8th sem (L. Tech.) Mid semester Model Answer Paper 2019

Tanning waste management

1. Define Pollution. Discuss briefly the types of pollution (1)

Pollution :- It is the introduction of harmful substances into the components of environment such as air, water, land & noise etc. and disturbing the balance of our ecosystem.

There are mainly four types of pollution.

1) water pollution 2) Air Pollution 3) soil pollution and 4) Natural pollution.

Water Pollution :-

It is the contamination of water bodies (lakes, rivers, surface water, oceans, groundwater etc.) usually as a result of human activities such as industrialisation, discharge of waste water etc. The sources of water pollution are dissolved solids, suspended solids, toxic and heavy metals (Cr, As, ba etc.), inorganic / organic chemicals etc. Water Pollution is the leading world wide cause of death and disease.

The water pollution is categorised into mainly three types :-

1) Groundwater pollution.
2) [Ocean water, surface water] pollution. sea, river, lake etc
3) Nutrient pollution.

The Tanneries are the main contributor to water Pollution. Tanning industry mainly causes water pollution. since it is a water based industry. (1)

c) Dis

Prevention :- 1)

a) Reducing the plastic consumption (A ver
hand step has been Implemented in C
so many steps towards this by
banning polythene).

2) Acidity (Limiting) the use of pesticides c
herbicides in agriculture.
Industrial

3) treating the waste water sufficiently
before discharging it into final pu

Air pollution :-

It is the introduction of harmful substances
(gases, particles and biological molecules) into the
earth's atmosphere. It is natural and human activitie
(industrialization, running automobiles) (storms etc)
are categorised into two main ports.

1) Primary pollutants → direct emission
a) ash from volcanic eruption.
b) CO_2 from vehicles, by burning fossil fuels.
c) SO_2 from factories

2) Secondary pollutants → indirectly affected air.
a) Ground level ozone.

other pollutants are CO, Nitrogen oxides (NO_x)
Volatile organic compounds (VOC), aerosols,
Toxic metals (Hg & Pb), NH_3, smog (mix. of
smoke & SO_2), etc.
results in respiratory diseases.

Soil Pollution :-

It is the introduction of harmful components in the soil by agriculture or industrialisation which disturbs the balance of the soil nutrients reduces the water uptake by plants, affects the soil porosity, causes oxygen depletion in the soil. And hence results in retarded plant growth by affecting soil fertility, soil pollution occurs both ways naturally & by man-made. Man-made are the main cause.

Types of soil pollutants :-

1) Biological agents → digested sludge from animal, bird and human excreta).
2) Agricultural Pollutants (Pesticides, fertilisers, herbicides etc.)
3) Radioactive " (Ra, Th, Ur, Nitrogen etc.)
4) Urban waste (garbage, dried sludge, sewage etc.)
5) Industrial " (steel, textiles, drugs, glass, sugar factories, etc, Tanning industry.

Effects soil pollution affects, Plants, humans animals.

Diseases :- headache, fatigue, nausea, skin rash cancer. etc.

4) Noise Pollution :- (Sound Pollution)

It is the propagation of noise with harmful impact on human / animal life. It is caused by loud music, transportation noise, machines in the industry, explosion, construction

Effects of sound pollution :-

1) cardio vaslar effects in human
2) coronary artery disease.
3) Permanent hearing loss, hypertension

4) serious threat to child's physical and psychological health. etc.

Prevention or Noise control :-

1) Better urban planning
2) Better design of roads
3) Jet engines in place of air craft quicker etc.

Tannery effluent :→

The waste water (loaded with contaminants) coming out from the tannery which disturbs the ecological balance of the environment is called tannery effluent.

The contaminants present in different operations from pre-tanning to post-tanning are following.

Pre-tanning :-

Operation	Contaminants
1) Soaking	a) Sod. bi carbonate (wetting agent) b) Preservatives c) Salt
2) Liming	a) $Ca(OH)_2$, Na_2S, $CaCO_3$, b) hairs, fleshings. NH_3, c) Ash, Sand and other insoluble impurities associated with tannery lime
3) Deliming	a) NH_4Cl, $(NH_4)_2SO_4$ b) Boric acid
4) Pickling	a) acid (HCl/H_2SO_4), Salt

Tanning :-

a) chrome-tanning	a) Cr^{+3} Cr^{+6} masked Chrome complexes
b) veg. tanning	b) sludge of veg. tan yard (suspended solids) condensed tannin
c) bleaching	c) reducing type of [illegible] agents

Post - tanning

1) Neutralisation — Borax, Sod. bi Carbo, Neutralising synt[illegible] to stabilize pH & specif[illegible]

2) Retanning — Retanning agent

3) Dyeing — dyes (color), formic acid

4) Fatliquoring — Fatliquors,

3) Dissolved oxygen (DO) :-

It is an example of gas in liquid (water) solution. The min^m O_2 (O_2) dissolved. required for the life of aquatic species which is 5 PPM. This concn of O_2 must not go less than 5 PPM in any case, otherwise, aquatic species may die.

