Date.....

Unit-2

(2020) (2020) Process for removal of suspended solid (2021)
Colloidal solid
Organic and Inorganic Dissolved solid;
(2021)

Removal of suspended solids:

1) sedimentation ✓
2) Filtration ✓
3) Flotation
4) ~~Sie~~ Micro Screening - SS | BOD.
5) Flocculation ✓
6) Coagulation ✓

Removal of Colloidal solid

1) Chemical coagulation
2) Centrifugation
3) Flocculation ✓
4) sedimentation ✓
5) Screening: but ultra filters.

Organic Dissolved solid

1) Lagooning in Oxi. Pond
2) Activated sludge Treatment
3) Trickling filtration
4) Spray irrigation
5) Anaerobic digestion
6) Wet Combustion
7) Subsurface disposal
8) Adsorption

Inorganic dissolved soli

1) Evaporation
2) Ion Exchange
3) Reverse Osmosis
4) Electrodialysis

Date.....

Unit-1

Methods for the treatment of industrial wastes :

(2020) Reduction of volume & strength ✓

(2021) (2020) Neutralisation - Techniques ✓

(2020) Equalisation and Proportioning of waste

Q: High strength waste water?

Q: Volume reduction? Reduce strength

Volume Reduction:

The first step in minimizing the effects of Industrial wastes on receiving streams and Treatment plants is to reduce the volume of such wastes. This may be accomplished by -

1) Classification of wastes

- If wastes are classified, so that manufacturing - process water are separated from cooling waters - the volume of water requiring intensive treatment may be reduced considerably.
- Sometimes it is possible to classify and separate the process waters themselves so that only the most polluted ones are treated and the relatively uncontaminated ones are discharge without treatment.
- Three main classes of waste are:
  1) Wastes from manufacturing process
  2) Waters used as cooling agents in industrial pr..
  3) Wastes from sanitary uses

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1) Wastes from manufacturing processes:
These includes water used in:
→ forming paper on travelling wire machines
→ those discharged from washing of milk cans in dairy plants.
→ dyeing & washing of textile fabrics
→ washing of picked fruits from canneries.

2) Water used as cooling agents in industrial processes:
→ Volume of these wastes varies from one industry to another
→ cooling waters have been found to be contaminated by small leaks, corrosion products, or effects of heat.
→ Power plants — industry in which cooling waters are segregated and account for a high % of total volume of plant wastes.

3) Wastes from Sanitary Uses:
→ Range from 90 to 180 litre per employee per day.
→ Vol. depend on many factors:
① Including size of plant
② Amt. of waste product materials washed from floors
③ The degree of cleanliness required of workers in process operati

2) Conservation of Wastewater:

→ Water cons. is waste saved
→ Cons. begins — when industry changes from open to closed system
→ Recycled wastewater are often treated at end of their period of usefulness.
→ Two fold: Water costs, waste treatment cost] Lower.
→ Many changes to effect cons. → quite costly & benefit must be balanced against costs.
→ For eg. Coal processors reuse water to remove dirt & other non-combustile material from coal.

3) Changing Production To Decrease Wastes:

→ Effective method of controlling the volume of wastes but difficult to put into practice.
→ Hard to convince plant managers to change their operations just to eliminate wastes.
→ operational phase of engineering — primary objective is cost savings.
→ Protection of public health / Cons. of Natural Resources

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→ Engineer also mention that balancing the quantities of acids and alkalis used in a plant often result in neutral waste.

→ several Measures that can be used to reduce waste:
- ⊙ Improved Process Control
- ⊙ Improved Equipment design
- ⊙ Use diff. or high quality raw material
- ⊙ Good housekeeping
- ⊙ Preventive Maintenance

4) Reusing both Industrial And Municipal Effluents from Raw water supplies:

→ Practised mainly in areas where water is scarce or expensive.

→ Economic method of conservation.

→ The greatest manufacturing use of water is for cooling purposes.

