

A Study on the Impact of Sewage Disposal and Marine Pollution at Zliten Beach on the Libyan Coast

Salah M. Algoul^{*}, Moftah Bozakaya, Mohamed Derenesh, Abdulah Alhdaar
Department of Chemical Engineering, The Higher Institute of Professions and Engineering, Zliten, Libya
^{*}Corresponding Author: golsasa40@yahoo.com

Abstract

Water pollution is a serious problem for the entire world. It threatens the health and well-being of humans, plants, and animals. The Mediterranean Sea is one of the most international waters on our planet. Nineteen nations border it, more than 10,000 species live in it and millions of people get food, work and pleasure from it. It is the feeding and breeding ground for many endangered species. The Mediterranean sea is expected to be one of the first seas to suffer harm from man's impact. The study is attempt to investigate of the impact of direct injection of domestic sewage in Zliten city in to Mediterranean sea. In this research paper physico-chemical characteristics of Mediterranean Sea were studied. The parameters studied were pH, electrical conductivity, total dissolved solids, total hardness, chloride, sulphate and biochemical oxygen demand BOD. The values of these parameters were found in excessive amounts of waste water are injected daily into the sea without treatment. It can be concluded that the water parameters which were taken for the present study are above the pollution level especially biological oxygen demand (BOD) and total hardness (TH). A brief attempt has been made to study the extent of change in the quality of water in comparison with pure or unpolluted water in Mediterranean Sea.

Keywords: Water pollution; pH; total hardness; Mediterranean Sea.

1. Introduction

The Mediterranean Basin is one of the most highly valued seas in the world. The region comprises a vast set of coastal and marine ecosystems that deliver valuable benefits to all its coastal inhabitants, including brackish water lagoons, estuaries, or transitional areas; coastal plains; wetlands; rocky shores and near shore coastal areas; sea grass meadows; coralligenous communities; frontal systems and upwelling; seamounts; and pelagic systems [1].

The Mediterranean is not only complex in ecology, but also socio-politically – twenty-one countries border this heavily used sea. The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) embodies international partnership

to protect the sea, its coasts, and the uses and livelihoods that it supports. One of the main objectives of the Barcelona Convention is to protect the marine environment and coastal zones through prevention and reduction of pollution among Mediterranean Coastal States [2]. Libya is one of that countries which have a costal around 1950 km and the disposal sewage domestic is a huge problem which needs to be fixed. The problems associated with sewage disposal have become a major problem of the urban world due to increase in human population and urbanization. The commonality of sewage related problems throughout coastal areas of the world is significant since these areas are inhabited by over 60% of the human population. Consequently, domestic wastewater discharges are considered one of the most

significant threats of the coastal environments worldwide. Environmental effects associated with domestic waste-water discharges are generally local with transboundary implications in some areas [3]. Coastal waters are facing a variety of pressure affecting both the ecosystem and human health through sewage waste-water discharge and disposal practices that may lead to introduction of high nutrient loads, hazardous chemicals and pathogens causing diseases. The adverse public health, environmental, socio-economic, food quality and security, and aesthetic impacts from sewage contamination in coastal areas are well documented [4]. Pollution of the coastal water usually interferes with various water uses. Cultured bivalves are generally reared in areas that are often densely populated and are sensitive to heavy pollution from human activities. Pathogens transmitted by human feces are most commonly involved and the discharge of sewage polluted by human and animal pathogens into the sea represents the main source of bacterial pollution. Every pathogen present in seawater may be trapped and concentrated in the tissues of the bivalves and so represents a potential health hazard.

The fact that the majority of urban populations depend on coastal surface waters which are usually used for sewage disposal, in one way or another, makes water pollution the principal problem that requires sound management practices to contain impacts. The study is developed to make an assessment in order to evaluate the prevailing situation and provide accurate information on the water quality [5].

Sewage effluents have historically been discharged through outfall in shallow coastal waters and is one of the major stresses impacting coastal ecosystems. There are usually significant effects on water quality and on marine life arising from sewage disposal. Water quality deterioration is one of the most important water resource issues of the 21st century. Therefore the quality status of coastal surface water is very important and would always be under public scrutiny because of health risk associated with sewage contamination [3-4].

