

## ANALYSIS OF TREATMENT OF CRUDE OIL POLLUTED WATER AT TONDAIRPET, NORTH CHENNAI

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### ABSTRACT

*Oil spills in the sea and groundwater are one of the most common hazards to the environment. Leakages from pipelines, oil wells, underground storage tanks of gas stations, improper disposal of petroleum wastes and stranded oil spills are the major sources of surface and groundwater contamination. There cleaning process is rushed upon because of its ill-effects. The effects are even more harmful to people if the spill happens from an underground pipeline and contaminates ground water. A leak was observed from one of the pipelines that transport crude from Chennai Port to several refineries located in North Chennai. The crude oil in the ground water has to be removed from the water in a way to assure safe usage of groundwater by the residents of north Chennai.*

*The main aspect is to analyse the treatment of crude oil mixed water by freezing methods. By using the difference in density of the water and oil, large amounts of oil content can be removed. The main goal of this project is analyse crude oil polluted water and to develop and design a prototype model which caters a procedure to treat crude oil contaminated water.*

**Keywords :** Crude oil , Leakage, Freezing Method, groundwater

### INTRODUCTION

Water is a constant gift of nature that defines peace in life. It remains a veritable endowment of nature necessary for life sustenance of plants and animals. The United Nations (UN) predicts that water shortages could retard the economic growth of some countries and lead to food shortages and possibly, to international conflicts. Organic substances from oil spillage and petroleum products disposed into water bodies significantly contaminate and degrade them and could possibly elevate the concentration levels of heavy metals. Ground water contamination by crude oil, and other petroleum-based liquids, is a widespread problem. An average of 83 crude-oil spills occurred per year during 1994-96 in the United States, each spilling an average of about 50,000 barrels of crude oil (U.S. Office of Pipeline Safety, electronic commun., 1997).

Crude oil is a naturally liquid with a complex mixture of organic molecules, mostly hydrocarbon with varied chemical and physical properties. A precise description of the chemical composition of crude oil is not practicable because of its complexity. Crude oil, or petroleum in its natural state, is the unprocessed fossil fuel extracted from the ground. It is an oily, toxic, flammable, yellow-to-black liquid that forms naturally beneath the earth's surface.

With the production and distribution of crude oil, there comes a certain amount of risk in the transportation aspect. As many precautions that can be taken to make a safe and fault free delivery, there is always that slight chance that something unexpected and unavoidable can come up. In the past, there have been many instances where the worst occurs, and the crude oil spills out of the transport container and contaminated the surrounding environment.

### CRUDE OIL AND ITS CONSTITUENTS

Crude oil consists of several chemical elements that include carbon, nitrogen, sulfur, hydrogen, and oxygen along with other various metals. The chemical elements in crude oil are listed below:

In its purest form, petroleum is only made up of crude oil. Crude oil contains six main elements. The order of greatest abundance of these six elements is: carbon, hydrogen, nitrogen, oxygen, sulfur, and various metals including: iron, nickel, copper, and vanadium. But in the form of common usage, it contains both crude oil and natural gas (both mainly consisting of hydrocarbons). There are four different types of hydrocarbons in crude oil; paraffins, aromatics, naphthenes, and asphaltics.

There are some crude oils which have up to 80% aromatic content, and these are known (as aromatic-base oil). Attempts have been made to define or classify petroleum based on various distillation properties when combined with another property such as density. It has been suggested that a crude should be called asphaltic if the distillation residue contained less than 2% wax and paraffinic if it contained more than 5%.

