams of Cırpıcı and Ayvalı. The pollutants in seawater and sediments were investigated as minerals (Balkıs and Çağatay, 2001), oils (Singh *et al.*, 1993; Güven *et al.*, 1996), pesticides (Law and Dobson, 1998; Quensen *et al.*, 1998; Bajet *et al.*, 1999; Barlas, 1999). There is no sewage treatment system on the streams of Cırpıcı and Ayvalı. Land – based pollutants such as ammonium, nitrite, nitrate,

sulphate, hydrogen sulphide, fluorur, chloride and total organic carbon, pesticides, oil and pollutants based from sea are to be investigated in the harbour area.

In this work the pollutants are determined in sediment of Zeytinburnu port.

Material and Methods

The sediment sample was taken from the Zeytinburnu Port on 04 Feb. 2003. The map of this area is shown in Fig.1.

The determined – matrix groups and applied methods are as follows.

Metals ; AAS, Halogened solvents ; HP 6890 GC/MS, Oil and gress ; DIN, Ammonium ; Titrimetric, Nitrite ; Nitrate ; Detergents ; Phenol ; Cyanide ; Standard Methods 1995, Sulfate ; Gravimetric, Hydrogene sulphide ; iodimetric, Fluoride ; UDR 2000 Spectrophotometric, Chloride ; Argentimetric, pH ; pH meter, TOC ; Walkey – Blake, Pesticides ; HP 6890 GC/ECD, Petroleum hydrocarbons ; UVF (Shimadzu RF – 1501).

Standard curve equations of the pollutants determined are :

Pb	: Abs = 0.0742 Conc + 0.00478	$r^2 = 0.99991$
Cu	: Abs = 0.0876 Conc – 0.00537	$r^2 = 0.99927$
Zn	: Abs = 0.199 Conc – 0.00197	$r^2 = 0.99986$
Ni	: Abs = 0.0422 Conc- 0.0075	$r^2 = 0.99980$
Cr	: Abs = 0.0125 Conc	$r^2 = 0.99915$
Cd	: Abs = 0.130 Conc + 0.00353	$r^2 = 0.99967$
Hg	: Abs = 0.0152 Conc	$r^2 = 0.99987$
As	: Abs = 0.0447 Conc + 0.0650	$r^2 = 1.00000$
Nitrite	: Abs = 0.6135 Conc	$r^2 = 0.9671$
Nitrate	: Abs = 0.0071 Conc	$r^2 = 0.9303$
Cyanide	: Abs = 1.3994 Conc + 0.052	$r^2 = 0.9995$
Grease and oil:	Response = 5.12e+005 Conc + 1.46e+005	$r^2 = 0.991$
Phenol	: Abs = 0.0159 Conc – 0.0475	$r^2 = 0.9964$

