



Introduction of Microbiology

“Microbiology is the deepest & widest branch in all over the universe. So microbiology is placed in the broad field of Biology”.

- “Microbiology is the study of living organisms of microscopic size which include bacteria, fungi, algae, protozoa and the infectious agents at the borderline of life that are called viruses exist all over the universe”. It is concerned with their form, structure, reproduction, physiology, metabolism and classification. It includes the study of their distribution in nature. Their relationship to each other and to other living organisms, their effects on human beings and on other animals and plants, their abilities to make physical and chemical changes in our environment and their reactions to physical & and chemical agents.
- History of microbiology is the story of the achievements of men and women but it records relatively few outstanding names and events. Many important contributions were made by people whose names have been forgotten and whose accomplishments have been lost in the longer & deeper shadows cast by those who caught the fancy of the chroniclers. It has been said that in science the credit goes to the one who convinces the world, not to the one who first had the idea; so in the development of microbiology the outstanding names are often of those who convinced the world – who developed a technique a tool or a concept that was generally adopted or, who explained their findings so clearly or, dramatically that the science grew and prospered.
- Many scientists contributed in the development of microbiology. But some greatest name who play an important role are as below:
 - Robert Koch (Generator of microbiology)
 - Antony Van Leeuwenhoek (Discovery of first simple microscope and first to observe microorganism)
 - Ernst Ruska (Make a first electron microscope)
 - Louis Pasteur
 - John Tyndall
 - Paul Ehrlich
 - Hans Christial Gram
 - Sergei N. Winogradsky
 - William Henry Welch



- Applied microbiology is a huge branch so divided in to many fields are as below:

Field	Some Applied Areas
Medical Microbiology	Causative agents of disease, diagnostic procedures for identification of causative agents, preventive measures.
Aquatic Microbiology	Water purification, microbiological examination, biological degradation of waste, ecology.
Aero Microbiology	Contamination of spoilage, dissemination of diseases.
Food Microbiology	Food preservation and preparation, food borne disease and their prevention.
Agricultural Microbiology	Soil fertility, plant and animal diseases.
Industrial Microbiology	Production of medicinal products such as antibiotics and vaccines, fermented beverages, industrial chemicals, production of proteins and hormones by genetically engineered microorganisms.
Exo Microbiology	Exploration for life in outer space.
Geochemical Microbiology	Coal, minerals and gas formation, prospecting for deposits of coal, oil and gas. Recovery of minerals from low-grade ores.

MICROORGANISMS

Microorganisms, namely bacteria, algae, fungi, protozoa and viruses exist all over the universe. They are more than 30,000 species of bacteria comprising both gram positive and gram-negative types. A recent estimate puts the bacterial population in the universe at a mind-boggling level of 5 million trillion times trillion (5 followed by 30 zeroes). The majority of them are hazardous to our health environment, industrial application areas like:



(1) Cooling Water (2) Paper Industry (3) Metal Working Fluids (4) Petroleum Industry (5) Leather Industry (6) Textiles Industry (7) Paints- Industry (8) Consumer Products (9) Polymer Emulsions (10) Wood Industry and other various industries.

- All microorganisms are not harmful in nature. It depends heavily upon activity of bacteria. The cycling of nutrients such as carbon, nitrogen and sulphur is completed by their ceaseless labour.
- When organisms die, the carbon contained in their tissues becomes unavailable for most other living things. Decomposition is the breakdown of these organisms and the release of nutrients back in to the environment and is one of the most important roles of bacteria.
- Some another beneficial microorganism is yeast, which is unicellular fungi and is endearing to wine makers, brew masters and bread makers. It has the trait to ferment converting food in to alcohol and carbon dioxide.
- In spite of some beneficial effects of microorganisms they cause serious damage to human health and in a wide range of industrial segments.
- The microorganisms are Bacteria, algae, Fungi, Protozoa & Viruses. Now here we discuss about Bacteria only.

BACTERIA: -

First of now "What are Bacteria"?

"Bacteria are unicellular (single cell) prokaryotic organism or simple associations of similar cells. Cell multiplication is usually by binary fission", found in water, air & soil.

- Bacterial cell contain cell wall, cytoplasm membrane, cytoplasm, flagellum, ribosome, nuclear material (DNA), granules, mesosome and absent of mitochondria, chloroplasts, Golgi structures, endoplasmic reticulum and pseudopodia. Generally size range of bacteria is 0.2 by 100 mm (micrometer).



- When most people think of bacteria they think of disease causing organism like the mycobacterium bacteria. While pathogenic bacteria are notorious for such diseases as cholera, tuberculosis, gonorrhoea, tetanus, anthrax, syphilis, pneumonia, meningitis, typhoid, urinary tract infection (UTI), diphtheria etc. such disease causing species are comparatively a tiny fraction of the bacterial population. Bacteria are also found on the tops of mountain, the bottom of the deepest oceans and in human body, animals and ice of Antarctica. One feature that has enabled them to spread so far and last so long is their ability to go dormant for an extended period.

For the first time a recent estimate, by a team of researchers from Georgia University, USA, places the bacterial population at five million trillion trillion (5 followed by 30 zeros). This incomprehensible number gives only a sketch of the vast penetration of bacteria in the universe is so large event that would occur once in 10 billion years in the laboratory occur every second in nature. Thus In spite of the beneficial effects of some type of bacteria, it is essential to prevent the huge degradation and financial burden they cause in various branches of industry.

- Most bacteria can be placed in to one of four groups based on their response to gaseous oxygen namely aerobic, anaerobic, facultative anaerobes and microaerophilic.

The characteristics and typical examples are as follows:

(1) Aerobic Bacteria: -

Requires oxygen for growth and can grow when incubated in the air atmosphere. This category includes following bacterial genus:

(1) *Pseudomonas* (2) *Thiobacillus* (produce sulphuric acid) (3) *Gallionella* (produce ferric oxide) (4) *Sphaerotilus* (produce ferric oxide) (5) *Camphylobacter* (6) *Zoogloea* (7) *Neisseria* (8) *Micrococcus* (9) *Planococcus* (10) *Staphylococcus*.



(2) Anaerobic Bacteria: -

Do not use oxygen to obtain energy. Moreover, oxygen is toxic for them and they cannot grow when incubated in an air atmosphere.

This type of bacteria that live in deep under water deposit form. This category includes following bacterial genus:

(1) *Desulphovibrio* (2) *Veillonella* (3) *Megasphaera* (4) *Desulfuromonas* (5) *Desulfococcus* (6) *Fuso bacterium* (7) *Streptococcus* (8) *Peptococcus* (9) *Peptostreptococcus* (10) *Sarcina* (11) *Clostridium* (produce H_2S)

(3) Facultatively Anaerobic Bacteria: -

Do not require oxygen for growth, although they may use it for energy production if it is available. They are not inhibited by oxygen and usually grow as well under and air atmosphere as they do in the absence of oxygen.

Conclusion: -

The above mention bacteria can be helpful to determine the root cause of microbiological growth formation on the fins or deck of the cooling tower. The classified bacteria according to the groups will be easier to design the best cooling water treatment to get rid of the microbiological growth. In the fast growing era and industrial globalization, customer demands BULLS EYE solution to any problem.