→ Bcz volume of this water requirement is usually great, industries located in areas where water is expensive should consider reusing effluents.

→ Reusing municipal and industrial effluents saves water and brings revenue into city.

5) Elimination of Batch or Slug Disharges of Process Wastes

→ In "wet" manufacturing of a product, one ore more steps are sometimes repeated – which is ~~some~~ produd" of higher vol. & strength of waste.

→ If this waste is discharged in a short period, it is usually referred to as a slug discharge.

→ Because of contaminant / surge in volume – troublesome to both treatment plants & receiving streams.

→ Two methods:
1) manufacturing firm can alter its practice to ↑se the frequency and lessen the magnitude of batch discharges.
2) slug waste can be retained in holding basins from which they are allowed to flow continuously & uniformly.

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Strength Reduction

The strength of waste may be reduced by -

1) **Process changes**

→ In reducing the strength of wastes through process changes, sanitary engineers are conc. with wastes that are most troublesome from a pollutional standpoint.
→ Many industries have resolved waste problems through process changes. Eg. Textile & metal fabricating ind.
→ Eg. Dry quenching of coke (instead of wet)
Hydrochloric acid pickling (instead of sulfuric acid)

2) **Equipment Modifications**

→ Change in equipment can reduce the strength of the waste, usually by reducing the amt. of contaminant entering the waste stream.
→ Often quite small changes can be made in present equipment to reduce waste.
→ In pickle factories, screen placed over drain lines in cucumber tanks prevent the escape of seeds & pieces of cucumber, which adds strength & density of waste.
→ Traps on discharge pipeline in poultry plants prevent emission of feathers & pieces of fat.
→ This method is to change the production procedure to "dry collect" as much waste material as possible from manufacturing machines and operating floors rather than "Hosing down" the same matter into drains.
→ For eg: In dairy Industry, in 1944 redesigned the large milk cans used to collect farmer milk.
New cans were constructed with smooth necks so that they could be drained faster & more completely.
⇒ Prevented a large amt. of milk waste from entering streams and sewage plants.

3) **Segregation of Wastes**

→ It reduces the strength or difficulty of treating the final waste from an industrial plant.
→ Result in two wastes → One strong & small in volume
Other weaker, with almost same volum as original unsegregated waste.
→ Volume red^{n} alone segregation of cooling water & storm water from process water will mean a saving in size of the final treatment plant.

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→ Although this type of segregation may lse the strength of the waste being treated, it will typically produce a final effluent cont. less polluting matter.
→ Segregation of certain waste is of great advantage in all industrie
→ Just in reverse technique, complete equalization – necessary in certain circumstances.

4) Equalization of Wastes

→ Diversities of process prefer to equalize their waste.
→ If a manufactured item requires a series of operations that take 8 hrs, plant needs an equalization basin designed to hold the waste for that 8 hr period.
→ effluent from EB is much more consistent in its characteristics than each separate influent to that same basin.
→ Stabilisation of pH & BOD & settling of solid & heavy metal are obj. of equalizatn.
→ Sometimes equalization may produce an effluent that warrants no further treatment.

5) By - Product Recovery

→ Concerning the low % of successful by-products developed from waste salvage.
→ Any use of waste material – disposed of & search for by products should be encouraged – provide management with a clearer insight into processing & waste problems.
→ Eg: Sewage plants have entered the by-product busines. Methane gas from sewage digesters is used for heat & power.
◎ Packinghouses & slaughterhouse recover waste blood, which is used as a binder in laminated wood products & in manufacturing of glue.

6) Proportioning Wastes

→ By proportioning its discharge of conc. wastes into main sewer, a plant can often reduce the strength of its total waste to the point at which – it need a minimum treatment. or will cause the least damage to stream.

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7) **Monitoring Waste Streams**

→ Remote sensing devices that enable the operator to stop, reduce or redirect the flow from any process — when its conc. of contaminant exceed certain limit.

→ Accidental spills are often sole cause of stream pollution or malfunctioning of treatment plants — can be controlled & often eliminated completely, if sources monitored.