Halogenated solvents: Response = 1.86e+006 Conc + 3.76e+005
 $r^2 = 0.992$

Petroleum hydrocarbon ,

From Russian oil equation: Abs = 293.37 x c + 105.60
 $r^2 = 0,960$

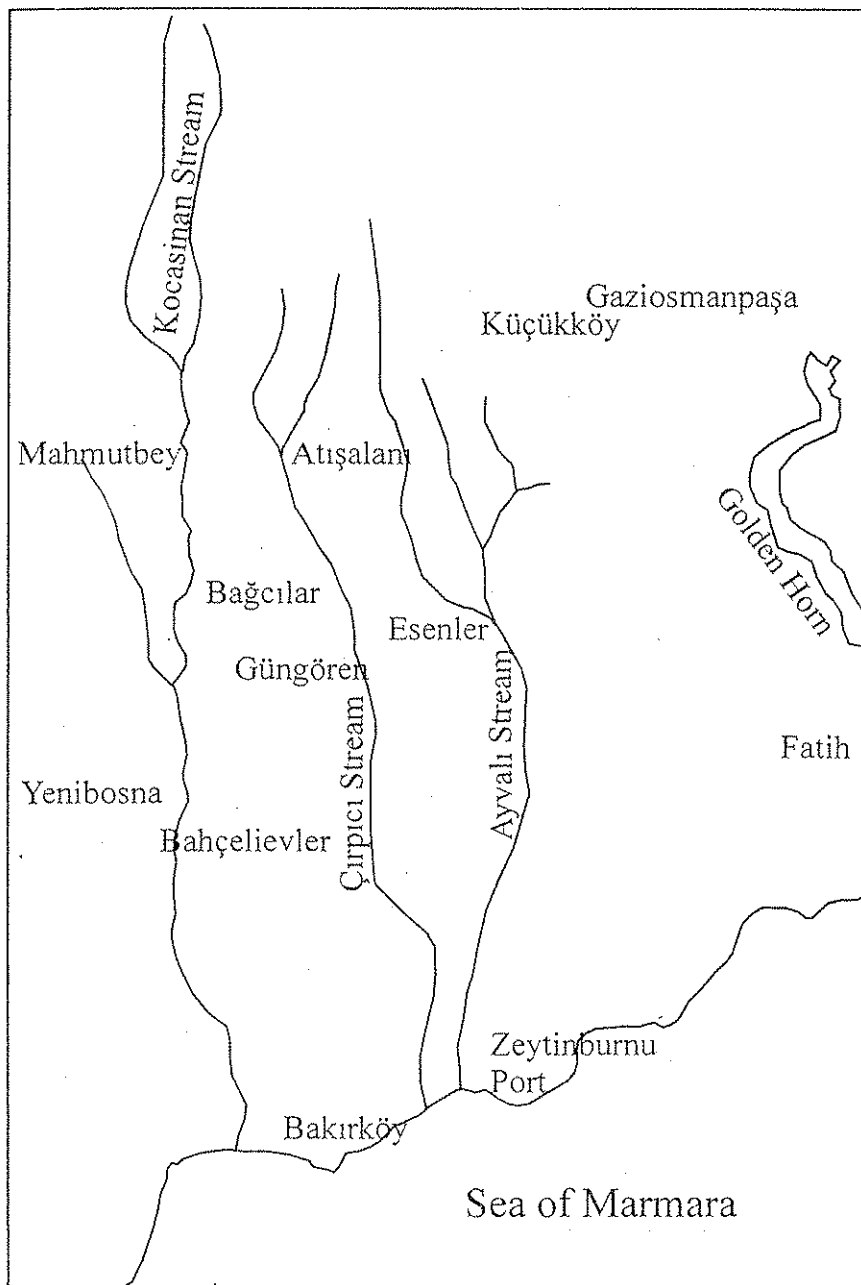


Fig. 1. The map of Zeytinburnu port

Results and Discussion

pH	: 9.5
As	: 0.18 µg/g
Pb	: 3 µg/g
Cd	: < 2 µg/g
Cr	: 30 µg/g
Cu	: 14 µg/g
Ni	: 5 µg/g
Hg	: 0.240 µg/g
Zn	: 163 µg/g
Fluoride	: 2.72 µg/g
Chloride	: 2 mg/g
Cyanide	: 0
Sulphate	: 1.64 µg/g
Hydrogen sulphide	: 172.04 µg/g
Ammonium	: 0.17 mg/g
Nitrite	: 0.126 µg/g
Phenol	: 0.47 µg/g
Total Organic Carbon	: 8 µg/g
Halogened solvents	: 0.06 µg/g
Oil and grease	: 0.82 µg/g
Chlorinated Pesticides	: 9.55 ng/g (The chromatogram in Fig.3).
	(DDE : 0.93 ng/g)
	DDD : 0.76 ng/g
	Heptachlor : 0.78 ng/g
	Chlordan : 0.22 ng/g
	Methoxychlor : 1.32 ng/g
	Cypermethrin : 5.54 ng/g)
Oil soluble substances	: 200 µg/g
Petroleum hydrocarbons	: 3.804 mg/g

The numerous studies have been published on the heavy metal levels in sediment samples of the Marmara Sea (Çağatay *et al.*, 1996 ; Algan *et al.*, 1997, 1999a, 1999b ; Balkıs *et al.*, 1999 ; Balkıs and Çağatay 2001).

The metal contents with exception Zinc in Zeytinburnu Harbour were found below shale average (Wedepohl, 1960 ; Krauskopf,

1979). The high Zinc concentrations suggest the anthropogenic inputs in this region.

Fluoride which is used in dental health coming from the sewage of the city into seawater has been the subject of discussion.

The origins of ammonia, nitrite and nitrate in the sea are from human, animal, bacterial, plant fertilizers and also urban discharge. The ammonia is decomposed to nitrite and nitrate. They indicate the pollution in sea. Nitrate amount varied in coastal water during the season. High level of ammonium, nitrite and nitrate were found in sediment of the port.

Cyanide comes into sea from industrial waste water. It is not found in the sample of sediment.