The potential deleterious effects of pollutants from sewage effluents on the receiving water quality of the coastal environment are manifold and depend on volume of the discharge, the chemical composition and concentrations in the effluent. It also depends on type of the discharge for example

whether it is amount of suspended solids or organic matter or hazardous pollutants like heavy metals and organochlorines, and the characteristics of the receiving waters [6]. High levels of soluble organics may cause oxygen depletion with a negative effect on aquatic biota. Contamination of the coastal water may result in changes in nutrient levels, abundance, biomass and diversity of organisms, bioaccumulation of organic and inorganic compounds and alteration of trophic interaction among species. Receiving waters with high flushing capacity are able to dilute or eliminate most of the conventional pollutants but persistent toxic compounds and long lived pathogens will always be troublesome. The threat has however been increased for both the environment and the public health for the following reasons [7]:

1. Direct dumping in open unsheltered area results in wider dispersion of the effluent and increases its threat to the reef ecosystem and benthic communities.
2. The high concentrations of heavy metals in the fish catch from the area, which may represent a real threat to the public health .
3. Emanation of bad odours resulting from the degradation of the organic matter.

The present study is an attempt to make an assessment of the change in the physico chemical properties of the quality of sea water by the addition of sewage, domestic waste and garbage of Zliten city.

2. Material and Methods

2.1. Study area

Geographically, Zliten city is located on the Mediterranean Sea 160 kilometers east of Tripoli at latitude of 32°27'50'' (N) and longitude of 14°34'21'' (E). Zliten is widespread and covers an area of 30,000 km². It is surrounded by the Mediterranean from the north, Misrata from the east, Bani Walid from the south and Al Khoms from the west with a population of approximately 200,000. The map of the study area is presented in Figure 2.1. The main activities of the population are agriculture, trade, and small-scale businesses. Most of the cities and towns have established a Sewage treatment plants in Libya but unfortunately, Zliten beach are being polluted by



Figure 2.1: Map of the study area.

indiscriminate disposal of sewage and industrial wastes. At the past, an equivalent volume ($\sim 6,500 \text{ m}^3$) of entirely raw sewage is transported and dumped in a huge sewage lake at the north of the City. The problem of sewage disposal in beach of Zliten is began in 2015 as a temporary solution from municipality of Zliten until the finishing of establishing new plant of treatment sewage in the city. The sewage dumping pipeline is suited on the shore at about 2.5 m above sea water level.

2.2. Climate

Zliten city has a Mediterranean climate: the year is divided into four distinct i.e., summer (June to August), Autumn (September to November). Rainy (December to February). The minimum temperature around 9/10 °C and a maximum around 17/19 °C in January and February, and hot, sunny summers, with highs in July and August of around 43 °C. The annual rainfall is amounts to just 190 mm, and the mean average humidity is 55% .

2.3. Collection of samples

The water samples were taken on July 2016 between 9 a.m. to 11 a.m. in one Liter dark bottles at each selected sites. Four selected sites were chosen and compared with unpolluted sample. The brief details of sampling site are presented in the Table 2.1. Sampling was carried out

by dipping each sample bottle at approximately 10- 30 cm below the water surface by projecting the mouth of the container against the flow the direction. Preservatives were added as required in the specific test methods in order to avoid changes in chemical composition of the sample as a result of microbial degradation and inter-chemical reaction. Consequently. Samples were transported to the Environmental sanitation office in the city of Zliten.

Table 2.1: Breif detail of sampling sites.

S.No.	Site code	Description
1	Site I	Located under the pipeline outlet
2	Site II	Located 100 meters left of the pipeline outlet
3	Site III	Located 500 meters left of the pipeline outlet
4	Site IV	Located 100 meters right of the pipeline outlet

3. Results and Discussions

In an arid region, such as Libya, the water resource is inadequate which forces the authorities to establish the desalination program throughout the country. In addition, reclaimed sewage water is on the increase to be used in farming and industrial sectors [8].

