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ImprovementTest

Sub:	INDUSTRIAL WASTEWATER TREATMENT							Code:	10CV835
Date:	27-05-2017	Duration:	90 mins	Max Marks:	50	Sem:	VIII	Branch:	CIVIL

Answer Any FIVE FULL Questions

		Marks	OBE	
			CO	RBT
1(a)	List the characteristics of wastewater generated from distillery industry.	[03]	CIV809.4	L1
(b)	Explain the treatment methods for wastewater from distillery industry	[07]	CIV809.3	L2
2	Explain the methods for removal of inorganic solids in industrial wastewater.	[10]	CIV809.3	L2
3	Explain grab, composite and integrated sampling.	[10]	CIV809.1	L2
4	Explain Strength Reduction method for treatment of industrial waste water	[10]	CIV809.3	L2
5	Explain the treatment of tannery wastewater with the help of flow diagram	[10]	CIV809.3	L2
6	Explain the treatment of wastewater from Pharmaceutical Industry.	[10]	CIV809.3	L2

IMPROVEMENT TEST SOLUTION

INDUSTRIAL WASTE WATER TREATMENT(10CV835)

1.a. Characteristics of wastewater generated from distillery industry

	Yeast Sludge	Combined waste	Spent wash	Spent wash
pH	4.8	3.9–4.3	3.5–3.65	4.0–4.5
Temperature, °C	—	—	—	90–95
COD, mg/l	368000	27900–73000	118000	70000–151200
BOD, mg/l	165000	12230–40000	41380	28000–80000
Total Solids, mg/l	—	16640–26000	99000	59100–114500
Suspended Solids, mg/l	73000	4500–12000	350	1000
Total Nitrogen, mg/l	—	—	1135	14800–19000
Alkalinity	—	380–510	—	—
Colour	—		Dark brown	Dark brown
DO	—	—	NIL	—

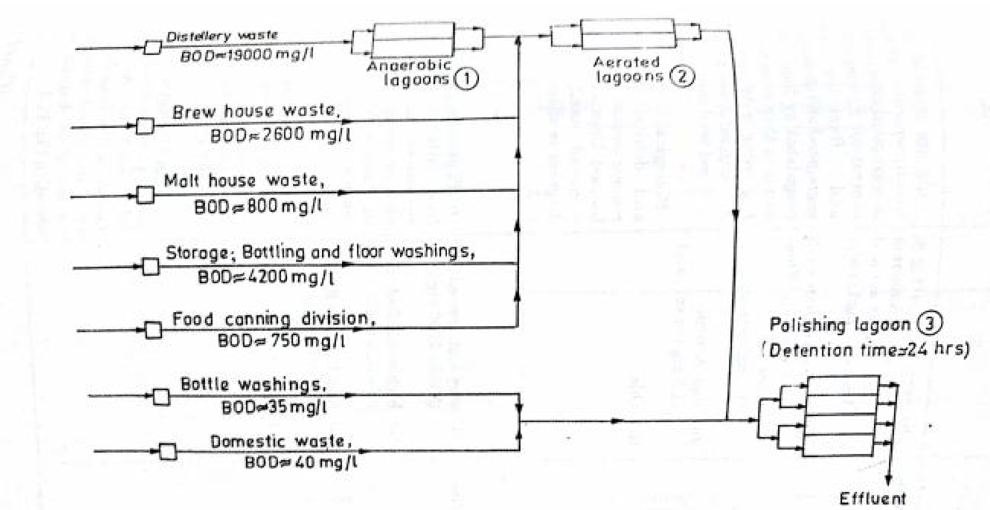

Fig. 11.2. Flow chart for treating wastewaters, of a Complex Distillery Plant, containing brewery, distillary and fruit carving divisions—*Both Aerobic and Anaerobic Treatments suggested.*

1.b.

2.	**Distillery** and *Brewery wastes.* (*Wines ; alcohols,* and *brandy producing industry*)	(*i*) extremely high BOD (12000—40000 mg/l) (*ii*) very high COD (28000—73000 mg/l) (*iii*) high chlorides and sulphates—dissolved solids (7000—10000 mg/l) (*iv*) highly coloured-brownish yellow.	*Brewery wastewaters*, being less strong, can be generally treated by two stage aerobic biological treatment units like *High rate trickling filters*, after *screening* and *neutralisation* (Fig. 11.1). But yeast sludge *Distillery wastewaters* generally make it highly polluted, as shown in col (3) ; thereby necessitating *two stage treatment* ; consisting of *biological anaerobic* treatment followed by *aerobic* treatment (Fig. 11.2)

2.a. The dissolved solids are of both organic and inorganic types. A number of methods have been investigated for the removal of inorganic constituents from waste water. Three methods which are finding wide application in advanced waste treatment are ion-exchange, electrodialysis and reverse osmosis. For the removal of soluble organics from waste water the most commonly used method is adsorption on activated carbon. Solvent extraction is also used to recover certain organic chemicals like phenol and amines from industrial waste waters.