Sulphate is found in this area in usual concentrations..

Hydrogen sulphide is a high toxic compound. It is a potent inhibitor of aerobic respiration and produced in sediment and also from sewage. The amount of hydrogen sulphide in the Zeytinburnu port was 172.04 $\mu\text{g/g}$

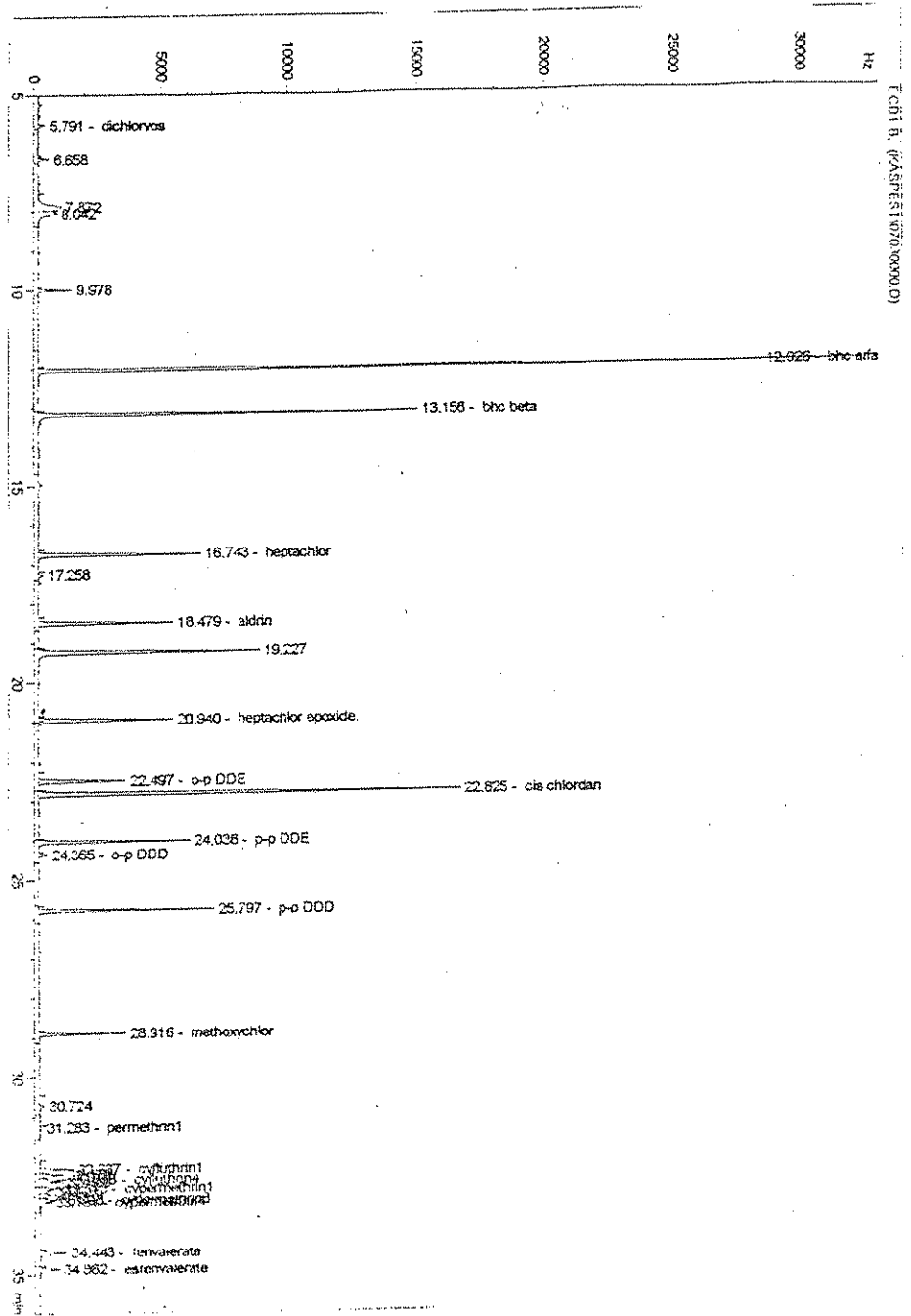
Phenols are organic contaminants. They are substances with hydroxy group attached to benzene or aromatic nucleus. Phenol is a carcinogen promotor and toxic chemical. Phenol in this area was 0.47 $\mu\text{g/g}$ showed, the pollution in marine system.

