**Secondary wastewater treatment**

**Biological treatment**

**Organic substance :**

Organic substance is unstable substance, composed of the following elements:

C O H N P S

C: Carbon

O: Oxygen

H: Hydrogen

N: Nitrogen

P: Phosphorous

S: Sulphar

**Types of organic substance :**

1- Biodegradable organic substance ( 95 - 96 % of total organic substance).

It is the organic substance which can be decomposed by the microorganisms, such as hydrocarbons, proteins, ..ext.

2- Refectory (4 - 5 % of total organic substance)

It is the organic substance which can't be decomposed by the microorganisms, such as cellulose, pesticides, ..ext.

**Stabilization process :**
it’s the process in which unstable organic matter is changed to stable matter using microorganism such as bacteria.

 Microorganisms

 C O H N P S CO2

 Organic H2O

(unstable Compounds) SO4

 PO4

 NO3

 Inorganic matter

 (stable products)

 Many microorganisms

**Biological process :**

It’s a process involving microorganism to transform organic substance from a complex unstable state to a simple state matter, this process is characterized by a realize of energy which used by bacteria for movement and reproduction.

**Secondary treatment** are sometimes called oxidation units since their main function is to oxidize organic matter to stable matter through the activity of aerobic bacteria living in these units.

**Bacteria:**

Bacteria is a single microscopic cell.

80% water

 90% organic

20% solids

 10% inorganic

pH = 4 – 9.5

Temperature -2 – 65 ◦C.

**Types of bacteria with respect to temperature:**

1- Cryplophilic bacteria: -2 – 30 ◦C

2- Mesophilic bacteria : 30 – 45 ◦C

3- Thermophilic bacteria: 45 – 65 ◦C

A schematic diagram of bacteria

A microscopic photo of bacteria

**Parameters affecting biological process :**

1) Temperature: the rate of reaction increases as temperature increase.

2) Presence of oxygen

Aerobic reaction > Anoxic > Anaerobic reaction

3) Composition and concentration of organic matter.

4) Concentration of microorganisms.

5) PH value (4 - 9.5)

6) Humidity: the rate of reaction decreases as the water content decreases.

7) toxic matter.

Growth characteristic curve of bacteria

The reaction between the bacteria and the organic matter occurs

1- On inert media and it called attached growth reactor such as trickling filter.

2- In suspension and it called suspended growth reactor such as activated sludge process.

**The objectives of biological treatment:**

The removal of 1- dissolved organic matter.

 2- colloidal solids.

Two units process:

Biological

Reactor

Stable matter

Stable matter

+ new bacterial

cells

Dissolved organic

Colloidal solids

 Sludge