Ion exchange: This technique has been used extensively to remove hardness, iron and manganese salts in drinking water supplies. It has also been used selectively to remove specific impurities and to recover valuable trace metals like chromium, nickel, copper, lead and cadmium from industrial waste discharges. The process takes advantage of the ability of certain natural and synthetic materials to exchange one of their ions. A number of naturally occuring minerals have ion exchange properties. Among them the notable ones are aluminium silicate minerals, which are called zeolites. Synthetic zeolites have been prepared using solutions of sodium silicate and sodium aluminate. In the water softening process, the hardness producing elements such as calcium and magnesium are replaced by sodium ions. A cation exchange resin in sodium form is normally used. The water-softening capability of cation exchange can be seen when sodium ion in the resin is exchanged for calcium ion in solution.

Reverse osmosis: In the reverse osmosis process, demineralisation water is produced by forcing water through semipermeable membranes at high pressure. In ordinary osmosis, if a vessel is divided by a semipermeable membrane (one that is permeable to water but not the dissolved material), and one compartment is filled with water and other with concentrated salt solution, water gets diffused through the membrane towards the compartment containing salt solution until the difference in water levels on the two sides of the membrane creates a sufficient pressure to counteract the original water flow. The process can be reversed by applying sufficient pressure to the concentrated solution to overcome the osmotic pressure force, and the net flow of water through the membrane towards the dilute phase. The solute concentration (impurity) builds up on one side of the membrane while relatively pure water passes through the membrane

Electrodialysis: Electrodialysis uses ion-selective membranes and an electrical potential difference to separate anions and cations in solution.

3. *Grab sample:* A grab sample is a discrete sample which is collected at a specific location at a certain point in time. If the environmental medium varies spatially or temporally, then a single grab sample is not representative and more samples need to be collected.

Composite sample: A composite sample is made by thoroughly mixing several grab samples. The whole composite may be measured or random samples from the composites may be withdrawn and measured.

A composite sample may be made up of samples taken at different locations, or at different points in time. Composite samples represent an average of several measurements and no information about the variability among the original samples is obtained. When these factors are not critical, compositing can be quite effective. When the sampling medium is very heterogeneous, a composite sample is more representative than a single grab sample. For example, in a study of the exposure to tobacco smoke in an indoor environment, a several hour composite sample will provide more reliable information than several grab samples.

Composite samples may be used to reduce the analytical cost by reducing the number of samples. A composite of several separate samples may be analyzed and if the pollutant of interest is detected, then the individual samples may be analyzed individually. This approach can be useful for screening many samples. A common practice, for example, in clinical laboratories screening samples for drug abuse among athletes is to analyze a composite of about ten samples. If the composite produces a positive result, then the individual samples are tested.

Integrated sampling.

Integrated sampling involves mixing simultaneous grab samples from different points. Integrated samples are required in case of river or stream, which varies in composition across its width and depth. Integrated samples are required if combined treatment is proposed for several separate wastewater stream.

4. Waste Strength reduction is the second major objective for an industrial plant concerned with waste treatment. The strength of wastes may be reduced by:

1.Process Changes

2.Equipment Modifications
3.Segregation of Wastes
4.Equilization of Wastes
5.By-Product Recovery
6.Proportioning of Wastes and
7.Monitoring Waste Streams

Process Changes:

In reducing the strength of wastes through process changes, the sanitary engineer is concerned with wastes that are most troublesome from a pollution standpoint.

Equipment Modification:

Changes in equipment can effect a reduction in the strength of the waste, usually by reducing the amounts of contaminants entering the waste stream. An outstanding example of waste strength reduction occurred in the dairy industry. The new cans were constructed with smooth necks so that they could be drained faster and more completely. This prevented a large amount of milk waste from entering streams and sewage plants.

Segregation of Wastes:

Segregation of Wastes reduces the strength and/or the difficulty of treating the final waste from an industrial plant. It usually results in two wastes: one strong and small in volume and the other weaker with almost the same volume as the original unsegregated waste. The small- volume strong waste can then be handled with methods specific to the problem it presents. In terms of volume reduction alone, segregation of cooling waters and storm waters from process waste means a saving in the size of the final treatment plant.

Equalization of Wastes:

Plants, which have many products, from a diversity of processes, prefer to equalize their wastes. This requires holding wastes for a certain period of time, depending on the time taken for the repetitive process in the plant. For example, if a manufactured item requires a series of operations that take eight hours, the plant needs an equalization basin designed to hold the wastes for that eight hours period. The effluent from an equalization basin is much more consistent in its characteristics than each separate influent to that same basin.Stabilization of pH and B.O.D and settling of Solids and Heavy Metals are among the objectives of equalization. Stable effluents are treated more easily and efficiently, than unstable ones by industrial and municipal treatment plants.

By-Product Recovery:

All wastes contain by products, the exhausted materials used in the process. Since some wastes are very difficult to treat at low cost, it is advisable for the Industrial Management concerned to consider the possibility of building a recovery plant which will produce a marketable by-product and at the same time solve a trouble some wastes problem.

Proportioning Wastes:

By Proportioning its discharge of concentrated wastes into the main sewer a plant can often reduce the strength of its total waste to the point where it will need a minimum of final treatment or will cause the least damage to the stream or treatment plant.