Neutralisation

It is defined as treatment of industrial waste so that it is neither too acidic nor too alkaline for safe discharge.

Reason :

→ To make industrial waste compatible (in term of pH) with municipal sewage when joint treatment is practiced.

→ more specifically to make certain that its pH doesn't kill or otherwise inactivate the microorganisms being used to biologically oxidize the OM content.

→ To prevent corrosion of pipelines.

→ To comply with effluent standards for excessive acid or alkaline condn in sewers.

→ To make certain that waste discharge pH doesn't kill fish or other organ. in receiving waters.

→ Excessively acid or alkaline wastes should not be discharged into a receiving stream without treatment.

There are many acceptable methods for neutralizing over acidity or over alkalinity of wastewater such as :

① Mixing waste so that Net Effect is a near - neutral pH.

② Passing acid wastes through beds of limestone.

③ Mixing acid waste with lime slurries.

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4) Adding proper proportions of conc. soln of caustic soda ($NaOH$) or soda ash (Na_2CO_3) to acid wastes.
5) Blowing waste boiler - flue to alkaline wastes
6) producing CO_2 in alkaline wastes
7) adding sulfuric acid to alkaline wastes.

Neutralisation of Acidic Wastes

1) Mixing wastes
2) Limestone treatment for acid wastes
3) Lime slurry treatment for Acid Wastes
4) Caustic Soda treatment for ——.
5)

Neutralisation of Alkaline Wastes:

1) Using Waste Boiler, flue gas
2) CO_2 treatment for alkaline wastes.
3) Sulfuric acid treatment for Al. (expensive)

Equalization and Proportioning of Waste

Equalization: Method of retaining wastes in a basin so that effluent discharged is fairly uniform in its characteristics

↓

pH, color, Turbidity, alkalinity, BOD etc.

Objective: To minimise or control fluctuations in wastewater characteristics in order to provide optimum conds for treatment.

both Equalize flow volumes.

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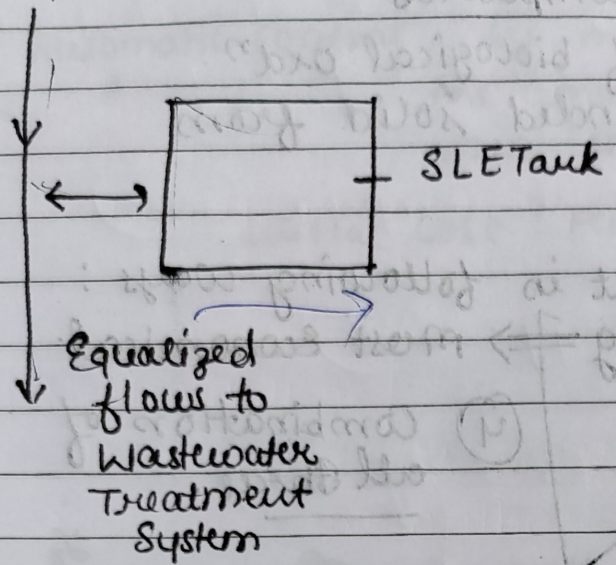
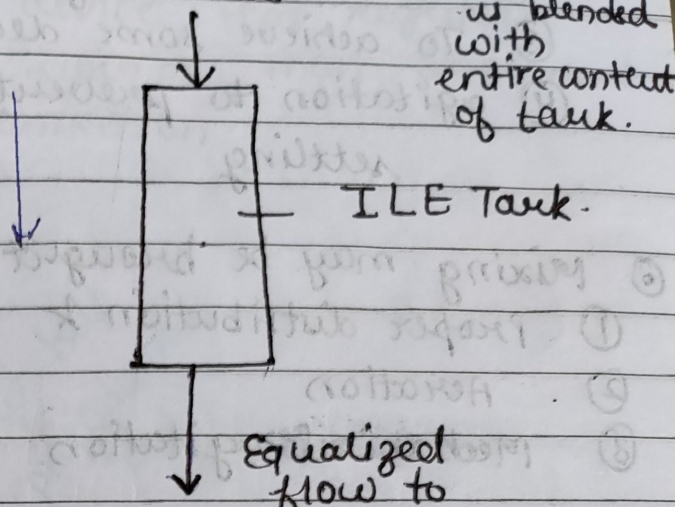
Side line Equalization

