# STUDY OF WASTEWATER TREATMENT UNIT IN ALBREGA COMPANY

# AZAWIA –-LIBYA

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## Abstract

Petroleum refining industry uses large volumes of water. The water demand is up to 3 $m^3$ of water for each ton of petroleum processed. The quantity of the wastewater generated in the refineries is almost 50% of the used fresh water. When this water discharged into streams or other bodies of water, they eventually lead to catastrophic water pollution. Furthermore the presence of this water in the oil streams during petroleum production may create severe problems such as expensive pumping due to increase of crude oil viscosity, corrosion of pipes and pumps, poisoning catalysts. The industrial wastewater samples were collected from different points and locations over a sufficient period of time in wastewater treatment unit at Azzawiya terminal storage Albrega oil company. The collected samples were analysed for the estimation of, oil and organic matter contents (Total Petroleum Hydrocarbon), biochemical oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity, dissolved metal contents.

## 1. Introduction:

In the last century, the world has experienced huge and various types of environmental threats. An important group of them is generated from the wide use of fossil fuel such as petroleum as the source of energy in industries, urban development and transportation ( Burklin et al, 1977).

Hydrocarbons are the main constituents of fossil fuels thus petroleum hydrocarbons are possible and important source of pollution worldwide. Petroleum hydrocarbons enter the environment from accidental oil spill, natural leaks, industrial releases, vehicles or as by products from commercial or domestic uses . Hydrocarbons in petroleum include several types and categories of normal alkanes (saturated, n-alkane), unsaturated hydrocarbons, non-symmetric cyclic hydrocarbons (terpanes) and polycyclic aromatic hydrocarbons (PAHs) (Romano. et al, 1991).

Polycyclic Aromatic Hydrocarbon (PAHs):- important class of petroleum hydrocarbons is polycyclic aromatic hydrocarbons (PAHs).PAHs and their derivatives are ubiquitous in the environment such as air, water, soil, sediments and living organisms Petrogenic sources of PAHs are mainly derived from the release of crude oil and petroleum products such as lubricating oil, diesel fuel, gasoline, asphalt and kerosene. This class of PAHs enters the environment via oil spill, tanker accident, routine tanker operation such as ballast water discharge and discharge from vehicle workshops . PAHs are released into the environment via natural and anthropogenic sources. PAHs associated with airborne particles reach to the top layer of the water column in the marine environment, moving to the water column and the bottom of the sea where settles in the sediment. Petroleum and petroleum products which are originated from concentrated hydrocarbon sources enter the marine environment and subjects to dispersion, evaporations, settlement in the bottom on the sediments, weathering, chemical changes, sunlight effects (photo oxidation) and microbial degradation (bacteria, yeast and fungi) in short and long term period .Petrogenic sources of PAHs on the sediment stick into the particles and consequently is subjected to different chemical and biological changes. Petroleum hydrocarbons mostly contaminate environment due to inherent ability, such as solubility, volatility, and their biodegradable, they also identified toxic for animal (Benyahya et al, 2001). The petroleum has been released from petroleum industry will likely be found in soils and possibly also in shallow groundwater and air that threaten health of human and environment. So the removal of these compounds from environment is vital. The stability of these pollutants at the soil and gradually accumulating over time disrupt the normal function of the soil, such as reduced agricultural capability. Phytoremediation describes the treatment of environmental problems (bioremediation) through the use of plants that mitigate the environmental problem without the need to excavate the contaminant material and dispose of it elsewhere (Flangian et al, 1988). . Wastewater from petroleum industry contains organic compounds, phenols, toxic metals, and other pollutants such as iron, dissolved and suspended solids, oil, cyanides, sulfides, and chlorine. In order to reduce these concentrations, an accurate analysis of processes is necessary. Pollutants or contaminants which enter a body of water can be divided into:

. Degradable (non-conservative) pollutants: Impurities which eventually decompose into harmless substances or which may be removed by treatment methods, that is, certain organic materials and chemicals, domestic sewage, heat, plant nutrients, most bacteria and viruses, certain sediments.

