

# Nalanda Open University, Patna

Course Name: M.A./M.Sc. Environmental science

Coordinator: Prof. (Dr.) Bihari Singh

Mob. No. : +91 9546452116

+91 9334331422

Email ID: [bihari\\_singh2001@yahoo.com](mailto:bihari_singh2001@yahoo.com)

## E-Content II (vi)

for

### Part II Examination, 2020

#### Short description of the suggested Topics

#### THEORY PAPER

#### PAPER – IX

#### (MARINE ECOLOGY)

#### 6. “Oceans are vast storehouse of Minerals and Energy”; Elaboration of the statement with reasons.

##### I. Oceans are vast storehouse of minerals:

Oceans which cover about 70% of the earth's surface are the ultimate depository of many minerals eroded or dissolved from the land surface. Though Seas and Oceans are the storehouse of many valuable minerals, at present direct extraction of mineral resources are limited to edible salt (i.e. NaCl), Magnesium, Tin, Titanium and the Gem diamonds. Today, the entire production amounts to about one tenth of the minerals mined on land. But the increasing population and the exhaustion of readily accessible terrestrial deposits will lead to broader exploration of many metals and nonmetals directly from ocean water and ocean basin.

##### **Minerals dissolved in ocean water:**

##### **Salt:**

Common salt (i.e. Sodium chloride) is the most common chemical extracted extensively from seawater. It occurs in sea water at a concentration of about 3%. The quantity available in all the oceans is so enormous that it could supply all human needs for thousands of years.

Salt is extracted directly from oceans in many countries including India by evaporating the sea/ocean water and collecting the residual salt. In India, salt is extracted from sea water along the Sea coasts of Gujarat, Tamil Nadu and Maharashtra.

##### **Magnesium:**

Magnesium is the only metal directly extracted from seawater. Presently approximately 60% of the magnesium metal and many of magnesium salts produced in United States are extracted from seawater electrolytically.

##### **Minerals from ocean basins**

Important mineral deposits in ocean basins and beaches include sand and gravel, limestone and Gypsum, Monazite from sea sand etc. Kerala coasts of our country have the largest deposit of Monazite sand which is used for extracting valuable Lanthanide metals. Older beach sand deposits are extensively mined for

construction materials, glass manufacture and preparation of silicon metal. Gravel deposits are processed extensively for building materials.

### **Manganese Nodules**

Manganese nodules which constitute the largest known source of Manganese are found extensively on deep floor. Despite the abundance of such valuable metals as Iron, Manganese, Copper, Cobalt and Nickel contained in Manganese nodules cost effective extraction technology for their extraction has not yet been developed. As such, these rich mineral deposits remain as potent resources for their future.

### **Phosphorites:**

Phosphorites are important phosphorus - rich crusts and granules found in shallow marine environments. Though not yet possible to economically exploit the mineral, they remain future potential reserves.

### **Tin, Titanium and Diamond:**

Today, much of the world's tin and many of the gem diamonds are being mined out from near-shore ocean sediments that were carried into the seas by rivers.

### **Water:**

With land based freshwater resources becoming scarce, there is greater emphasis now on the extraction of freshwater from oceanwater. We know that 3 - 3.5 percent salt content in ocean water makes it untenable for most of human needs. Technologies are being tried with much of success to increase the efficiency of freshwater extraction from ocean water. Reverse osmosis holds the promises in the years to come.

## **II. Ocean as vast source of energy:**

It is worthwhile to describe it under two broad headings:

[A]. Oceans as vast storehouse of Conventional Energy and

[B]. Oceans as source of Non-conventional Energy – Tidal energy, Oceanic wave energy and Ocean thermal energy.

### **[A]. Oceans as vast storehouse of Petroleum oil and Natural gas:**

By far the most important mineral extraction from oceanic crusts of continental shelves is petroleum oil and natural gas. Offshore drilling is the name given to extraction of petroleum by drilling holes into the sea bed.

