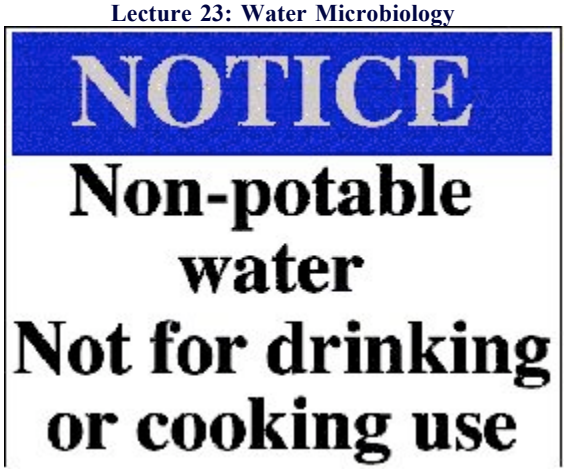
Lecture 23: Water Microbiology



I. Introduction

A. Water microbiology is the _____ _____. This is done to determine what organisms are present, and if they are helpful or harmful.
B. The safety of water for drink and contact is the main reason for _____ _____. We must know if the water will cause harm to us or the environment. Some microorganisms can actually reduce the amount of environmental damage. We treat drinking water to make it potable.

II. Harmful organisms (Bacteria, Parasites and Viruses)

A. _____ may affect as few as 1 or 2 people, or they may affect enough people to reach epidemic proportions. Luckily, the Safe Water Drinking Act and the _____ _____ help keep us safe. Water Treatment is not without flaws, so it is still a _____ that drinking water is safe, especially with the increased number of HIV/AIDS patients.
B. Water contamination from _____ _____ introduces into the water:

1. Pathogenic Bacteria (Mostly enteric or GI Tract)

a. *Vibrio cholerae* which causes Cholera
b. _____ including *Salmonella typhi*
c. *Cyanobacteria* which may be a risk factor in cancer
d. *Mycobacterium*

2. _____ including the "Super Bugs" *Cryptosporidium* and *Giardia*
3. Viruses including Hepatitis viruses

III. Screening for pathogens

A. It is _____ to screen for enteric pathogens (e.g. *Shigella* and _____) for several reasons:

1. These pathogens enter the water supply _____ because not everyone is infected and shedding them continuously.
2. Most enteric pathogens are not stable in the environment, therefore they _____.
3. These pathogens are generally _____ so they may _____.
4. _____ are required to culture enteric pathogens.

B. Due to these problems associated with finding pathogens in large volumes of water, we will instead look for _____ whose presence indicates fecal contamination. The most common group of these indicator organisms are called _____.

C. Coliforms are _____ that are present in the _____ of every warm blooded animal. They are defined as aerobic or facultative anaerobic Gram-negative rods that do not form spores, but do _____.

The _____ than enteric pathogens for several reasons:

1. Animals and humans _____ in their GI tract.
2. They are _____ in feces.
3. Their presence in water will indicate fecal contamination which suggests the possibility of pathogen contamination.
4. Coliforms _____ in water and are much _____ in the lab.

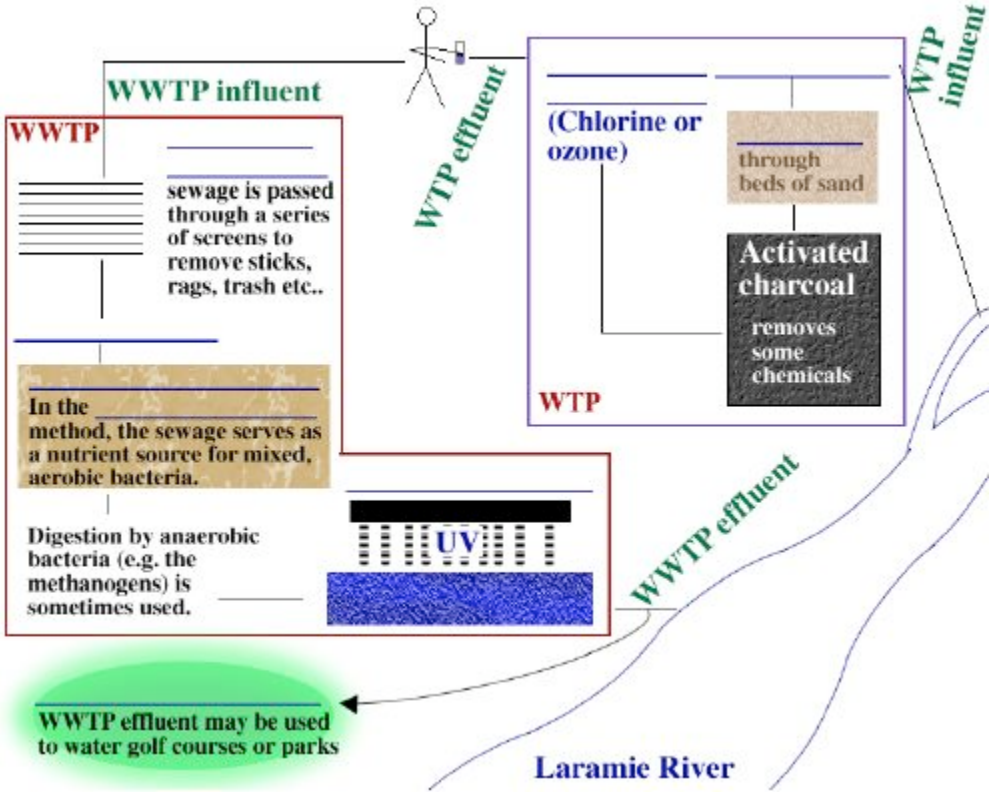
D. The detection of coliforms is complicated by the fact that _____. In fact, some are commonly found in the environment. Because of this, we commonly distinguish coliforms biochemically, to determine _____ using the _____.