The results of the physico chemical analysis of different sampling sites were studying and compared with pure or unpolluted sample from the Mediterranean sea. Sites close to sewage outlets had the highest nutrient values because they are more influenced by the incoming products from detergent from the households The physical and chemical characteristics of sea water samples are illustrated in Table 3.1.

PH of Zliten beach ranged from 8.2 to 8.7 for four sites. The obtained results indicate that the water of Zliten beach at all the sites is slightly alkaline which can be attributed to the regular discharge of domestic sewage and disposal automobile/workshops wastes.

The BOD represent the ability of microorganisms to oxidise organic material in the sewage into carbon dioxide and water based on the molecular oxygen which used as an oxidizing agent. High

Table 3.1: Average of physical and chemical parameters of collected sea water samples around sewage.

Parameter	Site I	Site II	Site III	Site IV	Pure seawater (unpolluted)
Temperature ($^{\circ}\text{C}$)	23.5	22.6	23.8	22.5	24
pH	8.4	8.5	8.7	8.2	8.3
EC μs	93506	93920	93372	93417	94290
TH mg l^{-1}	14000	15300	9400	13400	5600
TDS mg l^{-1}	63210	63490	63120	63150	63740
BOD mg l^{-1}	0.5	20	6.7	8.6	57
Cl mg l^{-1}	28100	3100	25800	25400	24200
SO ₄ mg l^{-1}	7000	1000	1000	error	error

concentrations of BOD in sewage lead to the reduction of dissolved oxygen of the receiving water bodies and thus reduction in pH values and microbial growth, as well as deaths of aquatic animals [9]. The biological oxygen demand (BOD₅) revealed that the highest concentration (20 mg l^{-1}) was recorded at site II and the lowest was (0.5 mg l^{-1}) observed at site I.

The BOD were quit low compared to the pure or unpolluted sea water which is (57 mg l^{-1}).

Temperature was between 22 and 24°C . The temperature of the sewage is one of the important factors which influence in the chemical and biological reactions of aquatic organisms in the water bodies. Temperature also affects the conductivity, pH, saturation level of gases and various forms of alkalinity [10].

Total dissolved solids (TDS) indicate the general trend of the water quality of surface water bodies, phosphates and nitrates of calcium, magnesium and other particles. The effect of presence of total dissolved solids (TDS) in the costal of Zliten is the turbidity due to presence of silt content and organic matters. The permissible levels of TDS for sea water as published by the Water Quality Association is 30,000-40,000 ppm. During the present study, minimum values of TDS were recorded at site III and IV (63120 , 63150 mg l^{-1}) respectively and maximum were at sit II (63490 mg l^{-1}). All values of TDS for four sites were less than of TDS value for unpolluted sea sample (63740 mg l^{-1}).

Total hardness mainly depends upon the dissolved salts present in water [11]. The highest value of total hardness TH was at site II (15300 mg l^{-1}) and the lowest was at site III (9400 mg l^{-1}) while

the sample five (unpolluted sea water) recorded TH value (5600 mg l^{-1}).

The electrical conductivity EC might be considered as the same for four sampling. The range was around ($93553 \mu\text{s}$) whereas the value of sample five recorded ($94290 \mu\text{s}$).

Chloride (Cl⁻) is one of the major anions found in water and are generally combined with Calcium, Magnesium, or Sodium. All values were bigger than unpolluted sample for all sites (28100 , 31000 , 25800 , 25400 mg l^{-1}) consequently. The permissible levels of SO₄ for any sea is (2700 - 3100 mg l^{-1}). The sites II and III registered same value (1000 mg l^{-1}) which below the tolerance level. In the other hand, the highest value documented at site I (7000 mg l^{-1}). This amount may contributed to a presence of organic matters .

4. Conclusion

It can be concluded that the direct discharge of sewage into the sea water represent a serious risk for the environment and all organisms in the sea water including fish. The human infection might take place via the consumption the contaminated of sea food. Taking in consideration that the costal of Zliten city is around 35 km. There is considerable need for better understanding of the authority to establish new sewage treatment plant as soon as possible and to insure the efficiency of the treatment and produce high quality sewage effluents before the final disposal into the sea water.

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