Currently the conventional oil reserves i.e. those which can be recovered easily and affordably using today's technology – are estimated to be a good 157 billion tonnes. Of this amount, 26 percent to be found in offshore area. In 2007, about 37% of annual oil production was derived from the ocean. The proportion of offshore production is therefore, already relatively high. The most productive areas are currently the North Sea and the Gulf of Mexico, the Atlantic Ocean off Brazil and West Africa, the Arabian Gulf and the seas off South East Asia.

In our country, reserves of offshore petroleum oil has been found and are being mined out from offshore near Mumbai, Gujarat coast, Malabar and Coromandal coasts, Krishna-Cauvery delta

coast, Sunder ban etc. Bombay high oil field is the most important offshore oil field of India.

### **Natural gas:**

Natural gas is a mixture of hydrocarbons consisting mainly of Methane (about 95% by volume) and small quantities of ethane and propane. It is a good domestic and industrial fuel better than any other fossil fuel. In many parts of the world, Continental shelves in oceans have been found to have big deposit of natural gas. In India natural gas field have been found in the Krishna Godavari delta off the coast of Andhra Pradesh, at Cauvery offshore and the Kutch offshore of Gujarat. But the most important natural gas field of our country lies offshore north - west of Mumbai in the Arabian Sea, popularly called Mumbai High. Over 70% of India's natural gas comes from Mumbai High.

### **[B] Oceans as a source of non-conventional energy:**

Oceans are vast natural resources of water. Recent researches have shown that Tidal Power and Wave Power of the oceans can be utilized for power generation. Moreover, temperature difference between the upper and lower layers of sea water has been made use of to generate electricity through Ocean Thermal Energy Conversion (OTEC).

#### **Tidal Energy**

In oceans, the gravitational pull by the Sun and the Moon causes tides, in which the sea level rises and falls down in 24 hours. Technology has been developed to utilize the energy associated with huge oceanic water moving up and down during tides for power generation. Exploitation of the tidal power for power generation is possible along the coasts where there is sufficient (above 6 metre) vertical difference between high and low tides. At present, tidal power plants are in operation in Russia, France and a few more countries.

#### **Oceanic Wave Energy**

High energy waves are produced in the oceans where air currents rub against the surface of oceans. These waves reach the seashore with enormous speed and their kinetic energy gets dissipated. Techniques have been developed to use this energy to drive turbo generators and produce electricity. Our Country's first power plant that makes use of oceanic wave energy is located near Thiruvananthapuram, Kerala.

#### **Ocean Thermal Energy**

In oceans there exists a temperature difference between the upper and lower layers of sea water. In tropical countries such as India, this temperature difference is as high as 20°C-30°C at a depth of 1,000 metres or so. Work is in progress to utilize this temperature gradient to generate electricity. Currently most devices to trap the oceanic energy for power generation are uneconomical.

## **10. Causes of pollution of Ocean water; Effect of ocean pollution on different biotic and abiotic components of ocean water and the Environment.**

### **Causes of pollution of ocean water:**

In modern time human activities have not spared even the seas, oceans and estuaries from being polluted. In fact oceans and seas are taken as endless dustbins for wastes. For industries located in coastal region seas and oceans are used as a convenient dumping ground for wastes of all kinds, most of which are toxic in nature. Millions of tons of waste have already been dumped into seas and oceans and are being dumped even now. As things stand now seas and oceans are reeling under the reckless attack of human activities of varied nature.

### **Other sources of marine pollution are as given below:**

- ❖ Rivers flowing through agricultural areas carry fertilizers and pesticides with them, which finally reach the seas and oceans. River water also carries huge quantities of domestic, industrial and commercial wastes and sediments due to soil erosion which ultimately reach seas and oceans.
- ❖ Activities at the coasts and seaports generate a huge quantity of commercial and domestic wastes, most of which get into seas and oceans.
- ❖ Nuclear wastes are highly dangerous wastes, which are often dumped into the seas and oceans. Though these wastes are dumped in sealed containers, any damage of containers or leakage from them may cause serious damage to the flora and fauna of marine habitat.

