

Industrial Effluents from petroleum & Agro Industries :

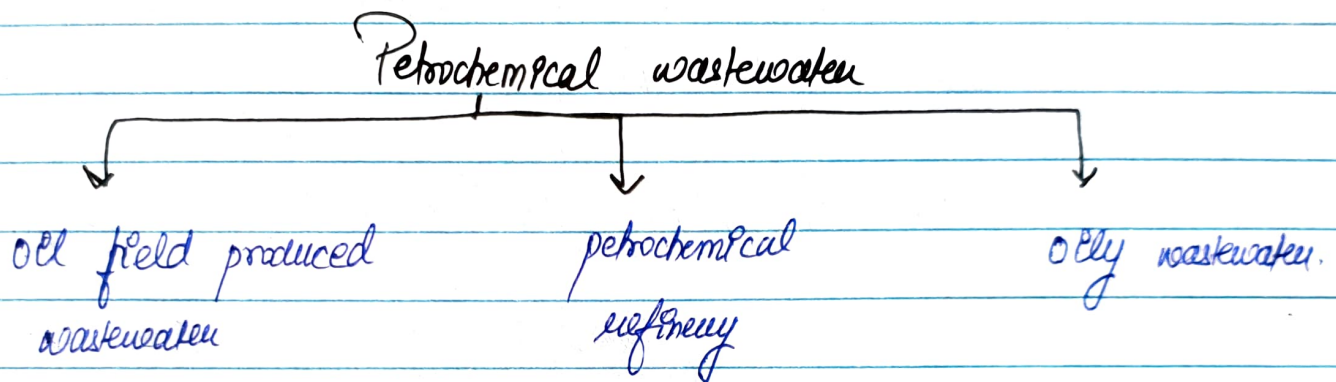
Effluents : • It is defined by United States of Environmental Protection Agency as "wastewater - treated or untreated" - that flows out of a treatment plant, sewer or industrial outfall.

- They are the major source of water pollution

Petrochemical effluents :

- They are the major source ~~source~~ of ~~water~~ aquatic environmental pollution.
- Processing of crude oil causes a lot of water waste, studies have showed that volume of petroleum refinery effluents generated is 0.4 - 1.6 times the crude oil processed.
- These effluents are composed of greases & petroleum compounds which consists of three main hydrocarbon groups -
 - (1) Paraffin [C_nH_{2n+2}]
 - (2) Naphthene [cyclohexane]
 - (3) Aromatic compounds [such as benzene, xylene].

- ① It also contains appreciable amount of phenols, heavy metals and sulphides. And these phenolic compounds are toxic and stay in water bodies for long periods.



⇒ oil field produced wastewater:

- ① generated in crude oil
- ② oil extraction from oil wells that contains high concentration of surfactants & emulsified crude oil characterised of high COD & low biodegradability
- ③ examples → heavy metals like Hg, Titanium, lead

⇒ Petrochemical refinery:

- ① generated in oil refinery processes that produces more than 250 refined products. The wastewater can be from cooling systems, distillation etc.
- ② example → NH_3 , sulphides, phenols.

- ⇒ Oil wastewater:
- any wastewater that doesn't belong to first two categories.
 - can be from oil transportation tank, garage oil wastewater etc.
 - high COD that can be over 15g/L.

- Effects of effluents:
- (i) The toxic chemicals are hazardous to aquatic life.
 - (ii) The metals present in effluent seriously effect the different organs of humans like kidney, liver.
 - (iii) This corrodes the pipelines.
 - (iv) Oil spills from cargo oil tankers on the seas, can cause accidental fires on ship. further it reduces DO in water & endangers water birds, coastal plants & animals.

Treatment

- (i) Physical treatment
 - Adsorption by active carbon & zeolites. can be used for removing hydrocarbon in petrochemical wastewater.
 - Evaporation is proposed to remove all residuals in saline wastewater.
 - Dissolved air flotation is commonly used for wastewater containing oil/fat as well as suspended solids.

(10)

Chemical treatment

- enhancing hydrolysis by adding chemicals for removing the long chain organic compounds.
- Micro-aeration: breaks down high hydrocarbon contents from wastewater. Also removes sulphides & simultaneously from both gas and liquid phase.