. Non-degradable (conservative) pollutants: Impurities which persist in the water environment and do not reduce in concentration unless diluted or removed through treatment, that is, certain organic and inorganic chemicals, salts, colloidal suspensions.

. Hazardous waterborne pollutants: Complex forms of deleterious wastes including toxic trace metals, certain inorganic and organic compounds.

. Radionuclide pollutants: Materials which have been subjected to a radioactive.

This work is to study the efficiency of waste water treatment unit at Azawia terminal storage, involves laboratory analysis and investigation. The study focused on test of hydrocarbons concentration in terms of, TPH(Total Petroleum Hydrocarbon), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), electrical conductivity, dissolved metal contents at several locations in the wastewater separation processes.

## 2. Experimental Work:

Experimental measurements and analysis were carried out in environmental laboratory at Libyan petroleum institute (LPI), wastewater samples were collected from three diferent locations in wastewater treatment unit at Azawia terminal storage Albrega oil marketing company. Sampling points are, primary settling separation (A), secondary settling separation (B), a point of final discharge to sea water (C). Most of the samples were collected several times to check the consistency of the parameters measured. Table 1 shows the sampling dates over 6 months time period from three different locations that mentioned earlier.

Table 1: Sampling dates.

| Sample date | Sample no. |
|---|---|
| 13.10.2014 | 1 |
| 20.02.2015 | 2 |
| 05.03.2015 | 3 |
| 03.04.2015 | 4 |
| 12.05.2015 | 5 |
| 20.05.2015 | 6 |

### 2.1 Estimation of Total Petroleum Hydrocarbons (TPH).

Estimation of oil and other organic matter content can be expressed in terms of (Total Petroleum Hydrocarbons) (TPH), (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site. TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals. Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

**Materials**: whatman (40) filter paper,11cm,or equivalent Silica gel, anhydrous,75-150 micrometers disposable glass or equivalent.

TPH test steps:

All sample should be filtrated carefully using filter paper to remove the solid wastes before pouring it in to the separatory funnel.

1-pour a measured sample into a separatory funnel.

2-Adjust the-(pH) to less than(2) with Hydrochloric Acid or Sulfuric Acid (typically(3-5drops)depending on buffers in sample ,and then test the PH.

3-Add one tenth of the sample size of solvent to the sample collection container to rinse interior surfaces and cap. pour the solvent from the sample collection into separatory funnel containing sample or directly into the prescription bottle.

4-Shake the separatory funnel ,and allow the phases to separate
5-Drain the lower layer(solvent) into clean container.
6-Fill the cuvette with the extract, and place it into the holder on the Infra Cal (TPH)-Analyzer with the frosted side facing front.
7- press Run, then estimated value will be displayed.
**8-**INFRA-CAL (TOG/TPH ) Cuvette Holder Analyzer Model (CVH) was used for conducting TPH test ,the device was simplified with illustrated instructions for determining TOG/TPH concentration levels in waste water.

## 2.2 Estimation of Biochemical Oxygen Demand (BOD):

Group of samples 5 was selected for BOD,COD, and electrical conductivity analysis, samples involves three sampling points.

**BOD Test Procedures**

1. To ensure proper biological activity during the BOD test, a wastewater sample:
   - Must be free of chlorine. If chlorine is present in the sample, a dechlorination chemical (e.g, sodium sulfite) must be added prior to testing.
   - Needs to be in the pH range of 6.5-7.5 S.U. If the sample is outside this range, then acid or base must be added as needed.
   - Needs to have an existing adequate microbiological population. If the microbial population is inadequate or unknown, a "seed" solution of bacteria is added along with an essential nutrient buffer solution that ensures bacteria population vitality.
2. Specialized 300 mL BOD bottles designed to allow full filling with no air space and provide an airtight seal are used. The bottles are filled with the sample to be tested or dilution (distilled or deionized) water and various amounts of the wastewater sample are added to reflect different dilutions. At least one bottle is filled only with dilution water as a control or "blank."
3. A DO meter is used to measure the initial dissolved oxygen concentration (mg/L) in each bottle, which should be a least 8.0 mg/L. Each bottle in then placed into a dark incubator at 20°C for five days.
4. After five days (± 3 hours) the DO meter is used again to measure a final dissolved oxygen concentration (mg/L), which ideally will be a reduction of at least 4.0 mg/L.
5. The final DO reading is then subtracted from the initial DO reading and the result is the BOD concentration (mg/L). If the wastewater sample required dilution, the BOD concentration reading is multiplied by the dilution factor.

