

# SOURCES AND COMPONENTS OF INDUSTRIAL WASTEWATER

Dr.Shabiimam

## INTRODUCTION

- Industrial (including agro-industrial) wastewaters have very varied compositions depending on the type of industry and materials processed.
- Some of these wastewaters can be organically **very strong**, easily **biodegradable**, largely inorganic, or potentially inhibitory.
- This means TSS, BOD<sub>5</sub> and COD values may be in the tens of thousands mg/lit.

- Unlike sewage, pH values well beyond the range of 6–9 are also frequently encountered.
- Such wastewaters may also be associated with high concentrations of dissolved metal salts.
- The flow pattern of industrial wastewater streams can be very different from that of domestic sewage.
- Since the flow of industrial wastewater would be influenced by the nature of the operations within a factory rather than the usual activities encountered in the domestic setting.

- A significant factor influencing the flow pattern would be the shift nature of work at factories.
- These shifts may be 8 h or 12 h shifts and there can be up to three shifts per day.
- wastewater characteristics within a factory can also vary with time because it may practice batch manufacturing, or it may practice slug discharges (Accidental discharges) on top of its usual discharges.

- Apart from these events which occur on a regular basis, there **would be spillages** and **dumping** which may occur within the factory infrequently but can have very adverse impacts on the performance of the wastewater treatment plant.

Industrial wastewater characteristics which would require consideration include the following:

1. **Biodegradability**
2. **Strength**
3. **Volumes**
4. **Variations and**
5. **Special characteristics which may lead to operational difficulties.**

# 1. BIODEGRADABILITY

- For an industrial wastewater to be successfully treated by biological means it **should have quantities of organics** requiring removal and these (and any other constituents present in the wastewater) **should not inhibit** the biological process.
- The quantity of organics in a wastewater is indicated by the wastewater's BOD<sub>5</sub> and COD (dichromate) values.

BOD<sub>5</sub>/COD ratio

# 2. STRENGTH

- Industrial wastewaters often have organic strengths which are very much higher than those encountered in sewage.
- Agro-industrial wastewaters are among those which may have very high organic strengths. E.g.- **sugar-molases, distillery-spentwash**
- Typically the biological processes address the dissolved and colloidal organic components in a wastewater since the particulate can be easily removed using physical treatment options.

### 3.VOLUMES

- It can be a common misconception that industrial wastewater treatment plants handle volumes which are smaller.
- While this may be so when compared with sewage flows received by sewage treatment plants serving metropolitan areas, not all sewage treatment plants serve large communities and not all industrial wastewater flows are small.

- The range of industrial wastewater volumes to be treated can be **very large, not only from one industry to the next but also from factory to factory within an industry , than sewage flows.**

## 4. VARIATIONS

- The study of wastewater characteristics show that the wastewaters generated by different factories vary even within the same industry group.
- This is so for every parameter indicated and particularly so in the case of the volumes of wastewater discharged.
- In part the variation would have been the result of different quantities of materials processed at different locations but even in terms of unit quantity of materials processed there are still variations and this is due to differences in housekeeping practices therein.

## 5. SPECIAL CHARACTERISTICS

- Industrial wastewaters may have certain characteristics, the effect of which may not be apparent from the sort of wastewater data usually provided.
- These may, however, have significant adverse impact on the equipment or unit process performance, and aesthetics of a wastewater treatment plant.

# HEAVY METALS

Industry	A	As	Cd	Cr	C	Hg	Pb	Ni	Zn
Pulp & paper mills				X	X	X	X	X	X
Organic chem.	X	X	X	X		X	X		X
Alkalis, Chlorine		X	X	X		X	X		X
Fertilizers	X	X	X	X	X	X	X	X	X
Petroleum refining	X	X	X	X	X		X	X	X
Steel works		X	X	X	X	X	X	X	X
Aircraft plating, finishing	X		X	X	X	X		X	
Flat glass, cement				X					
Textile mills				X					
Tanning				X					
Power plants				X					

## SOURCES OF INDUSTRIAL WASTEWATER

- In most industries, wastewater effluents result from the following water uses:
  1. Sanitary wastewater (from washing, drinking, etc.)
  2. Cooling (from disposing of excess heat to the environment)
  3. Process wastewater (including both water used for making and washing products and for removal and transport of waste and by-products); and
  4. Cleaning (including wastewater from cleaning and maintenance of Industrial areas).

# INDUSTRIAL EFFLUENTS

- Whereas the nature domestic wastewater is relatively constant, the extreme diversity of industrial effluents calls for an individual investigation for each type of industry and often entails the use of specific treatment processes.
- Therefore, a thorough understanding of the production processes and the system organization is fundamental.

- There are 4 types of Industrial effluents to be considered
  1. General manufacturing effluents
  2. Specific effluents
  3. General service effluents
  4. Intermittent effluents



# 1. GENERAL MANUFACTURING EFFLUENTS:

- Most processes give rise to polluting effluents resulting from the contact of water with gases, liquids or solids. The effluents are either continuous or intermittent.
- They even might only be produced several months a year.
- Usually if production is regular, pollution flows are known.

- However, for industries working in specific campaigns (synthetic chemistry, pharmaceutical and parachechemical industries), it is more difficult to analyze the effluents as they are always changing.

## 2. SPECIFIC EFFLUENTS

- Some effluents are likely to be separated either for specific treatment after which they are recovered, or to be kept in a storage tank ready to be reinjected at a weighted flow rate into the treatment line.
- Such as, pickling and electroplating baths; spent caustic soda.

## 3. GENERAL SERVICE EFFLUENTS

- These effluents may include wastewater (canteens, etc.), water used for heating (boiler blow down; pent resin regenerates) etc.

## 4. INTERMITTENT EFFLUENTS

- These must not be forgotten; they may occur from accidental leaks of Products during handling or storage, from floor wash water and from polluted water, of which storm water may also give rise to a hydraulic overload.

For the correct design of an industrial effluent treatment plant, the following parameters must be carefully established

- *types of production, capacities and cycles, raw materials used,*
- *composition of the make-up water used by the industrial plant,*
- *possibility of separating effluents and/or recycling them,*

- *daily volume of effluents per type,*
- *average and maximum hourly flows (duration and frequency by, type),*
- *average and maximum pollution flow (frequency and duration)*
- *per type of waste and for the specific type of pollution coming from the industry under consideration.*

## THEORY QUESTIONS

- *Discuss components of industrial wastewater flow*