Biological processes

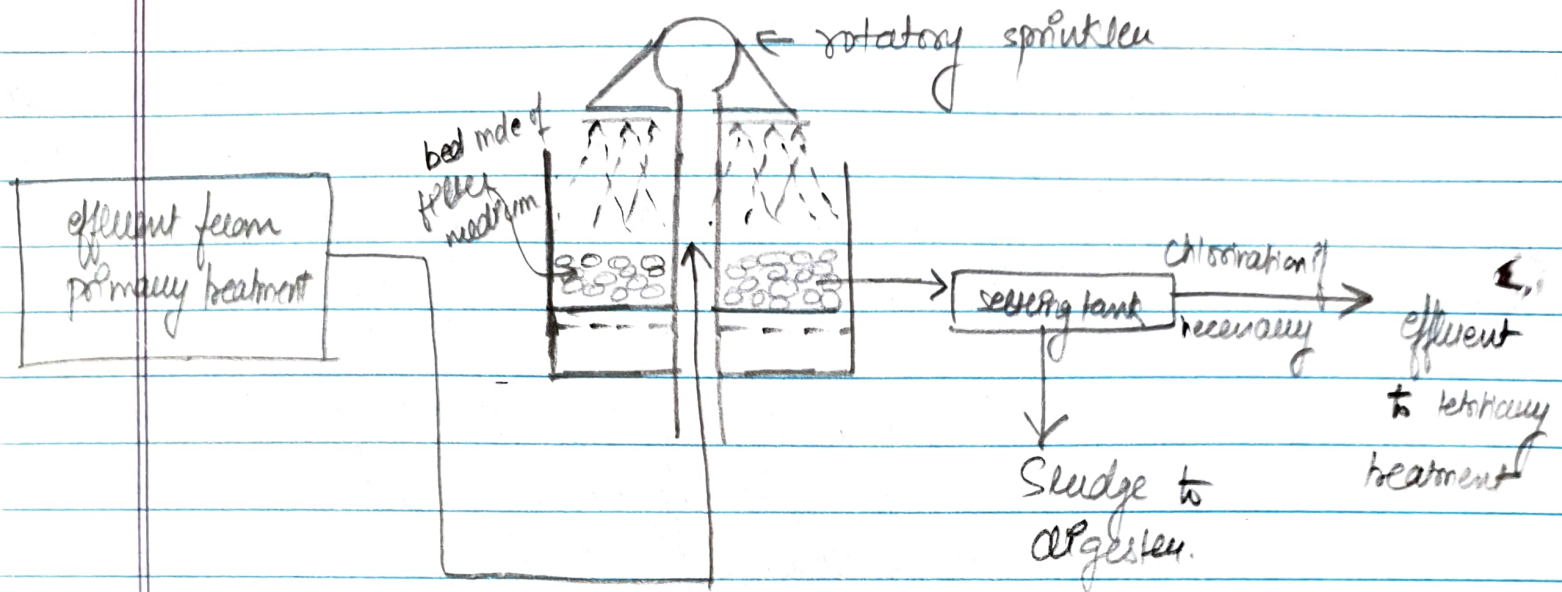
- Anaerobic digestion (AD), aerobic digestion or an integration of both methods is commonly applied in this process.
- Biological processes incorporate actions of different microbes to eliminate organic and stabilize hazardous pollutants in petrochemical waste.
- More micro-organisms in sludges, are formed and a portion of waste is converted to CO_2 , water & other end products.

Anaerobic biological process:

- has an excellent organic removal efficiency and an economical cost.
- Organic matter is converted into CO_2 & CH_4 & sludge during this process.

Trickling Filter:

- ① usually consists of circular or rectangular beds, 2m to 3m deep, made of well-graded media (such as broken stones, PVC, coal) of size 40mm to 150mm, over which wastewater is sprinkled uniformly with the help of a slowly rotating distributor.
- ② A gelatinous film, comprising of bacteria and aerobic micro-organisms known as "Zooglea", is formed on the surface of filter medium, which thrive on the nutrients supplied by wastewater.
- ③ The organic impurities in waste water is adsorbed on the gelatinous film during its passage & are then oxidised by bacteria.
- ④ The effluent from trickling filter is allowed to settle in a settling tank to retain the sludge particles & is then discharged.
- ⑤ Microbial film is sensitive to temperature, $\therefore$ efficiency of filter decreases in winter season.



Trickling filter

Agro industrial wastes and their utilisation using solid state fermentation :-

Agricultural residues are rich in bioactive compounds. These residues can be used as an alternate source for the production of different products like biogas, biofuel and mushroom as the raw material in various researches and industries.

