

# The Reason and Impact of Marine Pollution on the Sudanese Red Sea Coastal Water

Mohamed Ali Abushama<sup>1</sup>, Tahani B. Elyas<sup>2,3</sup>

<sup>1</sup>Director of Marine Safety Center, Marine studies college, Karry University, Khartoum state, Sudan.

<sup>2</sup>Assistant Professor, Faculty of Public Health and Tropical Medicine, Jazan University, Jazan, Saudi Arabia

<sup>3</sup>Assistant Professor, Faculty of Medicine, Red Sea University, Portsudan, Sudan

thani.babiker[at]yahoo.com

**Abstract:** *Maritime pollution include all kind of activities which cause damage or decay to the characteristics of sea water which lead to defect in environmental system and decrease its capability to fulfill its natural role in life. This is a retrospective cross-sectional study was conducted in the Sudanese Red Sea Coastal in the period from 2015 to 2017. The objective is to study the reasons and impact of maritime pollution. Data was collected from the record and interview. The study found that oil pollution consider as one of significant and serious maritime environment contaminants due to expansion of international oil trade through ports Bashayer Marine Terminal (1) and (2) which representative as the main producer and exporter of oil. Sudanese coast encounter to an accident of pollution by oil from Bashayer (2) port which leads to spread of oil in large area and the effect extends to all adjacent berths in the area. Also, causes death of numbers of organism, immigration of fish and cessation of fishing at the area. Even Mangrove trees affected by pollution. The study recommends that, strengthening the role of local authorities in Red Sea State in preservation of coastal environment which reinforce the insurance of maritime environment, activate national plan to control oil leak cases regarding supplying equipment's. Coordination and cooperation with Government and non-government organizations in nation and Red sea state to control maritime pollution.*

**Keywords:** Marine, Pollution, Sudanese Red Sea Coastal, Sudan

## 1. Introduction

According to FAO Corporate Document Repository the marine pollution is defined by (GESAMP, 1991b) "the introduction by means directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities."<sup>[1]</sup> Generally there is three main types of inputs of pollution into the ocean: direct discharge of waste water into the oceans, runoff into the waters due to rain, and contaminants that are released from the atmosphere. Runoff from agriculture, urban dwellings, construction etc., carry soil and particles laden with carbon, nitrogen, phosphorus, and other minerals to rivers and subsequently to the ocean. This nutrient-rich water cause algal blooms in coastal areas which have the potential to create hypoxic conditions by using all available oxygen<sup>[2]</sup>. There are many ways of polluting waterways and oceans by ships such as garbage, sewage, invasive species, noise and oil spills<sup>[3]</sup>. An oil spill is a release of a liquid petroleum hydrocarbon into the environment due to human activity; the term often refers to marine oil spills<sup>[4]</sup>. Oil spills include releases of crude oil from tanker ships, directly from accidents and indirect from ship operations, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products, such as gasoline, diesel and their by-products and heavier fuels such as bunker fuel used by large ships, or the spill of any oily white substance refuse or waste oil<sup>[2]</sup>. Oil industries for the Sudan economy but are also potential threats to the coastal marine environment especially after Sudan has entered exportation phase which requires awareness from early stages to achieve sustainable development between oil

resources development and environment. Maritime pollution with oil gets the attention of many researchers lately, especially after the great disasters that happened to some international aquatic surfaces. The Sudan coast which is of strategic importance, especially after exporting Sudanese oil in 1990. The Red Sea is long semi-enclosed tropical body of water, the coastline of the Sudan on the Red Sea is about 750 km long, including embayments and inlets. The main objective of this research is to determine the types, sources and impact of oil pollution in Sudanese coastal.

## 2. Methodology

### Study Design

This is retrospective cross-sectional study was conducted between 2015 to 2017 so as to identified causes and impact of maritime pollution, in the Sudanese coastal sea, Red sea state.

