



19CH101– ENGINEERING CHEMISTRY

Unit-1 WATER AND ITS TREATMENT

TREATMENT OF DOMESTIC WATER (OR) PURIFICATION OF WATER FOR DRINKING PURPOSE

Drinking water

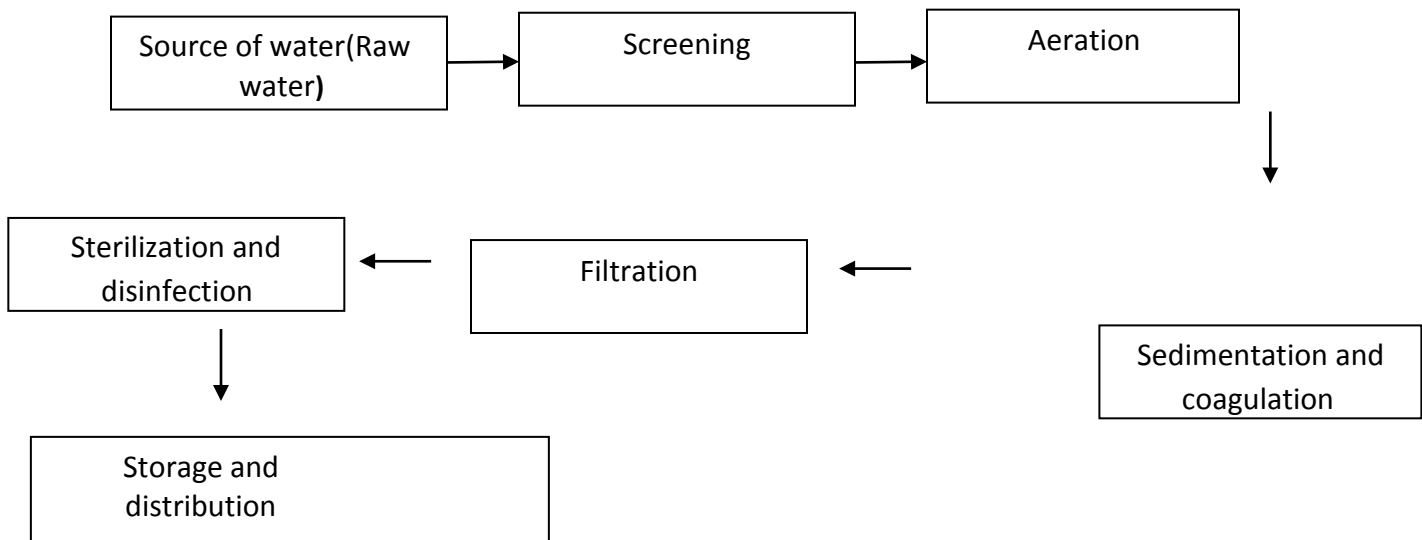
Water which is safe to drink and fit for human consumption is called drinking water. It is otherwise called potable water or municipal water.

Essential requirements of drinking water

- (i) It should be sparkling clear and odourless.
- (ii) It should be pleasant in taste.
- (iii) It should be perfectly cool.
- (iv) Its turbidity should not exceed 10 ppm.
- (v) It should be free from dissolved gases like H_2S , CO_2 , NH_3 , etc.,
- (vi) It should be free from minerals like lead (Pb), Arsenic (As), Chromium (Cr) and manganese (Mn) salts.
- (vii) It should be free from disease producing micro-organism.
- (viii) Its TDS (Total Dissolved Solids) is less than 500 ppm.
- (ix) pH of the drinking water should be 6.5–8.5.



The various stages in the treatment of water for domestic supply Block Diagram



Source of water

The main sources of water is,

- (i) Surface water
- (ii) Under ground water

These untreated waters are called raw water.

Screening

The raw water is passed through screens having large number of small holes, where floating matters like wood pieces, leaves etc., are removed.

Aeration

The process of mixing water with air is known as aeration,
The main purpose of aeration is,



- Increase the content of oxygen in water and makes it fresh and promotes taste.
- Remove unwanted gases like H₂S, CO₂ and other volatile substances.
- Salts of iron and manganese are also removed.

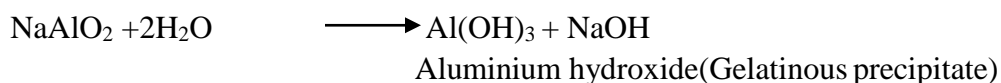
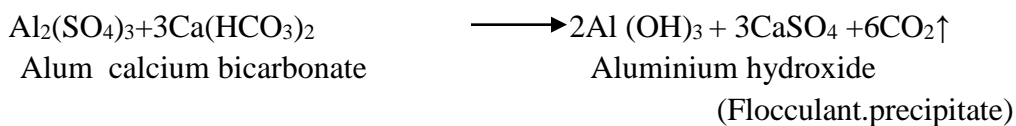
Sedimentation

It is the process of removing suspended impurities by allowing the water to stand undisturbed for 2-5 hours in a big sedimentation tanks about 5 m deep. Most of the suspended particles are settle down at the bottom due to forces of gravity and they are removed. Sedimentation process removes only 75% of the suspended impurities.