## 2.3 Estimation of Chemical Oxygen Demand COD.

**COD Test Procedures**

1. Prior to completing the COD test, a series of known standards are prepared using KHP (potassium hydrogen phthalate). Most wastewater samples will fall in the high range,

so standards of 100, 250, 500 and 1000 mg/L are typically prepared. COD standards can also be purchased.

2. A COD reactor/heating (150°C) block and a colorimeter are turned on so that both instruments are allowed to stabilize.
3. Pre-prepared low-range (3-50 ppm) or high-range (20-1500 ppm) vials are selected for the COD test based on expected results. Both ranges can be used if expected results are unknown.
4. One vial is marked as a “blank,” and three or four vials are marked with known standard levels. Two vials are then marked for the wastewater sample to make a duplicate run. Note: If multiple wastewater samples are being run, at least 10% of samples are duplicated.
5. 2 mL of liquid are added to each vial. In the case of the “blank,” 2 mL of DI water are added. 2 mL of each standard are added to the corresponding vials. If the wastewater sample is tested at full strength, then 2 mL is added to the corresponding vial. If dilution is required, then serial dilutions are performed and 2 mL of the diluted sample are added to the corresponding vial.
6. Each vial is mixed well and placed into the reactor block for two hours. After two hours, the vials are removed from the block to a cooling rack for about 15 minutes.
7. The colorimeter is set and calibrated per the specific instructions for that unit (i.e., proper wavelength, blank and standards) and each vial is placed in the unit and the COD concentration read.
8. If the sample was diluted, the corresponding multiplication is made.

## 2.4 Estimation of electrical conductivity.

Electrical conductivity (EC) is a measure of how conductive the water is to electrical current. Greater the ion concentration, greater is the EC. Generally higher the EC, higher is the total dissolved solids. Electrical Conductivity is an indirect measure for finding the total dissolved solids in a water body. To convert the electrical conductivity of a water sample (micro Siemens per cm, µS/cm) to the concentration of total dissolved solids (ppm), the conductivity must be multiplied by a factor between 0.46 and 0.9 (depending on the unique mixture of the dissolved materials). A widely accepted conversion factor is 0.67. TDS (ppm) = Conductivity { (µS/cm) x 0.67}.The instrument used for measuring conductivity is conductivity meter.

**Materials**: Reagents:

**1.** Conductivity water:- Any of several methods can be used to prepare reagent-grade water. Conductivity should be small compared to the value being measured.

**2.** Standard Potassium Chloride solution (KCl) 0.01 M:

Dissolve 745.6 mg anhydrous KCl in conductivity water and dilute to 1000 mL in a class A volumetric flask at 25ºC and store in a $CO_2$-free atmosphere. This is the standard reference solution, which at 25ºC has a conductivity of 1412 µS/cm. It is satisfactory for most samples when the cell has a constant between 1 and 2 $cm^{-1}$. For other cell constants, use stronger or weaker KCl solutions listed below table. Care must be taken when using KCl solutions less than 0.001 M, which can be unstable because of the influence of carbon dioxide on pure water. For low conductivity standards, standard reference material 3190, with a certified conductivity of 25.0 µS/cm±0.3 µS/cm, may be obtained from NIST. Store in a glass-stoppered borosilicate glass bottle.