### **Oil Spills**

Recent explorations have shown that oceans have huge deposits of Petroleum and Natural gas. Oil pollution of seas and oceans has increased over the years due to oil losses during offshore explorations and extraction of oil, leakage from underground pipelines and oil spills from cargo oil tankers on the oceans and estuaries. A huge quantity of waste oil also reaches seas and oceans due to

- Leakage of oil during loading and unloading of tanker ships.
- Run off from streets and roads at sea ports.
- Washing of cargo tankers on the Seashore etc.
- Many ships lose thousands of crates each year due to Storms, emergencies and accidents.
- Crude oil released in oceans and seas due to oil spills lasts for year in the sea and is extremely toxic to marine life, often suffocating marine animals to death once it entraps them.

### ❖ **Ocean Mining:**

Ocean mining in the deep sea is yet another source of Ocean Pollution. Ocean mining sites drilling for Silver, Gold, Copper, Cobalt and Zinc create Sulphide deposit upto three and a half thousand meters down into the ocean. Copper is a

major source of pollutant in the ocean and can interfere with the life cycles of numerous marine organisms and life.

❖ **Pollution from the Atmosphere:**

Pollution from the atmosphere is a large source of Ocean Pollution. This occurs when objects that are far inland are blown by the wind over long distances and end up in the ocean. These objects can be anything from natural things like dust and sand to manmade objects such as debris and trash. Most debris especially plastic debris cannot decompose and remains suspended in the ocean's current for year.

**Effect of Ocean pollution on different biotic and abiotic components of ocean water and the environment:**

- i. The oil spill and pollution affect marine life on a massive scale. The oil spilled in ocean could get on the grills and feathers of marine animals which make it difficult for them to fly or move properly or feed their children. The long term effect on marine life can include cancer, failure in the reproductive system, behavioral changes and even death.
- ii. Oil spill float on the surface of the water and prevent sunlight from reaching to marine plants and affect the process of photosynthesis. Skin irritation, eye irritation, lung and liver problem can impact marine life over a long period of time.
- iii. Most of the debris in the ocean does not decompose and remain in ocean for years. It consumes oxygen as it degrades. As a result of this oxygen level godown, with low oxygen level in seas and oceans, the chances of survival of marine animals like – Shark, Whale, Turtle, Dolphin, Penguin etc. for a long time goes down. According to one report, due to massive discharge of toxic wastes into the sea near the Norflok beach of U.K. along the North Sea, a serious example of ill impact of marine pollution was witnessed in the death of hundreds of Seals.
- iv. Industrial and agricultural wastes include various poisonous chemicals that are hazardous for marine life. Toxic pesticides can bio-accumulate in the fatty tissue of animals, leading to failure in their reproductive system.
- v. Chemicals used in industries and agriculture get washed in the rivers and from there are carried into the oceans. Many of these chemicals which do not dissolve in seawater sink at the bottom of the ocean. Small sea animals ingest these chemicals and are later eaten by larger animals which then affect the whole food chain. Humans eat such sea animals and thus enter the consumers of these animals. This is now toxics from the contaminated animals get deposited in the tissues of people and can lead to birth defects, cancer or long term health problem. Minamata disease of Japan is an example of the serious impact and industrial waste can have on the life and health of human beings.

- vi. Though nuclear wastes are disposed of in seas and oceans in sealed containers, any damage of containers or leakage from them may cause serious damage to flora and fauna of marine habitat.
- vii. Changes in water temperatures and other consequences of global warming will have a profound effect upon marine species.

**Note:** Study Learning Material M. A./M. Sc. Environmental Science, Paper IX provided by N. O. U, Patna and other resource materials may also be consulted if felt so.