But the dissolved O_2 content of the water of unpolluted, shallow, turbulent river is on an average is 7.0 mg/L. So, from every litre of water of an unpolluted turbulent river through which sufficient water flows, only 2.0 mg of O_2 is available to stabilize the effluent both chemically and biologically for all the industries.

COD (Chemical oxygen demand) :-

It means, the quantity of

Stabilize the oxidizable chemicals present in 1 litre of effluent under specific condition.

Method :- Chemicals required :-

1) Std. $\frac{N}{10}$ $KMnO_4$
2) Std. hypo soln.

Known volume of $\frac{N}{10}$ $KMnO_4$ solution is added to known volume of neutralized effluent (V_{litre}) in a stoppered bottle. The bottle is then kept at a specified temp (20°C) for a specified period of time (5 days). Then the unreacted permanganate is titrated with std. hypo soln. By subtracting the volume of unreacted permanganate from the volume of permanganate added, the volume of permanganate solution consumed by effluent is calculated.

1) Volume of $\frac{N}{10}$ $KMnO_4$ (Z cc.) (known) + Neutralised effluent (V litre) (known) → in a stoppered bottle → Reacted permanganate used + Unreacted permanganate left (y cc.)

2) Unreacted permanganate

3) Reacted permanganate soln

= Z cc (actual) − y cc (unreacted) = x cc.

So, finally V cc. of effluent contains x cc. of N/10 permanganate soln.

∴ 1 cc $\frac{N}{10}$ $KMnO_4$ = 0.8 mg of O_2

∴ x cc " " = 0.8x mg of O_2

∴ V litre of effluent ≡ 0.8x mg of O_2

1 " " " ≡ $\frac{0.8x}{V}$ mg of O_2/ litre of effluent

∴ COD = $\frac{0.8x}{V}$ mg of O_2/ litre of effluent

= $\frac{0.8x}{V}$ PPM.

BOD (Biological oxygen demand).

It is the mg of O_2 required to oxidize/ stabilize the organic compounds present in 1 litre of effluent biologically (by means of micro organisms). in 5 days at 20°C.

Method :- Known quantity of the waste water is taken in a 300 ml volume bottle and then the followings are added.

1) some seed organisms that will utilize

another bottle (identical), all the materials in the same concn except the waste water are taken. Both the bottles are then incubated at 20°C for 5 days and then the dissolved O_2 left in both the bottles are determined through titration with standard hypo soln.

The difference of the two titration values obtained in this way is the BOD (mg of O_2 / litre of effluent).

4) Steps involved for treatment of tannery effluents :-

Primary Treatment :-

1) Prevention and Reclamation of wastes
2) Reduction of volume of effluent
3) Mixing of effluents.
4) Settling of suspended and insoluble materials

Secondary treatments :-

1) Chemical treatments for coagulation. (sulfuric acid, Alum, $FeCl_3$, Flue gas, lime)

coagulated materials

Primary Treatments

1) Prevention and Reclamation of wastes

No Chemical should be wasted and go out through the drain unnecessary. This will reduce cost of production as well as simplify the effluent treatment Processes also. It can be done as follows:

a.) Soaking → Before soaking, the wet salted h/s should thoroughly be dusted off. It will remove the adhered loose salt. The salt can be purified and reused. It considerably lowers the Cl^- content of effluent.

b) Liming :- The pits of lime yard and tanyard ~~or drum~~ should be exhausted. & veg. tanning very slowly so that the settled materials like $CaCO_3$, Sludge etc. don't flow out with water and remain inside the pits / ~~drums~~. The remaining solid mass in the lime pit can be shovelled out, dried and finally burnt to get back the lime. The sludge of V. T. yard can be used as fertiliser.

c) Fleshings & hairs :- It can be collected very carefully by screening and may be sold to glue, rug, ~~pad~~ and Plaster binder manufactures.

2) Reduction of Volume of effluent :-

Indian tanneries already use much less quantity of water in leather processing (upto 40 litres/kg of h/s) than the American

Eg European tanneos (75 to 80 litres/Kg of his).
Mold growth to finished leather, darkening in color of V.T. leathers, bleeding of dyes. are the common defects with indian tanners. and therefore the Indian tanners can't reduce the water consumption more.

3) Mixing of effluents
a) (mineral tanning):-
By mixing the alkoline effluents of Beam house (soaking to beting) with the acidic effluents (Pickling + mineral tanning yard.)

