CMR INSTITUTE OF TECHNOLOGY	USN NO									

IMPROVEMENT TEST

Sub:	Environmental Engineering I							Code:	10CV61
Date:	30/05 / 2017	Duration:	90 mins	Max Marks:	50	Sem:	6	Branch:	Civil

Answer FIVE FULL questions

		Marks	OBE	
			CO	RBT
1	Explain the different forms of chlorination.	10	CIV601.4	L2
2	Bring out the differences between rapid sand filter and slow sand filter.	10	CIV601.4	L2
3	What is disinfection? With a neat sketch briefly explain break point chlorination.	10	CIV601.4	L2
4	Explain the mechanism of filtration.	10	CIV601.4	L2
5	What is a zeolite? How is it regenerated? Explain the zeolite process of water softening	10	CIV601.4	L2
6	Describe the different methods to achieve disinfection.	10	CIV601.4	L2

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ENVIRONMENTAL ENGINEERING -I
IMPROVMENT TEST
JUNE 2017

1.

Different forms of chlorination :

a. Plain chlorination : The chlorination is the only treatment given for the water which is taken from the source. Plain chlorination is given to remove the bacteria, odour and colour of water, The residual chlorine should be about 0.5mg/L. This source of water from a lake or a reservoir with less turbidity

b. Pre-chlorination : Pre-chlorination is a process of adding chlorine before the treatment of water i.e sedimentation, coagulation & filtration. The chlorine is added about 10-15 mg/L depending upon the turbidity of water and should have a residue of 0.1-0.5mg/L to decrease the load on the treatment plant

c) Post-chlorination : It is normal process of adding chlorine at the end of the treatment ie before sending it to the distribution unit. The post chlorination which is added should have a residue of 0.1-0.2 mg/L

d) Double-chlorination: It is a process when the chlorine is added twice to ensure complete elimination of the bacteria i.e pre chlorination and post chlorination, post chlorination is a normal process of adding chlorine at the end. The pre-chlorination is done when the water is high turbidity

e) Break-point chlorination:
The chlorine is added is used for two important process i.e killing of micro-organism and to oxidization of organic matter. The point at which the both the demands are satisfied for the applied chlorine is known as the break-point chlorination, any chlorine added after this point increases the residual chlorine concentration which should be 0.1-0.2 mg

f) Super-~~chlorination~~ chlorination: when the water is of high turbidity and is contaminated or during an epidemic Super ~~chlorination~~ chlorination is done, the dose is about 10-15 mg/L and the residue chlorines should be 1-2 mg/L

g) Dechlorination. It is a process of removal of chlorine, usually done after Super-~~chlorination~~ chlorination so as the demand the chlorine amount. The residue chlorine should be about 0.1-0.2. If the chlorine is eliminated completely during this process, the chlorine should be added such that it maintains 0.1-0.2 mg/L.

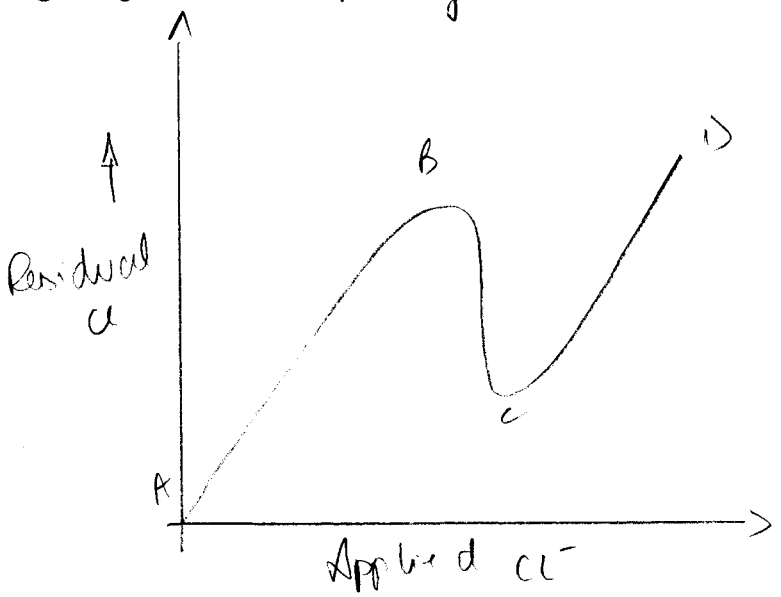
	Slow sand filter	Rapid sand filter
1) Pretreatment	Pretreatment of water is not required the water from plain sedimentation or raw water can be used	Pretreatment is required coagulation sedimentation & filtration
2) Size of grains	Gravel supports the sand of 3-65mm thick & 30-75cm depths	Gravel supports the sand of 3-40mm thick & 60-90cm depths
3) Under-drainage system	It is only for collecting the filtered water	It is for filtered water & for the back washing
4) Size	It is large in size 30×60m & area of 100-20000 m^2	It is small in size of 5m×8m & area of 10 to 80 m^2 ~~For filtration rate~~ is ~~about~~
5) Filtration rate	The filtration rate is about 100-200 litres per hour per meter	The filtration rate is about 6000 L/hr/m
6) Depreciation cost	Relatively low	Relatively high
7) Economy	Very minimal cost & low operational cost	Low initial cost & high operational cost but collectively less
8) Flexibility	It is not that flexible based on demand	It is quite flexible
9) Skilled labour	not required	Essential
10) Cleaning	1-3 months	1-3 days