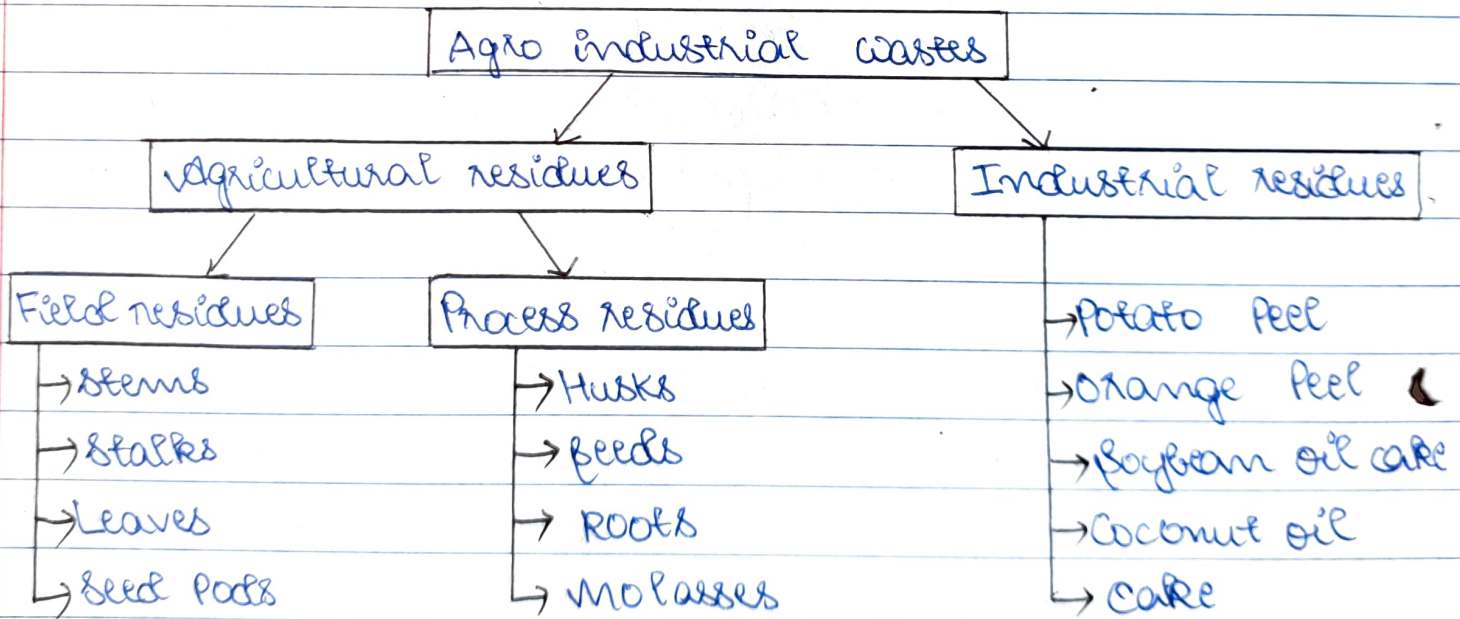
Uses :-

- (1) Use of agro-industrial wastes as raw materials can help to reduce the production cost and also reduce the pollution load from the environment.
- (2) Agro industrial wastes are used for manufacturing biofuels, enzymes, vitamins, antioxidants, antibiotics through solid state fermentation (SSF). Therefore SSF and their effect on the formation of value-added products are discussed.

Types of agro industrial wastes :-

(1) Agricultural residues :-

These can be divided into field residues and process residues. Field residues are residues that are present in the field after the process of crop harvesting. These field residues consists of leaves, stalks, stems whereas the process residues present even after the crop is processed into alternate valuable resource.



Industrial wastes :-

A huge amount of organic residues and related effluents are produced every year through the food processing industries like juice, chips, meat, confectionery and fruit industries. These organic residues can be utilised for different energy sources.

Approximately 20% of the production of fruits and vegetables in India are going waste every year. Because in India a large amount of apple, cotton, soybean and wheat are produced so as the production increased in the country, it also increased the percentage of waste produced from them. Similarly, the waste produced from food industries contains high value of BOD and other suspended solids.

Especially in oil industries, huge amount of processed residues are produced after oil extraction from the seeds, these residues are known as oil cakes. These industries cause air, water and solid waste pollution because these residues contain high conc. of fat, oil, grease, suspended solids and dissolved solids.



(1) Treatment of Agro-Industrial wastes using water Hyacinth:-

In Malaysia Lagoon systems have been successfully adopted by the natural rubber and oil palm industries to treat their effluents. The possibility of using water hyacinth in the lagoons to further improve the treatment system was investigated. Good removal of ~~removal~~ pollutants from the block rubber effluent was achieved using a hydraulic retention of 10-15 days. The resulting effluent discharge was of acceptable quality. Water hyacinth also markedly improved the quality of the effluent from the remitting rubber factories. Consequently propagation of water hyacinth in the lagoons has been recommended.

(2) Treatment Processes:-

- (a) Composting
- (b) Recycling
- (c) Incineration

(a) Composting:-

It is a method in which organic matter present in agricultural waste is decomposed by aerobically/anaerobically through a



biochemical process and converted into humus.

(b) Recycling :- It is a process to change waste into new products. It prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage.

(c) Incineration :- It is a modern and most hygienic method of disposal of dry waste. The method consist of burning the dry refuse in incinerator.