Test steps:

1. Determination of cell constant:- Rinse conductivity cell with at least three portions of 0.01 M KCl solution. Adjust temperature of fourth portions to 25.0º±0.1ºC. If a conductivity meter displays resistance, R ohms, measure resistance of this portion and note temperature. Compute cell constant, C.

$$C,\ cm^{-1} = (0.001412)\ (R_{KCl})\ [1+0.0191(t-25)].$$

Where, $R_{KCl}$ = measured resistance in ohms, and t = observed temperature in °C.

Conductivity meters often indicate conductivity directly. Commercial probes commonly contain a temperature sensor. With such instruments, rinse probe three times with 0.01M KCl as above. Adjust temperature compensation dial to 0.0191 $C^{-1}$. With probe in standard KCl solution, adjust to read 1412 µ/cm. This procedure automatically adjusts cell constant internal to the meter

2. Conductivity measurement:- Thoroughly rinse cell with one or more portions of sample. Adjust temperature of a final portion to about 25ºC. Measure sample resistance of coductivity and note temperature to ±0.1ºC.

### 2.5 Estimation of carbon atom distribution.

One waste water sample was selected from location (C) a point of final discharge to sea water, the test including the carbon atom distribution and the weight percentage of carbon.

**Test steps:** For semi volatiles, the gas chromatograph is generally equipped with either a packed or capillary column. Either neat or diluted organic liquids can be analyzed via direct injection, and compounds are separated during movement down the column.

The FID uses a hydrogen-fueled flame to ionize compounds that reach the detector. Any compound that burns can be detected by an FID. Ionized molecules produce a current proportional to the total volatile organic vapor concentration in the sample, and this current change is recorded as a signal. Calibration standards can be used to quantify instrument response, and analytic signals can thus be converted to concentrations.

A GC/FID system can be used for the separation and detection of non polar organic compounds. Semi volatiles such as PAHs are among the analysts that can be readily resolved and detected using a GC/FID system. If a packed GC column is used, four pairs of compounds may not be adequately resolved and are reported as a quantitative sum: anthracene and phenanthrene, chrysene and benzo(a)anthracene, benzo(b) fluoranthene and benzo (k) fluoranthene, and dibenzo (a,h) anthracene and indeno (1,2,3-cd) pyrene.

In a standard configuration, the CP-3800 accommodates up to three injectors and three detectors, all operating simultaneously. In addition, the CP-3800 is easily configured to perform on-line analyses for monitoring critical gas and liquid process streams.

The CP-3800's flexible platform lets you start with a basic configuration and add a wide variety of options in the field. Options include additional channels, gas and liquid sampling valves, and external sampling devices. Future upgrades guarantee that you can meet changing requirements at a moment's notice.

1) Place micro-vial samples into probe.
2) Insert probe into 1079 PTV Injector.
3)The Varian CP-3800 Gas Chromatography (GC) Auto Samplers was used for analysis**.**

There are several types of Auto samplers available.

1• CP-8400 handles up to 100 samples with liquid, ambient headspace, or optional SPME sampling modes
2• CP-8410 with a fixed sample tray supports multiple vial sizes
3• Combi PAL offers maximum flexibility for liquid, heated headspace, and SPME applications
4• Archon TM with Tekmar Velocity XPTTM for automated Purge and Trap sampling

### 2.6 Estimation of Dissolved Metal concentration.

Heavy metals are elements having atomic weights between *63.5* and 200.6, and a specific gravity greater than *5.0.*Most of the heavy metals are dangerous to health or to the environment. Heavy metals in industrial wastewater include lead, chromium, mercury, uranium, selenium, zinc, arsenic, cadmium, silver, gold, and nickel .Toxic metals are usually present in industrial, municipal, which can be harmful to humans and biotic life. Many dangerous chemical elements if released into the environment , accumulate in the soil and sediments of water bodies There are over 50 elements that can be classified as heavy metals, 17 of which are considered to be very toxic Toxicity level depends on the type of metal, its biological role and the type of organisms that are exposed to it Heavy metals have a marked effect on the aquatic flora & fauna which through bio magnification enters the food chain and ultimately affect the human beings as well .

