BACTERIA IN COOLING WATER SYSTEM

Bio Sciences consist of three branches.

- Botany ☐ Plants
- Zoology ☐ Animals
- MicroBiology ☐Micro organism

Virus:

Smallest micro organism which can not be seen under ordinary micro scope. It can be seen under Electron Micro Scope. It is an obligate intracellular Parasitic Micro organism, which is smaller than bacteria. Most of the Virus can pass through filters,which can retain bacteria.

Bacteria:

This is bigger micro organism than virus. It can be seen under ordinary micro scope. It has various shapes like
Rod Shape: Thin, Thick, Long, Short.
Spiral Shape:
Round Shape: Mono coccus, Diplo- coccus, Chains.
Its measurement is approximately 0.5 to 1.0 by 2.00 to 5.00 µm
Staphylo cocci & Strepto cocci have diameters ranging from 0.75 to 1.25 µm. It is having pathogenic nature & non- pathogenic nature.

Yeast:

Yeast cells are larger than most of bacteria and a kind of Fungus that is

Unicellular:

Their vegetative reproduction is usually by budding.
It grows faster than Fungai. Size of Yeast is varies from 1 to 5 µm in width and from 5 to 30 µm or more in length. It contains Vitamin B. It is Egg / Oval shaped. Some are elongated and some spherical.

Fungus:

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This Micro organism that lack Chlorophyll and are filamentous in structure it is called molds.

Algae:

Many of which are unicellular and very small. It contains Chlorophyll. They range in size from micro scopic unicellular forms smaller than some bacteria that may become many feet in length. They occur in great abundance in Oceans, Sees, Slat lakes, Fresh water lakes, ponds and Streams.

Some Algae grow on Snow & Ice of Polar regions and Mountain Peaks.

Some Algae grow in hot springs at temp as high as 90°C optimal growth temp of these thermal algae are between 50 to 54°C.
Algae are often problem in water supplies because they produce undesirable tastes and odors. Algal mats may act as barriers to the penetration of Oxygen in to the water, they prevent photosynthesis by excluding light from deeper water and may cause fish and other marine animals to suffocate. Algae may even increase the corrosive quality of water and cause disintegration of concrete.
Algae have a vide range of sizes and shapes. Many species occur as single cells that may be:

- Spherical – Round
- Rod Shaped
- Club shaped or
- Spindle shaped.

There are five types of Chlorophylls a, b, c, d, & e present in algae as it is in all photosynthetic organisms. Chlorophylls are lipid soluble.

Economic Role of Algae:

- It fertilizing the soil.
- Many species of algae are used as food in the orient. Few algae are pathogenic (Disease making)

In open re-circulating cooling water systems due to contact with the air the water picks up micro organism which grows well on the conditions of Moisture, Temperature, Oxygen and sunlight existing in the cooling system. The growths of these organisms whether they are bacteria, Yeast, fungus,

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Algae result in slime or plant deposits, which is seriously, interfere with the operation of system.

These growths may be visible in the tower or lodged in the piping and condensers. They reduce the heat transfer properties of the unit or Impart obnoxious odours to the water and surrounding area.

Biological fouling of industrial Cooling water systems results from the excessive growth of algae, bacteria & yeast (Fungi). Which can cause number of problems such as:

- Plugging, Of lines & Equipments
- Reduces heat transfer
- Corrosion
- Deterioration of tower function.

Cooling Tower Treatment:

Before giving chemical treatment of biocide to cooling tower we must obtain sample of cooling tower water from the concern Industry and in our laboratory we must find out microbial count and optimize dose level on the basis of lab observation. We should suggest the biocide dose for Cooling Tower Water Treatment.

Bacteria static effect of Biocide: Biocide level in ppm.

Time	None	10	20	30	40	50	60
4 Hour	×	×	×	×	×	×	×
24 Hour	×	×	×	×	×	×	×
48 Hour	✓	×	×	×	×	×	
72 Hour	✓	×	×	×	×	×	
7 days	✓	✓	×	×	×	×	
14 days	✓	✓	✓	×	×	×	
21 days	✓	✓	✓	✓	✓	×	

Before carrying this experiment we must know initial count of micro organism at Zero Hrs.
Growth ✓ No Growth ×

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Comparison of micro organizms characteristics

	Virus	Bacteria	Fungi	Algae
Shape		**Rod Shape** Thick, Thin, Long & Short Spiral **Rounds :** Mono coccus Diplo coccus Chain	**Yeast** Egg shaped or oval shape Elongated spherical Fungi filamentous	Filamentous & Mat type
Size	10 nm to 280 nm	0.5 to 1.0 by 2.00 to 5.00 µm	1 to 5.00 by 5 to 30 µm	Length many feet
Pathogenic	Yes	Yes Some are non pathogenic	Yes Some are non pathogenic	Yes Some are non pathogenic
Disease	Herpes, Influenza, Yellow fever Poliomyelitis, Foot & mouth Disease Bad cold mumps Small pox	Typhoid Dysentery Tetanus measles Whooping cough, Diphtheria Scarlet fever Septic sore throat Rheumatic fever Nephritis Osteomyelities Tuberculosis Pneumonic	Some are pathogenic	Some are pathogenic Attack leaves of Tea, Coffee & Pepper
Chlorophyll	No	No	No	Yes
Slime production	No	Yes	Yes	No It produce filaments and mats
Occurrence	Every where	Every where	Every where	Oceans, see,

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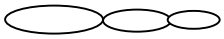
	water, air & food	water, air & food	Water, air & food	salt lake, fresh water lake, pond hot spring, streams snow & Ice
Economic Important	-	Production of various enzymes Aminoacids, Acids like : Lactic Acid, Production of vaccines	Production of various enzymes Acids & Anti biotic	Soil fertilities, Vitamin Synthesis, Foods
Appearance / Look		------		
Killed By	Steam sterilization Chemical Treatment	Steam sterilization Chemical Treatment	Steam sterilization Chemical Treatment	Steam sterilization Chemical Treatment
Seen	With the help of Electron Micro scope	Micro Scope	Micro Scope	Micro Scope / Nacked eye

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