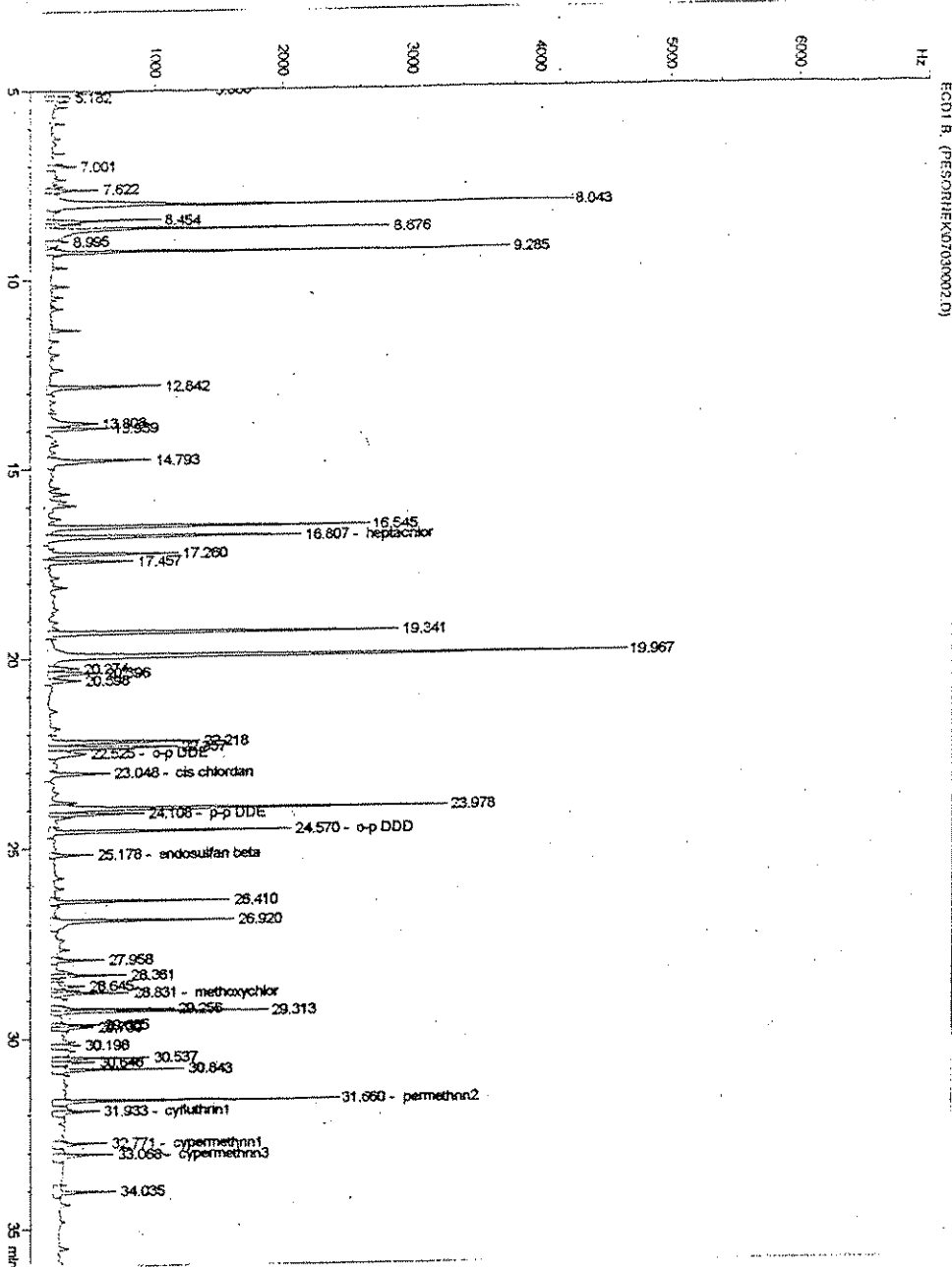
Chlorinated pestiside, DDT was widely used in the second World War all over the world. It has been restricted in many countries since 1972, but it still continues in use.

DDT was detected in the water of rainfall (Ohio), surface water (USA), estuary (California) and atmosphere as vapour and solid form (Jorgensen and Johnsen, 1981). Humic type particule adsorbes DDT at high level and sorbed DDT was found in marine environment.

DDT (1.1.1. - trichloro- 2,2 bis (p - chlorophenyl) ethane) was degraded by various microorganisms in aerobic and anaerobic conditions as (Fries, 1972).