→ • pH is adjusted.
• Cr^{+3} is precipitated as $Cr(OH)_3$
• Soluble lime → insoluble $CaSO_4$
• Al^{+3} ppt. out as $Al(OH)_3$ etc.

These ppt; absorb appreciable amount of soluble and suspended organic and inorganic materials and settle in the settling tank reducing the BOD, COD and suspended solids (SS) of effluent appreciably.

5) veg. tanning :-
Alkoline effluents of beamhouse shouldn't be mixed with the V.T. yard effluent because • considerable amount of vegetable sludge goes into solution due to alkalinity of the composite mixture. As well as, the • tannin becomes very dark in color in alkoline condition.

effluents of V.T. yard effluent should also

4) Settling of suspended and insoluble

After mixing of effluents, two types of effluent streams will come out.

From mineral tanning → A single stream of effluent

From vegetable toning → Two streams of effluent

a) V. T. + Bleaching yard effluent
b) from the rest of the tannery.

For these types of streams of effluents, three earth lagoons are made. Each lagoon should have a capacity of holding an entire day's flow and the 3 lagoons should operate in rotation on the fill-and-draw principle, filling during on day and discharging over the next 24 hr period, thus leaving the 3rd day available for sludge removal. The sludge of V.T. effluent can be used as manure for lower

Effect of Primary Treatments :- end n

Approx. 85 to 90% of suspended solids, and 45 to 50% of BOD & COD of the effluents can be reduced by primary treatments.

5) Working of Trickling Filter :-

It is used for the aerobic bio degestion. That means here the ~~oxidation~~ biodegradation of organic compounds takes place by means of microorganisms in presence of O_2.

Working :- 1) Soln of microorganisms + nutrients (for microorganism)

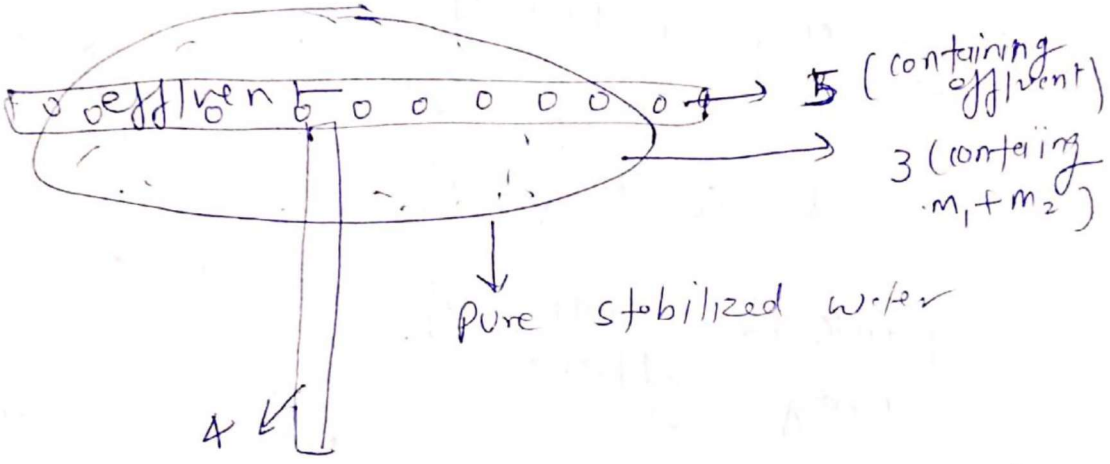
Materials :-

2) Porous sand stones / Charcoals / gravels

3) Shallow, circular horizontal bed - filter of big size

4) Vertical inlet pipe (Placed centrally)

5) horizontal rotating perforated pipe (closed on both ends)



Firstly the material no. 2 is soaked in material no. 1. The stones containing the necessary microorganisms are then filled in material no. 3 of big size. The effluent is then sprinkled on these stones by pumping the effluent through material no. 5 fitted above the filter on the centrally placed vertical inlet pipe. The sprinkled effluent then trickles through the stone bed and pure stabilized water comes out from the bottom of the filter along with end products.

After use of the filter for 2 days, a supporting film called the floc is formed on the stone and then the efficiency of the filter increases. The floc absorbs the organic degradable matters from the effluent and allow these materials to remain in contact with the micro organisms for the necessary period of time and finally allows the end products to come out into the external water.

Efficiency of trickling filter depends on
a) rate of sprinkling of effluent
b) concn of degradable organic compounds.