**Test steps:** a high technology device was used to inspect for heavy metals in waste water sample, One waste water sample was selected from location (C) a point of final discharge to sea water, the test include estimation of heavy metal concentration.

- Volume of sample 1 800ml was collected from location (C).
- Separate the (20ml) of heavy phase of sample using filter paper.
- clean the sample bottle using distilled water, to be ready for injection in the analyzer.
- Inductively coupled plasma optical emission, model- VESTA-PRO CCD SIMULTANEOUS (ICP-OES) was used for analysis.

## 3. RESULTS AND DISCUSSION:

Table. 2 summarize the results of (TPH) and fuel volume.

Table 2: Total petroleum hydrocarbon for several samples and locations.

| Sample no. | Dissolved TPH (mg/kg) | | | Fuel volume (ml) | | |
|---|---|---|---|---|---|---|
| 1 ----- Location→ | A | B | C | A | B | C |
| 2 | 41.0 | 181.9 | 21.0 | …… | 550 | 650 |
| 3 | …… | 3.0. | 3.0 | 870 | ….. | …. |
| 4 | 3.0 | 3.0 | 2.0 | 600 | ….. | …. |
| 5 | 4.0 | 3.0 | 1.0 | 300 | 280 | …. |
| 6 | 4.0 | 2.0 | 2.0 | 770 | 680 | …. |

Table 3 shows the results of $BOD_5$, COD, and Electrical Conductivity:

Table 3: $BOD_5$, COD and Electrical Conductivity.

| Location | $BOD_5$ (mg/L) | COD (mg/L) | Electrical Conductivity (µs/cm) |
|---|---|---|---|
| A | 560 | 5049 | 6610 |
| B | 700 | 5751 | 9350 |
| C | 742 | 4410 | 2170 |

Table. 4 shows the results of carbon atom distribution.

Table 4: Carbon atom distribution in the sample.

| COMPONENT | wt% | COMPONENT | wt% |
|---|---|---|---|
| C8 | 0.820 | C19 | 5.378 |
| C9 | 6.850 | C20 | 4.799 |
| C10 | 11.0576 | C21 | 7.167 |
| C11 | 7.684 | C22 | 2.946 |
| C12 | 6.668 | C23 | 1.860 |
| C13 | 8.184 | C24 | 1.351 |
| C14 | 6.703 | C25 | 0.801 |
| C15 | 8.627 | C26 | 0.539 |
| C16 | 6.813 | C27 | 0.262 |
| C17 | 6.0327 | C28 | 0.122 |
| C18 | 5.336 | TOTAL | 100 |

Table. 5 shows the Concentration of dissolved metals.

Table 5: Concentration of dissolved metals

| **Element** | **Concentration (mg/L)** |
|---|---|
| Ti | 19.65 |
| Ca | 111.98 |
| Fe | 2.0 |
| Mg | 40.84 |
| Na | 94.45 |

As shown in Tables 2 ,the samples was collected from three main locations (A,B,C),the results including dissolved (TPH),and volume of separated fuel and water. At location (A) the (up) samples given strong significant that the samples content at least (75%) separated fuel,(41mg/kg) of (TPH),(3-4) mg/kg total petroleum dissolved hydrocarbons. Which given indicator that the primary separation stage(location-A-) has thick layer of fuel separated by gravity ,the high of layer depends of the operation conditions. the results of four homogenous samples (H) at this stage given strong significant to found contaminated water layer at the medium of primary (TPI) separator stage ,the maximum water content at (1lt)of samples reading (870 ml), with range of dissolved (TPH) (2-3mg/kg). at location (C) all samples given less significant for hydrocarbons concentration with same range of dissolved (TPH),the low level of pump section using to pumping contaminated water to the sea causing to reduce free oil contents at samples ,except one sample which given strong significant of high hydrocarbons content results. Table. 6 shows the Total carbon atom in hydrocarbon fraction.