### COMPOSITION OF PETROLEUM (CRUDE OIL)

Petroleum (Crude oil) consists of mainly carbon (83-87%) and hydrogen (12-14%) having complex hydrocarbon mixture like paraffins, naphthenes, aromatic hydrocarbons, gaseous hydrocarbons (from CH<sub>4</sub> to C<sub>4</sub>H<sub>10</sub>). Besides crude oil also contains small amount of non hydrocarbons (sulphur) compounds, nitrogen compounds, oxygen compounds) and minerals heavier crudes contains higher sulphur. Depending on predominance of hydrocarbons, petroleum is classified as paraffin base, intermediate base or naphthenic base.

		cyclohexane, 1,2 dimethyl cyclohexane.	components of gasoline.
Aromatics	6 carbon atom in ring with three around linkage.	Benzene, Toluene, Xylene, Ethyl Benzene, Cumene, Naphthaline	Aromatics are not desirable in kerosene and lubricating oil. Benzene is carcinogenic and hence undesirable part of gasoline.

#### Non Hydrocarbons

Non-hydrocarbons	Compounds	Remarks
Sulphur compounds	Hydrogen sulphide, Mercaptans	Undesirable due to foul odour 0.5% to 7%
Nitrogen compounds	Quinoline, Pyridine, pyrrole, indole, carbazole	The presence of nitrogen compounds in gasoline and kerosene degrades the colour of product on exposure to sunlight. They may cause gum formation normally less than 0.2.
Oxygen compounds	Naphthenic acids, phenols	Content traces to 2%. These acids cause corrosion problem at various stages of processing and pollution problem.



**Hydrocarbons**

Hydrogen Family	Distinguishing characteristics	Major hydrocarbons	Remarks
Paraffins (Alkanes)	Straight carbon chain	Methane, ethane, propane, butane, pentane, hexane	General formula $C_nH_{2n+2}$ Boiling point increases as the number of carbon atom increases. With number of carbon 25-40, paraffin becomes waxy.
Isoparaffins (Iso alkanes)	Branched carbon chain	Isobutane, Isopentane, Neopentane, Isooctane	The number of possible isomers increases as in geometric progression as the number of carbon atoms increases.
Olefins (Alkenes)	One pair of carbon atoms	Ethylene, Propylene	General formula $C_nH_{2n}$ Olefins are not present in crude oil, but are formed during process. Undesirable in the finished product because of their high reactivity. Low molecular weight olefins have good antiknock properties.
Naphthenes	5 or 6 carbon atoms in ring	Cyclopentane, Methyl cyclopentane, Dimethyl cyclopentane,	General formula $C_nH_{2n+2-2R_n}$ $R_n$ is number of naphthenic ring The average crude oil contains about 50% by weight naphthenes. Naphthenes are modestly good

**CRUDE OIL AND ITS ENVIRONMENTAL EFFECTS**

Crude petroleum, as well as many products derived from it, is shipped from oil-producing locations to oil-consuming locations in oceangoing vessels having huge capacities. When there is an oil spill due to various circumstances, crude oil leaks into the surrounding environment, negatively affecting the ecosystem and most likely threatening the survival of the organisms in the surrounding environment. Accidents in which the hulls of such vessels are breached and their contents spilled can cause serious damage to the environment. Once the oil spills into the environment, it makes contact with many things. The longer the oil remains uncontained, the more difficult it becomes to rid the spill site from the hazardous material. The wildlife in the affected areas is unable to avoid the oil spill and becomes coated with the oil.

Exposure to crude oil in the air can be toxic and hazardous to the human body. Some symptoms of exposure may include: breathing problems, headaches, nausea, dizziness, and brief confusion. A person with asthma or any respiratory problems may experience side effects of crude oil toxins just by brief exposure. Long-term effects may include respiratory damage, liver, blood, and kidney damage, along with immune and nervous system damage. Exposure to crude oil can also be the cause of cancer and birth defects. The extent of reaction toward the toxins depends on the conditions of exposure and any other unique factors. Children are at a higher risk of negative side effects along with pregnant woman and their babies.

Oil pollution associated with groundwater contamination is a growing problem especially in arid countries due to limited water resources.

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## Materials and Method

### Sample

Groundwater sample was obtained by the grab sampling method in pre-sterilized 10 litre container from the tap in a housing board in Tondairpet, North Chennai that has its water source from a borehole within the City.

