Disinfection or chlorination or sterilization:

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Disinfection or chlorination or sterilization:

As practiced in water treatment disinfection refers to operation aimed at killing or rendering harmless , pathogenic micro- organisms . sterilization , the complete destruction of all living matter . or disinfection is the killing of disease – causing micro organisms .

Methods of chlorination :

1)physical methods :

a) boiling for period from (15-20) min . heat can be used to disinfect water ,but the method is impractical on a large scale.

b) by using sun – light which is consider as a natural disinfectant due to presence of ultra – violet ray .

c) by long storage here it means sedimentation and storage for one week.

The above methods are impractical in disinfection with large water – treatment – plants .

Disinfection or chlorination or sterilization:

2) chemical methods :-

a) disinfection by using ozone gas (O3).

HIGH

It happens complete mixing for ozone with water

$$O_2 \xrightarrow[\text{VOLTAGE}]{\text{HIGH}} O + O$$

$$O_2 + 0 \longrightarrow O_3$$

The free oxygen (o) is effective in killing bacteria in water . this method is considered very expensive . ozone has been widely used in Europe for many years and its use in the united states is increasing . the taste of water disinfect by ozone is better from that water disinfect by chlorine .

Disinfection or chlorination or sterilization:

b) ultraviolet ray :

is effective in killing all types of bacteria and viruses . through the probable mechanism of destruction of nucleic acids the source of this ray is the sunlight . it is seldom to be used in disinfection because it needs high cost

c) disinfection by lime (cao).

It was showed that the addition of lime with concentration of (14 – 43) mg / l helps to kill coli forms of 99% .

d) disinfection by using potassium permanganate

the using of dosage of (0.85 – 1.75) mg /l removes about 98 % of bacteria for period from (4-6)hrs

c)disinfection by using silver :

the dosage needed is (0.05 – 0.01) mg /l for (15 min – 3 hrs) this method is very expensive .

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Disinfection or chlorination or sterilization:

d)disinfection by (bromine and iodine) :-
bromine and Iodine are effective in disinfection . he chemistry of these two elements is similar to chemistry of chlorine but the iodine is contrarily of Loraine and chlorine ammonia dose not reacts with
to product chloramines. The iodine is effective disinfectant in swimming pools
the bromine is effective disinfectant but it has high cost , and due to luke of experience of it using therefore the bromine dose not used widely in disinfection of water .

e) disinfection with chlorine or its components .
chlorine in a variety of chemical , has been the disinfection most commonly used in the Iraq . chorine is cheap it has high reliability in disinfection , and it is easy to use , the chlorine may be used in disinfection as power , liquid or gas in compressed vessel of (45 – 1000) kg .

$$Cl_2 + H_2O \longrightarrow \underbrace{HOCL}_{\text{Hypochlorous acid}} + \underbrace{HCL}_{\text{Acid hydrochloric}} \text{ (reacts with bases)}$$

$$\underset{\text{ionizes}}{HOCL} \longrightarrow \underset{\text{Hydro ion}}{H^+} + OCL^-$$

Disinfection or chlorination or sterilization:

The hypochlorous acid (HOCL) and hypochlorite (ocl^-) are Disinfectants and they are catted together (free available chlorine).

the ionization of hocl to H^+ and ocl^- depends on PH value . AT PH = 8.5 or (PH>8) there is

a 90% of HOCL ionize to OCL^- . the activity of HOCL is greater than the activity of OCL^- by about 80 once . therefore it is necessary to keep PH> 7 to prevent ionization the PH range is (6-7.5) for most water , so (40 – 95) % from residual free chlorine is in state of hypochlorous acid,

disinfection by chlorine components

the chlorine is a chemical matter has fast evaporation therefore the chlorine dose not remains in water for long time . so it is necessary to use ammonia is added to filtered water before adding of chlorine where the chloramines will be formed . the chloramines is effective in kiiling of bacteria also chloramine stays many days in water therefore the keeping of chlorine in water is satisfied by using this method for long period as well as to improve the taste and adour of water , the dosage of ammonia is 1/4 of chlorine dosage according to the following equations which depend on value of PH .

Disinfection or chlorination or sterilization:

$CL_2 + H_2O \longrightarrow HOCL + HCL$

amonia

$NH_3 + HOCL \xrightarrow{PH>7.5} NH_2CL + H_2O$

ammonia — Monochloramine

$NH_2CL + HOCL \xrightarrow{PH\ (5\text{-}6.5)} NHCL_2 + H_2O$

Trichloromine

$NHCL_2 + HOCL \xrightarrow{PH\leq 4.4} NCL_3 + H_2O$

When the value of PH is reduced below 4.4 the nitrogen chloride is formed . the nitrogen chloride has rotten odour and it is to be considered as disinfectant .

Disinfection or chlorination or sterilization:

the monochloromine and dichloromine are very effective disinfectant and called together combined available chlorine which has more activity in disinfection then the

free available chlorine by about 25 once (or times)

chlorination the process of disinfection by chlorine is called chlorination there are three type of chlorination :

1-prechlorination :- is the addition of chlorine of prior to any other treatment . the advantage of prechlorination are :

a)chlorine improve the coagulation process

b)reducttodurs result by organic sludge in sedimentation tanks

c)reduction algae and other living microorganisms

d)chlorine is assist of maintaining clean sand filter with increasing of long operation (ran) period

desage of long chlorine is (0.2) mg/l

the concentration of combine chlorine is (0.10-0.50) mg/l

for water flows to filters .