Coagulation

In sedimentation process all the impurities cannot be removed. So certain chemicals are added to fasten the sedimentation and the process is called coagulation.

Alum [Al₂(SO₄)₃] and sodium aluminate (NaAlO₂) are widely used in water treatment plants. These are called coagulants.



The gelatinous precipitate of Aluminium hydroxide settles to the bottom and can be removed by filtration method.

*Salts of iron [(FeSO₄, FeCl₃)] are also used as coagulant.



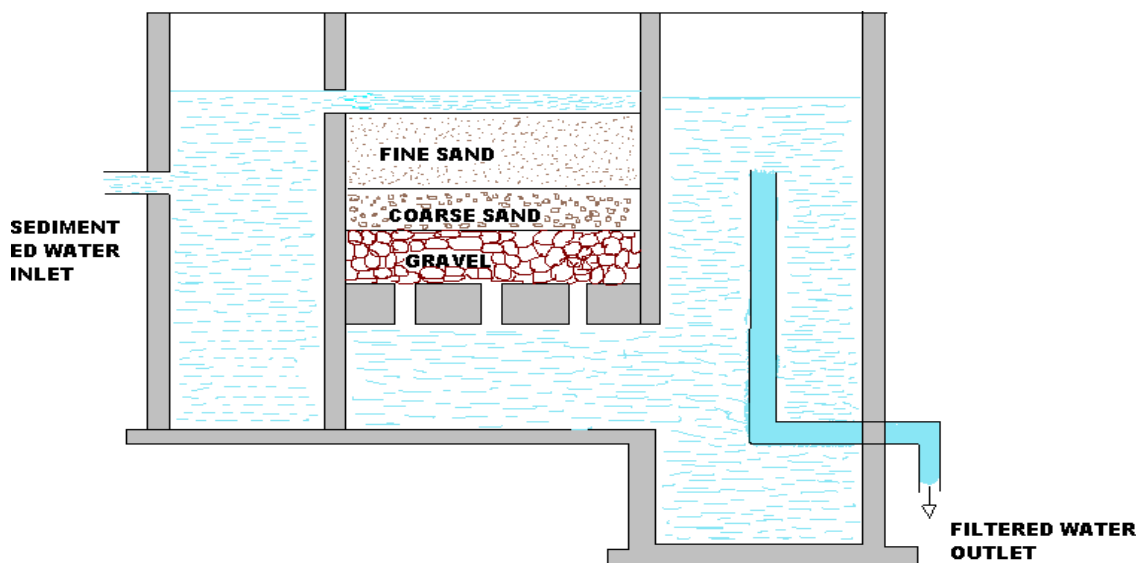
Fe(OH)₃ is in the form of heavy floc, which causes quick sedimentation.



Filtration

It is the process of removing colloidal matter and most of the bacteria, micro-organisms etc, by passing water through a bed of fine sand and other proper-sized granular materials.

Generally filtration is carried out by using sand filter.



Sterilization (or) Disinfection

The complete removal of harmful bacteria is known as sterilization. The chemicals (or) substances used for this purpose are called disinfectants.

This process can be carried out by the following methods.

- (a) Boiling method.
- (b) Ozonation (By using ozone).
- (c) UV Radiation method (By using UV Radiations)
- (d) Chlorination method.
 - By adding chlorine gas (Cl_2).
 - By adding chloramines (ClNH_2).
 - By adding bleaching powder (CaOCl_2).
 - Break point chlorination (or) free residual chlorination.

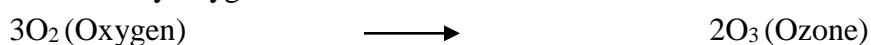


Boiling method

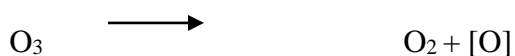
Just boiling the water 100°C for 10 to 15 minutes, all the disease producing bacteria are killed and water becomes safe for use.

Ozonation

Ozone (gas) is an excellent disinfectant. Ozone is produced by passing silent electric discharge through cold and dry oxygen.



Ozone (O_3) is highly unstable and decomposes to give molecular and nascent oxygen [O].



The nascent oxygen is highly powerful oxidizing agent and kills all the bacteria's and germs. It also oxidizes the organic matter present in the water.

Advantages

1. Ozone not only removes bacteria's but also removes colour, unpleasant taste and bad odour.
2. If present excess in water, it is not harmful, because it is unstable and decomposes to oxygen.

Disadvantages

1. This method is expensive and cannot be employed for municipal water works.