3. Disinfection: It is a process of removal of disease causing organisms i.e the pathogenic organisms.

Break-point chlorination:

The chlorine which is added as the disinfectant has to complete two process

1. Elimination of pathogenic organism
2. Oxidation of organic matter



The Cl added to the water first kills the pathogenic organisms and reaches the point B in the graph, at point B a bad smell is emitted indicating the oxidation process has just began, the residual Cl content decreases the point C, C is the break point which we mean both the process is completed i.e elimination of disease causing organisms and oxidation of organic matter, any Cl added at this point only will increase the residual content of Cl^- in the water

4. Mechanical Filtration
   a) Mechanical Straining
   b) Flocculation and Sedimentation
   c) Biological Metabolism
   d) Electrolytic action

a) Mechanical straining : The suspended particles present in the water which are of larger size than the voids of the filter media can be removed, the suspended particles get arrested on the wall of the filter media and forms a mat which further increases the filtration

b) Flocculation and sedimentation : The voids can remove the particles which are smaller than the void size as the voids act as a tiny coagulation & sedimentation tank etc which attracts the colloidal particles and forms a gelatinous mass which further attracts the smaller particles

c) Biological metabolism : The voids contain useful micro-organisms which feed on the impurities present in the water & produce harmless compounds in the process, these harmless compounds forms a layer on the sand which is called the schmutzdecke layer or dirty skin which helps in filtration

d) Electrolytic process : It is based on Principle of Ionization. The sand grains and the impurities present in water are of opposite charge, due to the electrolytic action they get attracted on the time passes the intensity of the charges decreases. Therefore, the beds have to be frequently cleaned.

5) Zeolite : It is also called green sand It is a rock mineral, It is a cation ben exchange hydrated silicate of sodium & aluminium

The chemical formal is $Na_2O Al_2O_3 x SiO_2 y H_2O$, The value of x is usually 2 and y depends on the reason.

The activated zeolite reacts with the salts of Ca & Mg and gets replaced by Ca & Mg

$Na_2O Al_2O_3 \cdot x SiO_2 \, y H_2O$

$$Na_2X + \begin{matrix} Ca \\ Mg \end{matrix}\left\{\begin{matrix} (HCO_3)_2 \\ SO_4 \\ Cl_2 \end{matrix}\right. \longrightarrow Na_2\left\{\begin{matrix} (HCO_3)_2 \\ SO_4 \\ CO_2 \end{matrix}\right. + \begin{matrix} Ca \\ Mg \end{matrix}\left\{ X \right.$$

activated zeolite — salts

The zeolite used can be regained by treating it with 5-10% of NaCl salt.

$$\begin{matrix} Ca \\ Mg \end{matrix}\left\{ X + 2NaCl \longrightarrow Na_2\right\{ X + \begin{matrix} Ca \\ Mg \end{matrix}\left\{ Cl_2 \right.$$

regenerated zeolite — salts which don't contribute to hardness

The zeolite is used in the filter media as sand and the water is left to filter through, during this process the Ca & Mg ions gets replaced with the zeolite compound and the water is filtered down.

Zeolite process is expensive & the water obtained contains zero percentage of hardwater

5. UV rays : Sunlight is allowed to pass through mercury vapour lamps & water is allowed to in thin sheets.

It doesn't impart taste or odour

It is expensive

6. Ozone : Ozone is the unstable isotope of oxygen ozone when added to water produces nascent oxygen which act as disinfectant

It is expensive

7. Chlorination : Chlorine is most economical disinfectant. It is cheap & easily available & stops the recontamination of the water.

6. Disinfection methods:

1) Boiling
2) Excess lime
3) $KMnO_4$
4) Iodine - Bromine
5) UV rays
6) Ozone
7) chlorination

1) Boiling water: Boiling the water for 10-15 minutes kills all the bacterial microorganisms, but it cannot be used for large industries etc.
Boiling water changes the taste & doesn't prevent recontamination

2) Excess lime: Lime when added to water it increases the pH of the water (pH 11-12) the excess lime should be treated with CO_2. It doesn't prevent recontamination of water

3) $KMnO_4$: It is used in villages to disinfect the wells,
It is cheap but imparts colour (pink)

4) Iodine & Bromine: It can be added in the form of pills or pellets to the water, it is not used for drinking water treatment.
It is used in swimming pools.