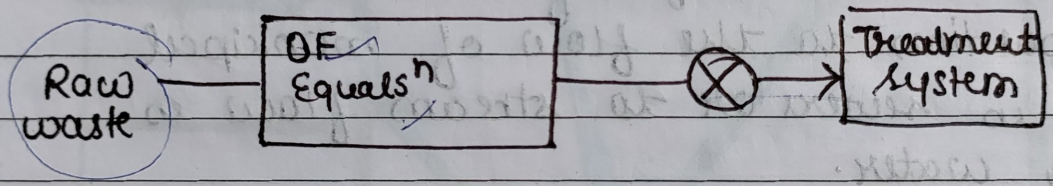


In-line Equalization

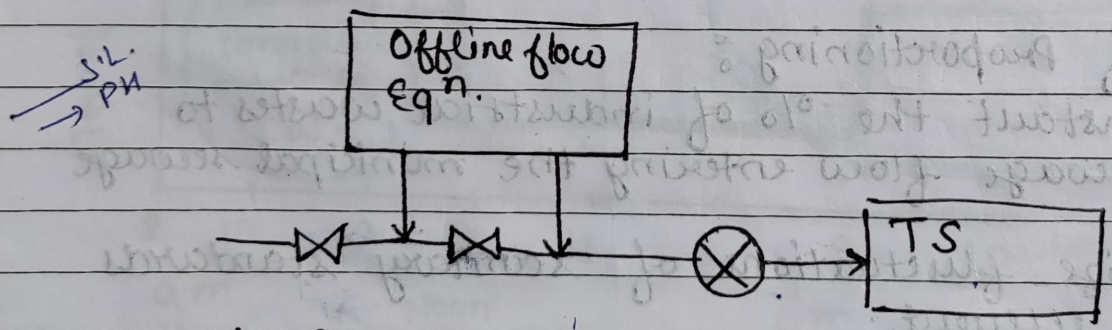
∴ More effective as flow is blended with entire content of tank.



a) Online flow Equalization



b) Offline flow equalization



Objectives:

1. To provide adequate dampening of organic fluctuations to prevent shock loading of biological systems.
2. To provide adequate pH control.
3. To minimise flow surges to physical chemical Treatment
4. To provide continuous feed to biological system when plant is not operating.
5. To prevent high conc. of toxic material from entering the biological treatment plant.

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⊙ Air is sometimes injected into these basins to provide—
① better mixing
② chemical oxidn of reduced compounds
③ To achieve some degree of biological oxdn.
④ agitation to prevent suspended solid from settling

⊙ Mixing may be brought about in following ways:
① Proper distribution & baffling
② Aeration
③ Mechanical agitation
④ Combination of all three. ⟹ most economical.

Proportioning

It means the discharge of industrial wastes in proportion to the flow of municipal sewage in sewers or to stream flow in receiving water.

→ In most cases, it is possible to combine eqn & propn in same basin.

→ **Objective** of Proportioning:
① To keep constant the % of industrial wastes to domestic sewage flow entering the municipal sewage plant.
② To minimize fluctuations of sanitary standards in treated effluent.
③ To protect biological-treatment devices from shock loads of IW that may inactivate the bacteria.

Methods
- Automatic control (less accurate) ← cost effective → Manual control
  - ↓ By electronics
  - ↓ well defined domestic sewage flow pattern.