Permissible limits for discharge of trade effluents :-

Parameters	River	Land
1) pH	5.5 to 9.0	5.5 to 9.0
2) Chloride (as Cl) mg/l	1000	600
3) BOD (mg/l)	30	100
4) COD (mg/l)	250	---
5) oil & grease (max)	10	10
6) Suspended solids (mg/l)	100	200
7) Dissolved solids (mg/l)	2100	2100
8) Total chromium as Cr, (mg/l)	2	2
9) sulfide (as S) mg/l	2	2
	Neutral	

a) Total Dissolved Solids (TDS) :-

It is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized or microgranular (colloidal sol) suspended form. These includes anything present in water other than the pure H2O molecules. Solids must be small enough to survive filtration through a filter with 2-micrometer pores. The principal application of TDS is in the study of water quality for streams, rivers and lakes. The most common chemical constituents are Calcium, phosphates, nitrates, sodium, potassium and chloride. The permissible limit for TDS is 2100 mg/l.

b) Physiological pollution. :-

The color, odour and the turbidity of the tannery effluent is responsible for physiological pollution. So, only removal of suspended particles and chemical stabilization of the effluent doesn't make it complete harmless. Some bad effects of these are :-

1) Chlorophenol can be tasted at a conc^n of 0.001 mg/L. (It is not harmful at this conc^n) conc^n 0.001 mg/l

receiving water which reduces the rate of oxidation. They
Self purification process

5) All dyes are not harmful but the color imparted by them is not tolerated by the public. In India most of the rivers are considered holy and Hindu pilgrims take holy bath in these rivers daily. So, tanneries shouldn't play with "astha" of these Hindu's. These physiological pollution can be prevented by biological methods of effluent treatment

c) Anaerobic biodegradation :-
When the colour and BOD of the effluent is very high, then Anaerobic biodegradation is done. The aerobic biodegradation is not so suitable on economic front. It means the biodegradation of organic compounds with micro-organisms in absence of O_2.

Principle :- Principle of degradation is more or less identical with the principle applied in Septic tanks of sanitary latrines. The micro-organisms degrade the organic matters by using the O_2 present in the food and multiply as usual.

The rate of degradation is much slower than the aerobic degradation due to much less time of contact between the micro organisms and degradable organic matters. The end products are foul smelling and very dark in color. So, they are again aerobically treated in the oxidation ponds for several hours to reduce smell & color before final discharge.

d) Oxidation ponds :-

They are also called stabilization ponds/ lagoons. are large shallow ponds ~~dug~~ designed to treat waste water by the biological system to reduce BOD. The biological treatment process mainly involves an interaction between bacteria, algae and other organisms

Principle :- It comprises different groups of organisms like bacteria, algae, virus, fungi, protozoa. These organisms coexist and compete with each other. The bacteria decompose the biodegradable organic matter and release CO_2, NH_3 and NO_3^-. These compounds are utilised by the algae, which together with sunlight and photosynthesis process, releases oxygen enabling the bacteria to break down more waste and hence reduction in BOD levels is attained. primarily these are used as tertiary treatment facilities specially to polish the effluents from conventional treatment plants. * In tannery biodegradation the effluents after anaerobic to remove the foul smell and dark color before final discharge. so, its use is to treat ~~domestic~~ (raw) sewage, settled sewage and industrial effluents.

e) Recycle and Reuse of chromium :-

There are two options for recycle of chromium (exhausted chrome tanning liquors)

Recycle of exhausted chrome liquors

1) To the pickling procon. (If tanning is executed in the pickle both (Readily recycled)

2) To the chrome tanning liquors (if the tanning is recycled to the chrome tannage).

For both the options, a holding tank and a screening of the solution is required. chromium liquor builds up volume. Cinsted of discharging into the environment. Process control and monitoring are necessary for adjusting float strength.

2) 20% of fresh cr input can be saved.

3) Cr discharge in the effluent can be reduced by 50%

2) Fresh cr input can be saved by 25% for bovine hides & 50% for sheep skins.

3) Cr discharge in the effluent can be reduced by 60%.

→ However quality losses may occur. Color of the wet blue may change affect the dyeing operation and the quality of the final product. That is why they have not been widely accepted.

→ So, Tanners prefer Precipitation & separation. Cr recovery through and subsequent use of re-dissolved chromium.

1) Effect of salt pollution on Plants.

Salt pollution results in retarded plant growth, affects the soil fertility and their treatibility (flowers) for irrigation. in the following ways

% of Na :- Sodium present in tannery wastes tends to replace Ca & Mg (which maintains the good condition of the soil) when being fed continuously. An increase of Na in soil causes flocculation of soil particles, impairs the soil porosity, affects the water and air relation of plants. This Na hazard of irrigation water is normally expressed in % of Na.

b) The dissolved salts present in the tannery effluents results in soil solution with increased concn: it prevents the water uptake by plants.

c) High BOD of tannery wastes results in oxygen depletion in the soils. ~~Also, PH < 5~~ ~~Cause reduction of elements such as. Fe, Al etc.~~ Also, PH < 5 results in toxicity for plant growth.