### Source of Crude oil

The refineries here include the government-owned Bharat Petroleum Corporation Limited, Chennai Petroleum Corporation Limited and Indian Oil Corporation. These are crucial for meeting the petrol, diesel, LPG and aviation turbine fuel requirements of Tamil Nadu and Puducherry, and also supply to neighbouring Karnataka, Andhra Pradesh and Telangana. Crude oil brought to Chennai Port via petroleum tankers are transported through pipelines to these refinery units.

### Preparation of Samples

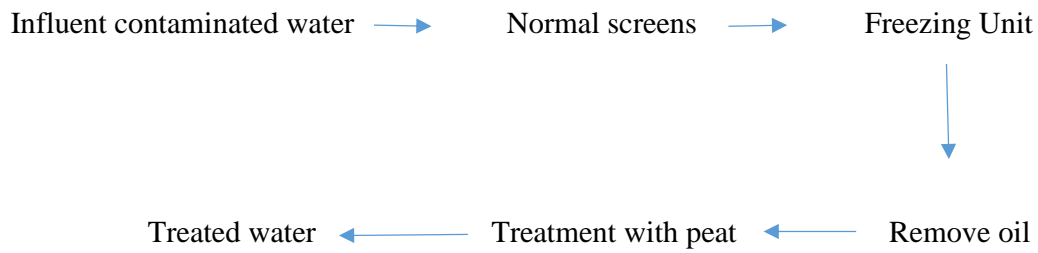
Pollution was simulated in the laboratory by contaminating 90 ml of the groundwater sample with 10 ml of crude-oil in several plastic microcosms to produce 10% contamination.

### Methodology

There are about six million tons of crude oil is transported around the world on a daily basis. Although the majority of countries have some form of equipment stockpiles in the case that an oil spill occurs, there are still many countries (mostly developing) where there is a heavy reliance on local resources to clean up oil spills. Most vulnerable countries are those with no significant oil production, and in turn, little oil spill response infrastructure. While oil spills also occur in countries that produce and export oil, there is often poor oil spill cleanup equipment maintenance. Factors that contribute to the risk of oil spills in developing countries include: high traffic density, bad weather conditions, and navigational obstacles. The response of oil spills varies greatly in developing countries. Because of the cheap cost of labor, but the lack of capital, most laborers are hired for shoreline cleanup. This introduces the need for improved, and economical, technological methods to clean up the water surfaces (Wagstaff, 1999).

Crude oil released to land or marine environment is immediately subject to a variety of physical, chemical and biological changes. At sea, crude oil, which is usually lighter than water, will spread over the water surface area. After a short time the thickness of the oil film on the water surface will amount to less than 1 mm.

The sample was stored in a container and then introduced into a freezing unit. This unit uses electrodes to freeze the crude oil polluted water. The crude oil polluted water was freezes in a quick time and the oil remains at the top like oil over a solid layer. The most part of the oil is removed easily. Some of the oil were removed by using oil absorbents. Then this treated water is allowed to undergo removal of oil through peat.



**STEP BY STEP PROCEDURE**

**CONCLUSION**

There are many remediation techniques available to treat the oil-contaminated sites in offshore as well as onshore; however, the removal efficiency of these methods depends on the type of oil, type of soil, weather conditions, penetration depth, sensitivity of the location and the toxicity of the chemicals. As there is no universal method can be generally applied to completely remove the oil from contaminated sites, thus, the preventing oil spills or leakages should be the first concern. However, if oil spills or leakages occur, response should be taken immediately to minimize the potential environmental consequences. The intrusion of crude oil has caused many ill-effects to the residents of north Chennai and the above method can be useful to mitigate the problem and fulfilling their water needs. This method can built in every resident and ground water can be purified with help of this method. This method can be used in marine oil spills to a certain extent. If the water is cooled the oil can be easily removed.

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