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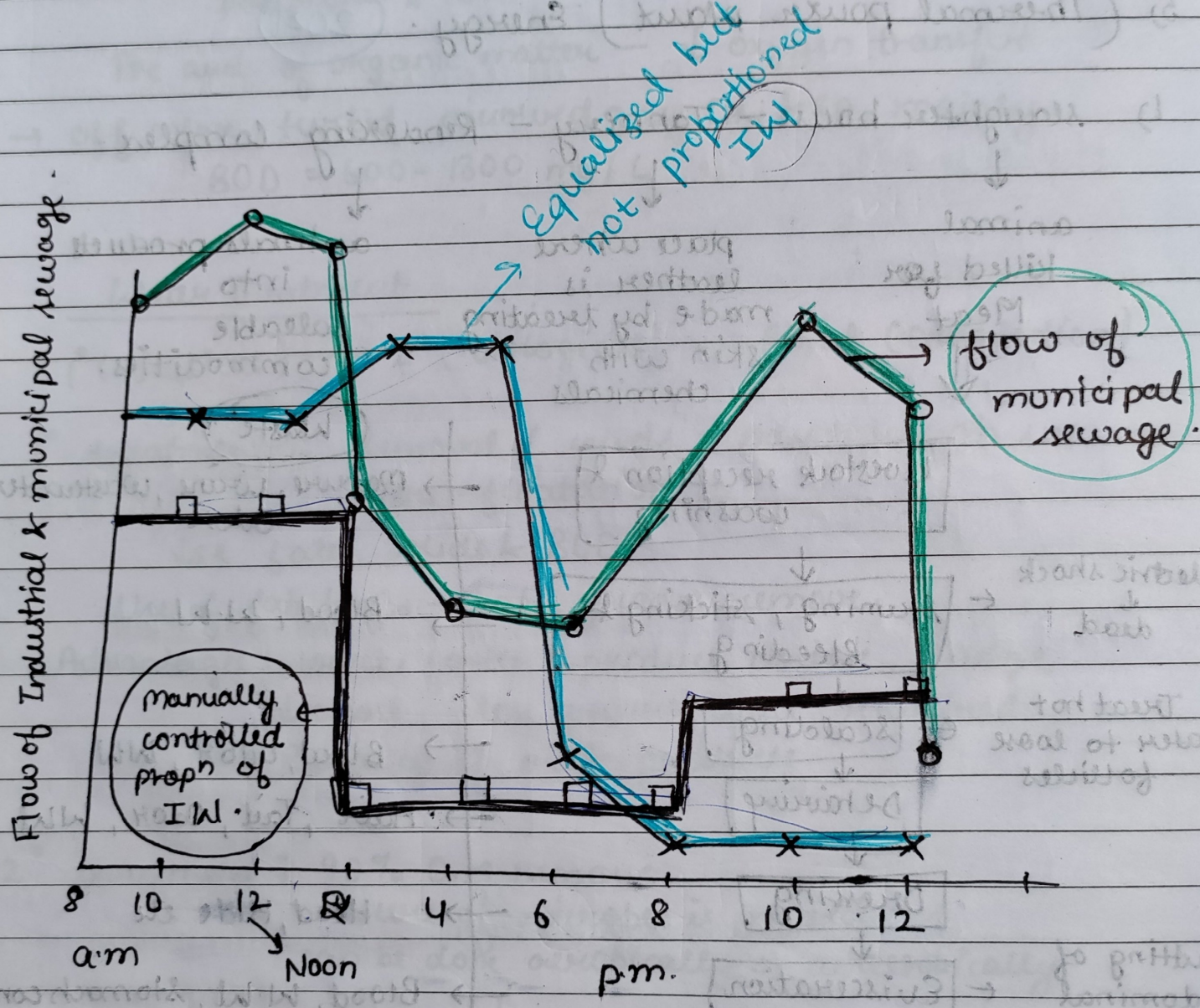
Manual Control: Determing flow for each day of week over a period of months.

Automatic Control: By metering device that register the amount of flow at most convenient main sewer connection.

Initial Cost: Higher



Effect of Proportioning