Table 6: Total carbon atom in hydrocarbon fraction

| Hydrocarbon fraction | Total carbon atoms % |
|---|---|
| Gasoline | 33.0787 |
| Kerosene + Gasoline | 48.9227 |
| Kerosene +diesel | 58.541 |
| Diesel +lube oil | 19.847 |

In Table. 6, the results for free oil phase separated from one sample was collected from location (C) including the carbon distribution (C8-C28)and the weight percentage of the compounds ,with flow chart . For the purposes of TPH laboratory analysis in this guidance, petroleum products are broken down into four general classes of TPH:

- Gasoline Range Organics (C5 – C12)
- Mid-Range Liquid Hydrocarbon Products or Diesel Range and Extended Range Organics (C8 – C36)
- High End Hydrocarbon Oils (C8 – C36)

. Waste Motor Oil (C8 – C36)

Gasoline is found primarily in the volatile range. Diesel fuel falls primarily in an extractable range. Jet fuel overlaps both the volatile and semi volatile ranges. However, the detection of different kinds of petroleum does not necessarily indicate that there have been multiple releases at a site. Analyses of spilled waste oil will frequently detect the presence of gasoline, and sometimes diesel.

-The GC-based methods usually cannot quantitatively detect compounds below C6 because these compounds are highly volatile and interference can occur from the solvent peak. As much as 25% of fresh gasoline can be below C6. This is not a problem for the analyst with weathered gasoline range and/or diesel range contamination because most of the very volatile hydrocarbons (<C6) may no longer be contaminants from the industry discharge flows through sea.

Some are accumulate, interact and settle with the living organism, plant and sediment and finally reach the coastal and sea. Plants and living organism in the sea are important food source for human intake. Contaminants may then enter human food chain and accumulate in fishes, molluscs (octopus, shellfish, and cockle), crustaceans (shrimp, crab, and lobster), seaweed. Therefore, it is essential to understand the effect to aquatic environment.

## 4. Conclusion:

Release of hydrocarbons into the environment whether accidentally or due to human activities is a main cause of water and soil pollution . Soil contamination with hydrocarbons causes extensive damage of local system since accumulation of pollutants in animals and plant tissue may cause death or mutations.

- The water quality at the point of effluent discharge may be considered to be similar to an improperly treated effluent that is in need of further treatment action in order to reduce the contaminant concentrations to acceptable levels.

-Receiving huge quantity of refinery white products with low capacity storage at AZZAWEA terminal ,and bad operation causing less settling time for gravity separation at fuel tanks ,and more quantity of contaminated water released with drained water, and low separation efficiency .

-The performance of oil-grit separator systems is based primarily on the relatively low solubility of petroleum products in water and the difference between the specific gravity of water and the specific gravities of petroleum compounds.

- Separators are not designed to separate other products such as solvents, detergents, or dissolved pollutants.

- Gravity separators also provide removal of debris, hydrocarbons, trash and other floatables. They provide only minimal removal of nutrients and organic matter.

-Separation efficiency depends highly on the residence time of the dispersed fluid in the champers of separator ,type or state and specific gravity of oil and wastewater, absolute viscosity, and amount of solid compounds in crude oil or refined products can cause toxic effects to marine life. Some of these chemical compounds are partially water-soluble and are slowly released from the oil into the water column. These compounds are collectively known as WAF (Water Accommodated Fraction).

-The efficiency of separation also decreases when flow exceeds the design capacity of the separator. Therefore, the design flow should be based on the maximum flow rate to be treated, including the addition of any future oily wastewaters and storm water runoff.

-Total petroleum hydrocarbons (TPH) are defined as carbon chains in the range of C6 through C35.

Products containing TPH include a wide variety of mixtures that may contain hundreds to thousands of hydrocarbon compounds including aliphatic (straight carbon chain) and aromatic (carbon ring) compounds.

Evaluating hundreds to thousands of compounds can be impractical.

The contamination of metals is a major environmental problem and especially in the aquatic environment. Some metals are potentially toxic or carcinogenic even at very low concentration and are thus, hazardous to human if they enter the food chain.