2-post chlorination :- is the addition of chlorine subsequent to filtration . the dosage of chlorine is (0.25 – 0.50) mg / l

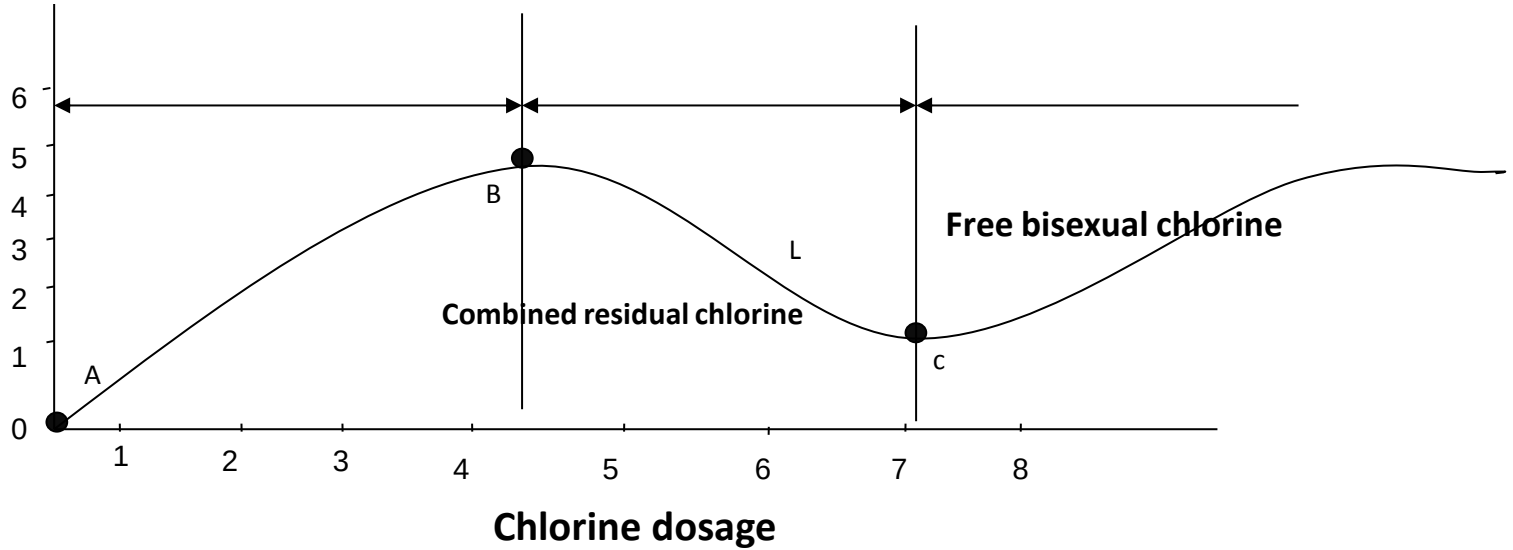
With detention time of (30 min) the residual combine chlorine concentration should be maintained at (0.1 – 0.20) mg /l where water in the clear well of treatment plant .the usuall concentration of chlorine is (7 – 10) mg / l .

Disinfection or chlorination or sterilization:

3-superchlorination :

The super chlorination is used in case of presence serious illness and emergency situation . the super chlorination lead to in crease the amount of un wanted residual chlorine which must be followed by dechlorination process dechlorination : can be effected with a variety of reducing agents (sulfur dioxide , bisulfate's, sulfites ,or thiosulfates) , by aeration , and activated carbon .

Break point chlorination –



Disinfection or chlorination or sterilization:

Breakpoint chlorination involves addition of chlorine in an amount sufficient to react with any ammonia and ready axidizable organics which are present . during addition of chlorine to water containing such oxidizable materials , the residual chlorine concentration will increase at a rate less than the rate of addition . at some point a further in crease in dosage will produce a decrease in residual concentration – perhaps to zero . further in crease in dosage will eventually cause the residual to in crease again . the point at which the concentration begins to in crease again is called the breakpoint , and the dosage required to reach that point is called the breakpoint dosage . beyond . the break point dosage concentration normally in crease at the some rate as the dosage . below the breakpoint the dosage the available chlorine is primarily combined chlorine , while above the breakpoint , it is primarily free chlorine . the point C represents the end of a chlorination process.

Ex : chlorine was used at rate of 7.70 kg /d to disinfect water of flow rate of 18927 .2 m^3/d . the residual chlorine concentration was (0.20 mg/l) after 10 min from chlorine addition . determine the use chlorine dosage in (mg/l) and required chlorine for water disinfection

Sol.

$$\text{Dosage} = \frac{7.7*10^6\ mg/l}{18927.2*1000\frac{l}{d}} = 0.41\ mg/l$$

Chlorine demand = 0.4 – 0.2 = 0.21 mg/l

For listening