Hello students, I am miss Lynette
Fernandes
of PES's Ravi S Naik College of Arts
and Science,Farmagudi.
Today, we will be studying about the microorganisms which
are used as indicators of water pollution. So,
in this session, we will be speaking about the microbial indicator organisms and certain microbial indicators which are used as indicators of fecal contamination
that is coliform - Streptococcus faecalis
and Clostridium perfringens. It explains
the importance of microbial indicators and here we are going to discuss a few examples of the microorganisms as indicators of water pollution.
What is water pollution? Water pollution is the contamination of water bodies such as lakes, rivers, oceans, aquifers and groundwater. Very often it is occurs because of the human activities in these contaminated waters. Pollutants are present either as particles, chemicals or substances that make the water contaminated. This occurs when pollutants are discharged directly or indirectly into the water bodies without enough treatment to get rid of the harmful compounds.
Water contaminated with either domestic or industrial wastes is called non-portable or polluted water and it is absolutely not fit for consumption.
Bacteria which are the most common pathogens in the water gain entrance into the water mostly through fecal contamination.
Bacterial pathogens are responsible for many diseases in man such as typhoid, parathyroid, cholera.
Indicator organisms -
What are indicator organisms? These are the organisms which indicate the quality
of water. They are the basic tools which are used for the measurement of water quality.
They provide evidence for the presence or absence of pathogenic organisms in water. Scientists need not observe or study the entire water community but they just have to check a single indicating species to know the health of the water body.
According to the IUBS, that is international union of biological sciences, they have grouped the bio indicators as microbial systems, plant systems, animal systems and cell biology and genetic systems. We will be speaking only about the microbial systems.
Microbial indicators can be used in a variety of ways to detect environmental pollutants
in the water. Microorganisms are found in large quantities and they are easier to detect and sample therefore it becomes easier to study microorganisms than other type of organisms.
The presence of some microorganisms is well correlated with a particular type of pollution and it serves as a standard indicator of pollution. Pathogens, if they are present in the water they may go undetected in the water sample as pathogens gain entry into the water sporadically
and they may not survive for a very long period of time and if they are present they might be present in very small numbers. Because of all these reasons the pathogens may just go undetected in the sample therefore it is necessary to look for some indicator organism which is possibly present in the possibly contaminated waters. If it is contaminated, the indicator organism has to be present. Bacterial indicators are the most important indicators of fecal contamination. These indicators include members of the family Enterobacteriaceae.
Enterobacteriaceae has coliforms, Streptococcus faecalis and Clostridium perfringens. These bacteria are the normal inhabitants of the large intestines of the humans and other animals and are present in the feces. They gain entry in the water which is meant for domestic supplies

through intestinal discharges and presence of these organisms in the water indicates fecal contamination of humans or animal origin. Other intestinal pathogens are also likely to be present. Several species of four enterobacteriaceae genera are Escherichia species, Klebsiella species, Enterobacter species and Citrobacter species. They also have the ability of giving positive results to tests on environmental waters but the fecal coliform groups are the most widely used.

Generally, these coliforms live much longer in water than other intestinal pathogens therefore they are easily detected as compared to the actual pathogens which might not even be present during the time of testing. Of the total coliform groups, E. coli is the most numerous in mammalian feces, hence it is considered the most specific indicator of fecal pollution. Majority of the E. coli strains are non-pathogenic and they reside in the colon or the large intestines of men or animals without causing any harm.

Streptococci is another group of indicator organisms which indicates fecal pollution in water and waste waters. It consists of two main genera Enterococcus and Streptococcus. Enterococcus is a preferred indicator of fecal pollution. Normally, it is found in the gastrointestinal tract of warm blooded animals.

Fecal streptococci and fecal coliforms are used to differentiate between human fecal contamination from that of the warm blooded animals because in the case of human fecal contamination, fecal coliforms will be found in large numbers. Some of the examples of this group are Enterococcus faecalis, Streptococcus bovis, etc.

Costridium perfringens - these are anaerobic forms. They form endospore. These endospores show a lot of resistance to different environmental factors so they are resistant and endospore forming bacteria are regularly present in the feces.

These spores survive much longer than the coliforms in water. Usually these spores are resistant to chlorination doses that are used in water works practices. Presence of these endospores in natural waters indicates fecal contamination and absence of coliforms at the same time indicates that contamination had occurred some time ago. Coliforms may not leave as long as the survival of the endospores of these organisms.

Phages - phages can also be used as indicators. They are the indicators of viral pollution in water and waste waters. Phages of coliforms indicate human enteric viruses. Most common coliphages are the t type and the f RNA coliphages. These are regarded as the best indicators of the fecal contamination and considered as the indicators of waste water pollution due to their high numbers in wastewaters and high resistance to chlorination.

There are bioluminescent bacteria which are also used as indicators.

Bioluminescent bacteria means they emit light. These are used for testing water for environmental toxins. The cellular metabolism of these bacteria is inhibited in the presence of environmental toxins because of which the quality and the amount of light emitted by these bacteria will be affected and hence they can be used as bio indicators.

Other microorganisms can also be used as bio indicators. Algae of many kinds are really good indicators of water quality and many lakes are characterized based on their dominant phytoplankton groups. Many desmids are known to be present in oligotropic waters while a few species frequently occur in eutrophic water bodies. Similarly many blue-green algae occur in nutrient-poor waters while some grow well in organically polluted waters. Species of diatoms are also used as indicators of organic pollution.

Spirillum volutons spores are used as indicators of industrial and toxic chemical wastes in waters.

With this we finish off with microbiological organisms as indicators of water pollution or water contamination.

Water contaminated with either domestic or industrial waste is called non-portable or polluted waters

Non-portable or polluted waters can be identified using indicator organisms as the basic tools for testing. Bacterial indicators are the most important indicators of fecal contamination. These are the references.
Thank you