### Study Area

Red Sea area location is between latitude (17 – 22.5) north, and longitude between (34 – 36) east, which cover the area of Red Sea State which border from east by Red Sea, from west by River Nile State, from north by Egypt, from south by Eretria and Kassala State. The total area of the state is about (212410) squired kilometer, which locate within dry tropical region. The quality of earth in coastal area are inconsistent, we can divide it into three parts as follow:

- Sea Coast: consisting in coastal strip starting from (Bir Shalatain) in the north at the border between Sudan and Egypt, till (Ras Kassar) in the south at Eritrea and Sudan border at length of (400) nautical mile. Sudanese coast

characterize by lots of curves which form a big number of gulfs and natural berths. From geographical view it form a vast strip high in northern parts, low in southern parts its width about (2 – 9)kilometer, border from west side by Red Sea mountain chain,

- Red Sea mountain chain: locate at the west side of the coast in parallel with it. Extends from Sudanese Egyptian border in the north connected with the Eritrean hill in the south, consider as rough mountainous area rise to about (1500) meter above sea level.
- Desert area: begin with barren land in the north and change gradually toward south to a semi-desert area (west of Red Sea mountain chain). Water resources are rare, with scattered hills separated from each other by valleys and bays descending toward river Nile.

### Data collection

The data collected by interview, record from Petroleum Company and also from previous study. The data included the date and of determine the sources and degree of oil pollution on the Sudanese Red Sea Coastal.

### Inclusion Criteria

Bashayer Marine Terminal which located in south Port Sudan city in Red sea state were included while of Port Sudan harbor were excluded from the study.

## 3. Result

### From previous study:

Study the Effects of maritime oil pollution on Sudanese coastal in 2007 by <sup>[5]</sup> the study revealed that raw oil and its derivatives consider one of most effective contaminants on maritime environment, since it has many sources for pollution to the environment from discovering operations to extraction and circulation. There are different effects of oil pollution in maritime environment such as chemical, physical, and biological in addition to material losses because of oil pollution and struggling against it. We can summarize these effects as follow:

- Physical and chemical effects: floating oil layer on sea surface influence on oxygen exchange between water and air specially when sea calm and increase in oil layer thickness. Floating oil spot influence the process of photosynthesis perform by sea plants as a result of shortage of carbon dioxide which hinder by oil spots from moving between water and air. The spread of oil spots of high light intensity which characterized by dark color lead to absorption of Sun's heat with high efficiency which rise sea water temperature degree to a degree more than its natural degree which cause to inactiveness or death of some maritime organism which sensitive to temperature changes like (Plankton) and coral reef. Research and scientific field studies verify the existence of poison materials high in concentration and heavy physics like mercury in floating oil spots at sea surface.
- The influence of oil pollution on sea creatures: changes in characteristics of maritime environment biology.

Nutritional consumption of oil hydro carbonic compounds by living creatures which cause accumulation of carcinogenic material like oil hydro carbonic multiple circle in maritime nutrition chain. Influence because of organisms covering by oil which cause confusion in vital functions. Deadly influence as a result of oil and its derivatives poisonous nature.

- Influence on Sea Birds: inability to fly or floating on water surface, swallowing of poisonous oil compounds when birds clean its polluted body. Birds lose of body temperature combined with no appetite. Eating of polluted organisms.
- Influence on sea mammals: rarely floating into surface and touch oil spots, characterize by constant movement throughout the year which enable them to escape from polluted areas.
- Influence on fish: when high concentration oil materials specially in coastal area near to oil spot which form recently. Cause failure in fish's vital functions and death. Using of oil derivatives consider more dangerous and damaging than the influence of raw oil. Since these derivatives stick on fish's skin, mouse, and gills. Also affect the process of fish eggs fertilization and low the production. Though, these effects can't easily noticed, but it is consider very important since it influence nutrition efficiency and fish growth and immigration. Lose of balance ability in sea water in addition to gain permeable smell and carcinogenic materials.
- Influence on mollusks: mollusk and snails resemble high economic value. Its ability to movement limited and can't easily stay away from polluted area. Sensation and degree of contamination depend on its type, but mostly suffer great death because of oil accidents near to the coast.
- Influence on Plankton: planktons drift with surface water current which expose it to stick with oil in case of accident, covered and die by strangulation. The lost of huge amount of plankton effect sea production of other organisms.
- Influence on living bacteria: oil pollution effect on bacteria depend on its type, some types grow and active in cases of oil pollution. Since it depend on different hydro carbonic compounds in nutrition.

Influence on coral reef: coral reef area consider as a high fertile are, which support different kind of sea creatures including commercial types of fish. Coral reef damage easily if polluted with oil, if it dead it can't return back to its previous situation in less than several decades. It difficult or impossible to clean it from oil pollution.

