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A Study of the Concentration of Petroleum Hydrocarbons in Tripoli Port

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Abstract:
Marine oil pollution is considered one of the most dangerous and common types of pollution. Problems associated with it have appeared since its discovery and have extended to include all stages of production, transportation, refining, manufacturing, storage, marketing, and even the disposal of used products. The continuous increase in each of these activities has led to an increase in the amount of oil pollutants in the waters of beaches, seas, and oceans. It has been proven that the waters of the seas and oceans are exposed to pollution with millions of tons of oil annually, especially since most factories and refineries are located along the coasts. This research focused on the concentration rate of petroleum hydrocarbons inside the Tripoli Port basin and its surroundings, where specific locations inside the port were selected, particularly the active docks which experience high ship traffic. Samples were taken from the selected sites according to standard procedures and then analyzed at the Oil Research Center. The results showed that the petroleum hydrocarbon concentration values were below the maximum allowed limit according to international standards, specifically as mentioned in Annex I of the MARPOL Convention, which stipulates that the maximum allowed concentration of petroleum hydrocarbons in the marine environment is 15 parts per million (ppm), equivalent to 0.15 mg/L.

Keywords: Marine oil pollution, Petroleum hydrocarbons, Tripoli Port, Marine environment.

دراسة تركيز الهيدروكربونات النفطية في ميناء طرابلس

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الملخص
يُعد التلوث النفطي البحري من أخطر أنواع التلوث وأكثرها شيوعًا، وقد ظهرت المشاكل المرتبطة به منذ اكتشافه، وامتدت لتشمل جميع مراحل الإنتاج والنقل والتكرير والتصنيع والتخزين والتسويق، وحتى التخلص من المنتجات المستعملة. وقد أدى التزايد المستمر في كل من هذه الأنشطة إلى زيادة كميات الملوثات النفطية في مياه الشواطئ والبحار والمحيطات. وثبت أن مياه البحار والمحيطات تتعرض للتلوث بملايين الأطنان من النفط سنويًا، لا سيما وأن معظم المصانع والمصافي تقع على طول الشواطئ. ركز هذا البحث على معدل تركيز الهيدروكربونات البترولية داخل حوض ميناء طرابلس وخارجه، حيث تم اختيار مواقع محددة داخل الميناء، لاسيما الأرصفة النشطة التي تشهد حركة مكثفة للسفن. أُخذت العينات من المواقع المختارة وفق الإجراءات القياسية ثم حُللت بمركز أبحاث النفط، وقد أظهرت النتائج أن قيم تركيز الهيدروكربونات البترولية كانت دون الحد الأقصى المسموح به وفقاً للمواصفات العالمية، وتحديدا ماورد في الملحق الأول من اتفاقية ماربول

(MARPOL)، حيث حددت أن أقصى حد مسموح به لتركيز الهيدروكربونات البترولية في البيئة البحرية 15 جزءاً في المليون (ppm)، أي ما يعادل 0.15 ملغم/لتر.

الكلمات المفتاحية: التلوث النفطي البحري، الهيدروكربونات البترولية، ميناء طرابلس، البيئة البحرية.

Introduction

The vast majority of the earth is covered with water, the world's oceans cover over 70% of the earth surface. Nearly all the earth's water is located in its oceans. Excluding the water retained in the pores of sedimentary rocks, the oceans contain 97% of the free water on earth. There are many pathways by which pollutants enter the oceans. Sewage and industrial wastes are pumped into coastal waters through marine outfalls, more sewage is dumped by ships plying the seas, solid wastes and sewage sludge are carried to sea a board barges and dumped into the oceans, harbour dredge spoils must be placed somewhere and are usually deposited into the sea, radioactive wastes from nuclear power plants, research laboratories, hospitals, and nuclear weapons development are dumped into the oceans in some parts of the world in both liquid and containerized from, runoff from land enters the oceans carrying a myriad of pollutants, and petroleum products continually contaminate the oceans from offshore drilling platforms, shipping accidents bilge and oil tank washing .

Of all marine pollutants, oil and petroleum hydrocarbons have received the greatest attention internationally, politically, and scientifically. The presence of oil in marine waters can have adverse impacts on both natural and human manufactured resources. The study of marine oil pollution is an extremely complex one because of thy myriad sources of petroleum materials entering the oceans, because oil is composed of thousands of different compounds, and because the fate of these materials is governed by many separate physical, chemical, and biological factors. [1]

Objectives of study

- To determine the concentrations of total petroleum hydrocarbons (TPH) in the waters of the Tripoli port basin and the surrounding marine areas, with a focus on the active docks experiencing heavy ship traffic.
- To assess compliance with international environmental standards, particularly the maximum allowable limits according to MARPOL Annex I.
- To provide practical recommendations to maintain water quality, reduce oil pollution, and support continuous environmental monitoring programs within the port.