Metals are usually dissolved into the aquatic system through natural or anthropogenic sources. Metal ions are distributed thoroughly during their transport in different compartments of the aquatic ecosystems, in biotic or a biotic compartment such as fishes, water, sediment, plant. Metals remain in contaminated sediments may accumulate in microorganisms which in return entering into the food chain and eventually affect human well being.

- Another problem associated with oil spills is the high expense of removing the oil from the ecosystem; it is not a cheap process.

-Heavy metals cannot be removed from waste water and when they enter into the soil, interfere with the marine life ,plant roots - these plants when eaten by fish, animals or humans they enter into food chain. Plants along with other nutrients also uptake lead and cadmium; their accumulation may be effected by the concentration time of exposure and climatic factor.

**5. Further remarks for future work:**

1-More storage area must be installed at the terminal to improving and support the activities .

2-Fixed environment regular limits by monitoring and controlling flow rates of released pollutant.

3-Improving the quality control management at the industrial areas in the company by training the employed to be qualified with new technology of waste water treatment, and creating new environment department at the company management structure.

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## الملخص :

تتعرض البيئة اليوم لمزيد من الإرهاق والإستنزاف والتلوث , مما أدى إلى بروز العديد من المشكلات التي أخذت تهدد سلامة الحياة البشرية , كما تعتبر مشكلة التلوث في مقدمة المشاكل البيئية لما لها من آثار صحية واجتماعية واقتصادية ,ونظرا للتطور الحضاري في جميع المجالات الحيوية وخاصة في قطاع البناء والتشييد والتوسع في المخططات العمرانية أدى ذلك إلى عدم ملائمة المساكن القائمة لمتطلبات الحياة العصرية وظهور كميات هائلة من مخلفات الهدم وبشكل عشوائي على جوانب الطرق الرئيسية والفرعية والزراعية وعلى شواطئ البحار والساحات المفتوحة إضافةً إلى المباني التي يجب إزالتها جزئياً أو كلياً الناتجة من دمار حرب التحرير وخاصةً في مدينة مصراتة , هذه الطريقة العشوائية في كيفية التخلص من هذه المخلفات كلفت خزينة الدولة أموالاً طائلةً لإزالتها بالإضافة إلى ماتسببه من تلوث بيئي واشمئزاز لدى جميع المواطنين . هذه الدراسة المعملية قد تساهم ولو بالقدر البسيط في التعرف على كيفية الإستفادة من هذه المخلفات وذلك عن طريق طحنها وإنتاج ركام خشن وإدخاله كبديل عن الركام الخشن الطبيعي في إنتاج الطوب الإسمنتي للحصول على بيئة خالية من مخلفات الهدم والإستفادة من الأراضي المستخدمة كمكبات لهذه المخلفات .

تتضمن هذه الدراسة المعملية دراسة الخواص الطبيعية والكيميائية والميكانيكية للركام الناتج من طحن وتكسير هذه المخلفات , حيث أظهر الفحص البصري لحبيبات ركام مخلفات الهدم بأن الشكل الخارجي هو شكل زاوي مع نسيج سطحي خشن مما يزيد من قوة الربط بين الحبيبات وعجينة الإسمنت , كما أوضحت الدراسة بأن التدرج الحبيبي للركام الناتج لمخلفات الهدم مطابق للمواصفات الليبية القياسية وأن نتائج الاختبارات للخواص الكيميائية والفيزيائية والميكانيكية تقع ضمن حدود المواصفات الليبية القياسية المعتمدة باستثناء الوزن النوعي والامتصاص.

في حين أظهرت نتائج اختبارات مقاومة الضغط للطوب الإسمنتي بأن مقاومة الضغط للطوب الإسمنتي الناتج من ركام مخلفات الهدم هي أعلى من مقاومة الضغط للطوب الإسمنتي الناتج من استخدام الركام الطبيعي وذلك حسب المواصفات القياسية الليبية وهذا يتوافق مع ما توصلت إليه بعض الدراسات السابقة حول هذا الموضوع .