## 4. Results from Interview

From interview with Sudanese petroleum company indicated that Ship operations are one of the main sources of oil pollution of the marine environment and a major disaster in Sudanese coastal occurred on 2007 and on 3/1/2008in Bashayer (2). The spill formed an oil layer with thickness of five sent meter and width of two meter on the extension of the coast south Bashayer (2) port with length of (34) kilometer. Also the Maritime environment in Sudanese coastal polluted in November 2010 from land sources, when Ports Engineering Company conducting

road asphalt in Port Sudan internal roads. They store barrels of asphalt in an area near to sea coast, as a result of heavy rains and floods some of these barrels with asphalt drift into sea through (Salalab) and causes environmental pollution in the area in addition to maritime environment.

### The economic impacts of Sudan coast oil pollution

- Fishing sector has been effected in the polluted area as result of escaping fishes which reflected negatively upon them, because it represents the outcome that they rely on in addition to the damage which influenced the fishing nets.
- The anti-pollution process which cost a lot of money was considered a great economical lose.
- Port Sudan city has lost very great touristic site in oil polluted area
- The camel's natural herds have been stopped in the polluted berths.

### Sudan marine environment counter pollution that comes from the bilge

The bilge represents a great danger to the marine environment for that reason, most of oil tankers which built after 1983 have a separated bilge tanks, and the raw oil is loading in the separate bilge tankers and that unlike what is being happening in the oil tanker which built before 1983, but the risk remain in that the oil tanker when it discharge its raw oil and while returning back to the charging ports it full with bilge for stability and discharge this bilge in a completely different environment which cause pollution to that area, there for saving Sudan marine environment from bilge pollution, so it's necessary for the oil tanker to discharge its bilge within distance (200nm) from Sudanese ports and in deep sea not less than (200m), and Sudan sea corporation must carry out the process of checking that all oil tanker carrying the international certificate for managing bilge in addition to the international certificate for oil pollution prevention also checking the ability of conducting physical, mechanical and chemical procedures for managing bilge. Concerning the oil tankers which do not have a separated bilge tankers that means the bilge carrying in the same raw oil tankers, therefore the Sudanese sea corporation must check that every tanker supported by a unit of separating oil from water, and the water which re-pump to the sea its oil percentage must not be over (15) part in million according to the IMO report. Also the ports must be provided by the unit of (Dirty water oil).

## 5. Discussion

Oil tanker vessel accidents are one of the most dangerous sources of oil pollution of the marine environment. Ship operations are one of the main sources of oil pollution of the marine environment. A major disaster on Sudanese coastal occurred on 2007 and on 3/1/2008 in Bashayer (2). The spill formed an oil layer with thickness of five sent meter and width of two meter on the extension of the coast south Bashayer (2) port with length of (34) kilometer. This result is coinciding with another study<sup>[6]</sup> conducted in the Sudanese Red Sea coastal (Port Sudan harbor and Bashayer

Marine Terminal (BMT) to determine hydrocarbons concentration. The highest concentration of Total Petroleum Hydrocarbons (TPH) in seawater was found at strip I (dockyard) with the average of 80.2 mg/l, the next to the highest concentration was generally occurred at strip IV (Bashayer Marine Terminal), the ranges of concentrations were between 5.8 and 24.2 mg/l with mean value of 14.98 mg/l. Values of oil concentration at strip II (South port) are much lower than those of strip I (6.8 to 10 mg/l) and can concluded that the Port Sudan harbor and BMT suffers from oil pollution in different degrees according to UNEP and AIDMO. Raw oil and its derivatives consider one of most effective contaminants on maritime environment, since it has many sources for pollution to the environment from discovering operations to extraction and circulation. There are different effects of oil pollution in maritime environment such as chemical, physical, and biological in addition to material losses because of oil pollution and struggling against it.

The important effects of oil on organisms include effects on fish, shellfish, seabirds, plankton, marine mammals, vegetation, as well as its effect on Oxygen Regime, public health and tourism.

Also great number of fishes and marine animals found dead on the coast, 6. The difficulties in accessing the location of Mangrouf trees inside the gulfs for removing the pollution impact.