It may prove less costly to proportion small but concentrated waste into the main flow. **Monitoring Waste Streams:** Accidental spills are often the sole cause of stream pollution or malfunctioning of treatment plants and these can be controlled, and often eliminated completely, if all significant sources of wastes are monitored.

5. The method of treatment of waste may be classified as physical, chemical, and biological. The physical treatment includes mainly screening and primary sedimentation. Screens are required to remove fleshings, hairs and other floating substances. About 98% of the chromium is precipitated in the primary sedimentation tanks and is removed along with the sludge.

Chemical coagulation, with or without prior neutralization followed by biological treatment is necessary for better quality of the effluent. Ferrous sulfate is reported to be the best coagulant for the removal of the sulfides and may be used for the effective removal of color, chromium, sulfides, BOD and suspended solids from chrome tan wastes.

Biological treatment of the tannery waste: In activated sludge process, after mixing with municipal waste water in a suitable proportion, acclimatized micro organisms capable to reduce the BOD, COD and tannin by about 90% are used. Trickling filters may also be used for effective removal of BOD, COD and color.

The low cost biological methods of treatment may effectively be used for the treatment of tannery wastes. Both oxidation pond and anaerobic lagoons are recommended for small and isolated tanners. For further improvement of the effluent quality the anaerobic lagoons may be followed by an aerated lagoon.

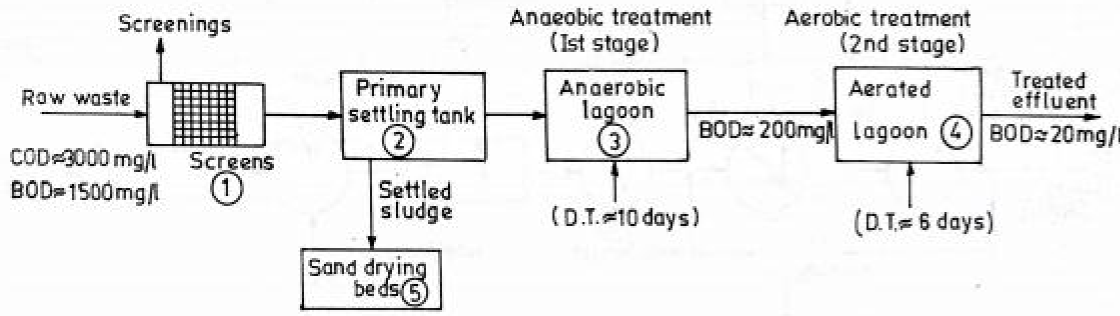

Fig. 11.9. Flow chart for treating Tannery wastewaters—*Anaerobic treatment followed by Aerobic treatment is suggested.*

6.

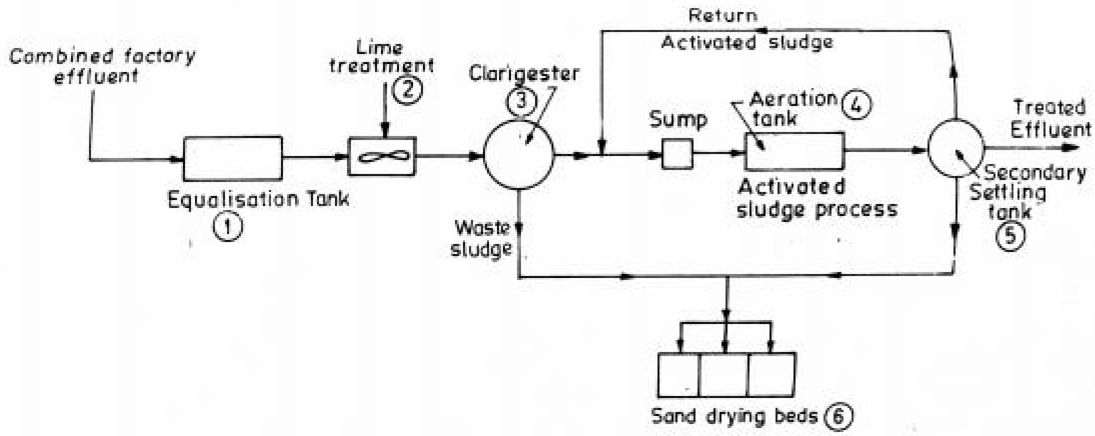

Fig. 11.7. Flow chart for treating wastewaters from a Pharmaceutical Plant, producing combined antibiotic and other chemical wastes—*Only Aerobic activated treatment after lime treatment is suggested.*

Pharmaceuticals (*a*) *Antibiotics* (*b*) *Synthetic drugs*	(*i*) **moderate BOD (500—1000 mg/l)** (*ii*) **very high COD (5000—7000 mg/l)** (*iii*) **very low $\frac{\text{BOD}}{\text{COD}}$ ratio (0.10—0.13)** (*iv*) **high total solids (1000—5000 mg/l)** (*v*) **either acidic or alkaline**	**(*a*) *Equalisation, Neutralisation with lime, Clarifier, Anaerobic digestion + conventional Aerobic biological processes* are used in a typical antibiotic plant (Fig. 11.7).**