Fig. 2. The chromatogram of chlorinated pesticides standard.





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Fig. 3. The chromatogram of chlorinated pesticides in Zeytinburnu Port.

DDD:	1,1 - dichloro - 2,2 bis (p - chlorophenyl) ethane
DDE:	1,1 - dichloro - 2,2 bis (p - chlorophenyl) ethylene
DDMU:	1 - chloro - 2,2 bis (p - chlorophenyl) ethane
DDOH:	1,1 - bis (p - chlorophenyl) ethane 2 ol.
DDA:	bis (p - chlorophenyl) acetic acid
DPM:	p, p ¹ - dichloro di phenyl methane
DBH:	p, p ¹ - dichlorobenzen hydrol
DBP:	p, p ¹ - dichlorophenzophenone

These degradations are due to reductive dechlorination of DDT. The degradation pathway of DDT as follows :



DDT and degradation products DDE and DDD caused slight hepatic cell tumors in mice (Tarzjan and Kemeny, 1969). LD₅₀ value of DDT for fish is 2.57 µg/L (Reish *et al.*, 1978). Degradation of DDT in half life is 8 months and 39% remains 17 years in soil (Jorgensen and Johnsen, 1981).

p, p¹ DDE and p, p¹ DDT were detected in blood during the antimalaria campaign in Argentina (Astolfi *et al.*, 1980), in fish (Barlas, 1999), cod liver (Arctic) (Crosby, 1972), in atmosphere, rain water, atmospheric dust, cultivated soil, fresh water, seawater, gras, aquatic macrophytes, phytoplankton, invertebrates in sea, human food, man (Jorgensen and Johnsen, 1981).

LD₅₀ value of DDT for fish is 2.57 µg/L in seawater (Reish *et al.*, 1978).

DDT, DDD, DDE were found in Sakarya river (Barlas, 1999), UK estuarine and coastal area (Law and Dobson, 1998).

Fig. 2 shows chlorinated pesticides standards. The detected pesticide are the degradation products of DDT as DDE, DDD, p, p¹ DDD and another chlorinated pesticide as chlordan, heptachlor,

methoxychlor, cypermethrin. The chlorinated pesticides found as DDT 0.5 – 0.8 ng/g, DDE 0.3 – 8.9 ng/g in Manila sediments (Bajet *et al.*, 1999). The amount of chlorinated pesticides in total are 9.55 ng/g in Zeytinburnu Port (Fig. 3) and they were :

The degradation products of DDT as DDE 0.93 ng/g and DDD 0.76 ng/g
heptachlor 0.78 ng/g,
chlordan 0.22 ng/g,
methoxychlor 1.32 ng/g,
cypermethrin 5.54 ng/g,

Pesticide residue have been indentified as a significant pollutant in this port.

Oil amount found in this area is 3.804 mg/g. The limit of oil in sediment is 0.10 µg/g (National Academy of Science, 1975). Hence the oil pollution in Zeytinburnu Port is considered very high.

Conclusion

The location of major industrial areas in the streams of Cırpıcı and Ayvalı includes a number of various types of industries. As a result Zeytinburnu Port is highly polluted and must be seriously and regularly controlled.

Özet

Bu çalışmada, Zeytinburnu limanındaki kirleticiler belirlenmiştir. Bu kirleticilerden, anorganik, Arsenik, kurşun, kadmiyum, krom, bakır, nikel, civa, çinko, florid, klorid, siyanid, sülfat, hidrojen sülfid, amonyak, nitrit, nitrat ; organik, toplam organik karbon, halojenli bileşikler, yağ ve gres, klorlu pestisitler, yağda çözünen maddeler, petrol hidrokarbonlarının analizi yapılmıştır. Metallerden çinko sınırın üstündedir. Sedimentte petrol sınırı 10 µg/g dir. Buna göre Zeytinburnu limanında petrol miktarı yüksektir. Ayrıca kullanılması yasak olan klorlu pestisitlerden DDT' nin parçalanma ürünlerine rastlanması bu pestisitlerin hala kullanıldığını göstermiştir. Pestisitlerden DDE, DDD, heptaklor, klordan, metoksiklor, cypermethrin bulunmuştur. Bu organikler yanında fenol' un bulunması Zeytinburnu limanının çok kirli olduğunu ve bu limanın ciddi bir şekilde devamlı kontrol edilmesinin zorunlu olduğunu göstermiştir.

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