## 6. Conclusion

- The marine pollution represents one of the main factors for the environmental pollution problem, which is grown as a direct result of human activities and environmental awareness malfunction basically plus the natural disasters that cause damage to the sea water and disorder the natural marine environment stability and inability to perform its natural role at life (The degree and the risks of the marine pollution defer upon marine environment and human beings one of them is the accepted pollution, dangerous pollution and the fatal pollution)
- The most significant reasons of marine environment pollution are: oil carriers accidents, loading and offloading processes of the petroleum, oil mining waste process, ships waste, sewage and industrial waste, baring the bulk and industrial waste in the sea, coastal power stations temperature as the result of discharging sea cooling water, rivers waters which containing different pollution as the result of passing different countries and towns until reaching the sea.
- Despite the variety of reasons and kinds of resources of marine environment, but the oil pollution considered the most dangerous marine environment pollution because of the great deal of the international oil trading through the seas and Sudan joined the stage of manufacturing and exporting through Bashayer (1) and (2) ports.
- Sudan coast expose to the oil pollution accidents from Bashayer (2) which leads to the spread out of oil over vast areas covering all berths and death of a great number of marine living creatures, migration of fishes and stopping fishing process in the area and also the Mangrouf trees have been influenced.

- The bilge in the oil carriers represents a huge risk to the Sudan marine environment, particularly after Sudan join the group of oil exporting countries and increased the probability of environmental pollution.
- The Sudan coast oil pollution accident has proved that the significant of maintaining the marine environment from the risk of pollution and providing the sufficient means to counter the pollution and cooperation of the different concerned authorities.
- The state institutions have roles and duties on framework of countering the marine pollution in shadow of the national plan for preventing oil spread-out.

## 7. Recommendations

- Enhance the role of the local authorities in the red sea state to maintain the coastal environment which will result in securing the marine environment.
- Intensify the law and procedures against the law violators.
- Encourage the universities and research centers to tackle the issue of the marine environment.
- Activating the national plan to deal with the emergent oil leak situations from the angle of providing the equipment's and conducting the joint exercises between the state concerned authorities to implement the plan and coordinate the cooperation for carrying out the counter pollution
- The necessity of developing and build the capacity of Sudan navy to impose the state superiority upon the Sudanese regional waters.
- Establish surveillance points or environmental check along the Sudanese coastal.
- Provide Sudan navy with counter pollution boats and equipment's.
- Conducting marine patrolling to detect the ships involving in marine pollution.
- Equip Sudanese ports with devices to deal with the ships wastes.
- Establish especial security units on the beaches to maintain the coastal environment.

## Acknowledgments

We would like to thanks all staff members of faculty of Economic in Red Sea University for their assistance and their active collaboration during the research period.

## Reference

- Expert on the Scientific Aspects of Marine Environment Protection), (2007). Estimates of oil entering the marine environment from sea- based activities. Ref. Stud. GESAMP No. 75. London: IMO.
- [4] ITOPF(International Tanker Owners Pollution Federation Limited). (2013). Oil Tanker Spill Statistics 2012. Retrieved June 2013, from <http://www.itopf.com/news-and-events/documents/StatsPack.pdf>.
- [5] Abdalsamh, Mohammed Sabri.2007-2008. The proposed method to cooperate with the state corporations to counter marine pollution. Unpublished research. High War College. Cairo. Course NO (22) p4. P13. P22
- [6] [6].Maysara E. Mohyeldien, Bashier M. Elhassan and Masoud G, Petroleum Hydrocarbons Pollution on the Sudanese Red Sea Coastal Water, SUST Journal of Engineering and Computer Sciences (JECS), Vol. 16, No. 1, 2015
- [1] FAO. (2008).Irrigation in the Middle East region in figures- Aquastat Survey 2008, Retrieved August 2013, from <ftp://ftp.fao.org/docrep/fao/012/i0936e/i0936e08.pdf>.
- [2] Hulsey & Ludivina. (2012). Marine Pollution. New Delhi: World Technologies, IMO. (2012). List of special areas under MARPOL and particularly sensitive sea areas. Retrieved from [http://www.imo.org/blast/blastDataHelper.asp?data\\_id=30979&filename=778.pdf](http://www.imo.org/blast/blastDataHelper.asp?data_id=30979&filename=778.pdf).
- [3] GESAMP (IMO/FAO/UNESCO/IOC-UNIDO/WHO/IAEA/UN/UNEP Joint Group of