IMViC

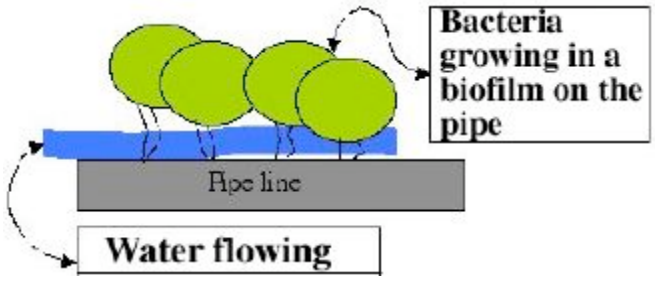
(_____)

Organism	Indole	MR	VP	Citrate
fecal coliforms (*Escherichia coli*)				
non-fecal coliforms (*Enterobacter aerogenes*)				

IV. We will screen waste water treatment plant (WWTP) influent and effluent, Laramie River water, water treatment plant (WTP) influent and effluent and drinking water for the presence of coliforms.



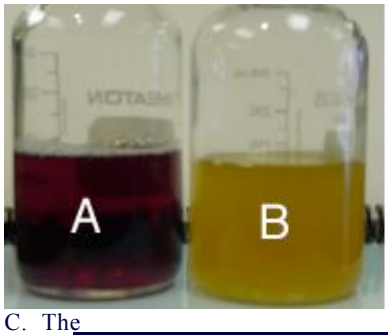
*_____ are one main reason for_____ of water.



V. There are several tests that we will use to determine whether fecal coliforms are present in a water sample.

A. The_____ is used to quickly examine for the presence of coliforms. This test is able to detect_____ _____.

B. The PA broth contains_____ and a pH indicator which will change from a purple color to a_____ from the fermentation of lactose.



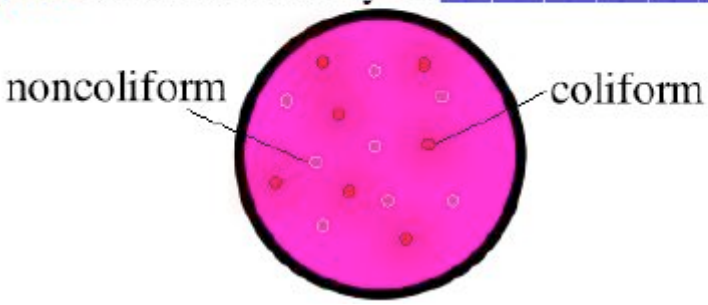
Which water sample contains at least 1 coliform??

C. The_____ is a test that may be used to assay a _____ and allow us to_____

_____ the number of coliforms in that sample.

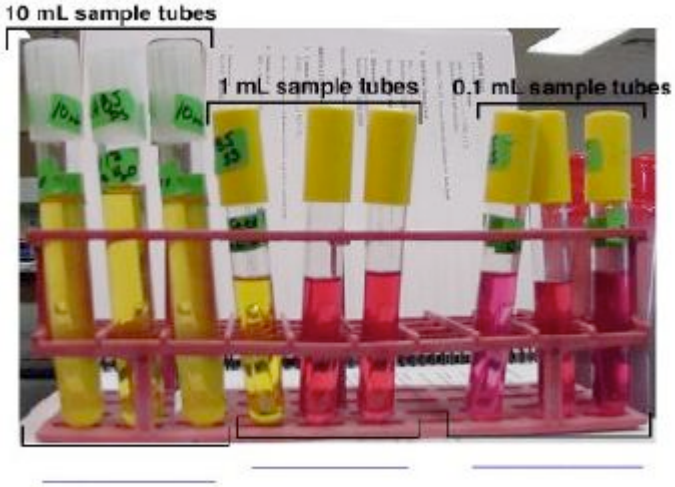
1. The water is passed through a 0.45 micron_____.
2. The filter is then placed on a selective and differential medium, usually EMB or Endo agar, which allows for identification of coliforms.
3. Once colonies form, they can be counted to determine the number of coliforms present in a sample.

Endo media contains sodium sufite and basic fuchsin to inhibit the growth of _____ organisms. Coliforms that ferment lactose form red or pink colonies that may be _____.



D. The Multiple Tube Fermentation Method is a test that is performed in three stages.

1. _____ uses a _____ _____ that will be used to determine the presence of lactose fermenting bacteria in the sample. The nine inoculated lactose broth tubes will also enable us to _____ the amount of coliforms present in our sample by using the MPN (most probable number) table located in your lab manual.



_____ _____ _____

Profile: _____

How many coliforms/100 mL are present in this sample?

2. _____ involves the inoculation of _____ with a lactose positive sample. EMB selects for the growth of _____ organisms and differentiates bacteria based on their ability to ferment lactose.
3. _____ is done by selecting a lac+ colony from our EMB plate and _____

_____ to verify lactose fermentation. Also, _____ should be inoculated with the same colony to demonstrate the Gram-negative, _____ character.

E. These tests are done on numerous bodies and sources of water _____ _____.

VI. Other microbiology applications in water treatment

A. Biosensing is one of the new breakthroughs in microbiology. Korean scientists are using _____ containing the lux operon to indicate if there has been a failure in waste water treatment.
B. Britain has the Microtox System which uses Photobacterium directly to detect pollutants. They can't _____.
C. Pseudomonas expressing _____ and other genes encoding toluene or benzene recognition will fluoresce in presence of these pollutants.

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