Study limit (tripoli seaport)

Overview:

Tripoli is situated in west Libya, and is the capital and principal port of the country; the harbour covers an area of approx. 3 km² and is protected by 2 breakwaters, 2,000 m and 700 m in length respectively.

- Traffic figures: Approx 600 vessels visit the port annually.
- Load Line zone: Summer.
- Max size: Max LOA 173.7m.

Figure (1): Tripoli Seaport.

Navigation

Sea buoys, fairways and channels: From a position N 32° 56.50’ E 013° 13.50', 3.25nm NE of Tripoli Light the approach channel, 400m in width leads S for 1nm through Caliuscia Bank. The W side of the channel is marked by light beacon and light buoy; the E side by Light Beacons .

Pilot: Compulsory, pilot boards 1nm NNE of the harbour entrance.

Anchorages: An area for vessels awaiting a berth is approx. 1.5 nm N of Tripoli Light .

Weather: Prevailing winds: North mist or haze is common; the latter especially with winds between E and S therefore the coast should be approached with caution. Strong NW winds raise a heavy sea in the harbour entrance.

Tugs: There are 17 tugs 500-2,400 hp available. [2]

Research method

Samples were collected from the port waters and outside, where the use of a private capacity 1 liter bottles after washed and sterilized as figure (2), Samples were analyzed in the laboratory of oil research center in Tripoli by using standard methods approved by the Commission on Marine Sciences (1976ioc) to set the concentration of petroleum hydrocarbon in sea water, and all samples were collected from a depth of 1 meter, with the addition of 50 ml of carbon tetrachloride solvent in each sample with sealable so back to the laboratory for analysis.

A device such as that illustrated in Figure (3) was used for analysis water samples.

Figure (2): Samples that have been taken

Figure (3): The measurement devise.

Results

Table (1): Total petroleum hydrocarbon (TPH) in seawater samples.

Sample ID	TPH (mg/l)
A sample of the area (outside the port)	BDL
A sample of the area (berth number 4)	BDL
A sample of the area (berth number 2)	BDL
A sample of the area (berth aleaskari)	BDL
A sample of the area (berth almarsi)	BDL

*BDL: Below Detection Limit

According to international standards, specifically Annex I of the MARPOL Convention, the maximum allowable concentration of petroleum hydrocarbons in wastewater discharged from ships into the sea has been set at approximately 15 parts per million (ppm), equivalent to 0.15 mg/L, and this level must not be exceeded to ensure environmental protection.

Conclusions

The findings of this study which has been carried out on Tripoli port area for measuring the concentration of the petroleum hydrocarbon in the water samples was taken from the Tripoli port area quays were below detection limit.

The results of this study, which was conducted in the Tripoli Port area to measure the concentration of petroleum hydrocarbons in water samples taken from the port's docks, showed that the levels were within the allowable limits according to international environmental standards and specifications, specifically those stated in Annex I of the MARPOL Convention, the maximum allowable concentration of petroleum hydrocarbons in wastewater discharged from ships into the sea has been set at approximately 15 parts per million (ppm), equivalent to 0.15 mg/L, and this level must not be exceeded to ensure environmental protection. This indicates that the environmental condition of the port's waters is good. We also recommend considering the continuation of environmental monitoring and regular follow-up programs to maintain the stability and cleanliness of the port's waters.

Recommendations

- Continue implementing regular environmental monitoring programs for total petroleum hydrocarbons (TPH) concentrations in the waters of Tripoli Port and its surroundings, at regular intervals, to ensure early detection of any abnormal increase in oil pollution levels.

- Expand the scope of the study in the future to include additional sites within the port and adjacent coastal areas, with an increased number of samples to improve the accuracy of environmental assessment.
- Adopt modern, internationally approved analytical techniques for measuring petroleum hydrocarbons, and standardize sampling methodology to ensure comparability of results.
- Enhance compliance with international regulations and conventions on marine environmental protection, particularly the requirements of the MARPOL Convention, through intensified monitoring of ships and port activities.
- Raise environmental awareness among port workers and ship captains regarding the importance of reducing oil pollution and its negative impacts on the marine ecosystem.
- Conduct future studies to link petroleum hydrocarbon concentrations with biological and physical water indicators, contributing to a comprehensive assessment of the port's environmental condition.

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Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.