## SYNOPSIS:

As achievements in engineering and manufacturing progress, problems emerge as a result of these processes. Cleanup concerns plague us as a legacy of the industrial revolution. This program focuses on an innovative yet natural solution science proposes for the cleanup of polluting by-products. We will see how science is Cleaning Up With Microbes. Throughout the world, scientists are exploring the use of living organisms to help solve the problem of waste disposal and recycling. They have found that microbes—such as bacteria, fungi and algae—can take care of almost any waste by-product by doing what they do best—eating!

## CURRICULUM UNITS:

Biology
Ecology
Microbiology
Biotechnology
Environmental
Chemistry
Organic Chemistry
Chemistry
Environmental Science
Science
Technology & and Society

## CAREER OPPORTUNITIES:

Biologist
Environmental Engineer
Chemist
Genetic Engineer
Chemical Engineer
Microbiologist

## PROGRAM OVERVIEW:

The waste by-products of our industrialized world have prompted scientists to turn to nature for help with their disposal and cleanup. Natural decomposers and recyclers have come to our rescue.

Microbes such as bacteria, fungi and even algae are able to decompose or recycle within their natural environments. In this program, students can see experiments with radioactive waste removal, bacteria that digest metals and a microbial solution to organic wastes such as fats and oils from restaurant kitchens. Using a bioreactor "fueled" with bacterial decomposers, waste water can be safely released into sewage systems.

## ISSUES & CRITICAL THINKING:

1) After viewing the program, ask your students to review and extend their understanding by answering these questions:
   a. Why is it important to explore the necessity for waste by–product management?
   b. How does the use of microbes directly and indirectly benefit the environment?
   c. What are some examples of using microbes in waste cleanup?
   d. How are the microbes able to breakdown or reuse this waste?
   e. How are anaerobic bacteria different from other bacteria?

2) Ask students to speculate how the efficiency of a bioreactor could be increased.

3) As a class project, ask students to construct a miniature treatment bed to simulate that used for bioleaching. Add a harmless, identifiable substance such as starch and ask students to determine if bacteria have degraded it.

4) How has the industrial revolution affected our environment?

5) Have student's research methods of managing waste other than with the use of microbes.

6) If there is a waste management facility nearby, arrange a class visit or invite a researcher or technician to speak to your class. Water treatment facilities utilize a variety of interesting methods (ask to see intermediate stages of treated water if protozoans are used in the process), and landfill environmental engineers can speak about special safeguards used.

7) Microbes are the "workhorses" of many biotechnological applications. Ask students to research how microbial enzymes are utilized.

8) How does nature manage waste? Ask students to research just how a functional compost bin is assembled and maintained.

9) Discuss enzymes with the class: basic chemistry of molecules, actions, energy requirements, optimum conditions and reusability.

10) Just as microbes that produce antibiotics can be cultured from the soil, microbes that digest starch can be cultured from soil samples. Ask students to devise an experiment to test this supposition.

## GLOSSARY:

**Anaerobes-** An anaerobic organism or anaerobe is any organism that does not require oxygen for growth.

**Bioleaching-** The extraction of specific metals from their ores through the use of bacteria.

**Microbes-** An organism that is unicellular or lives in a colony of cellular organisms.

**Anaerobic Reactor-** Biological Wastewater Treatment.

**Bioleaching Reactor-** Bioleaching uses naturally-occurring bacteria in reactors (tanks) to oxidize sulphides.

**Organic-** Of or relating to an organism, a living entity.

**Atomic Force Microscope-** A very high-resolution type of scanning probe microscopy.

**Bioreactor-** A bioreactor in which metals such as copper, zinc, uranium, nickel and cobalt are leached from the associated mineral using microorganisms.

**Uranium-** A silvery-white metallic chemical element in the actinide series of the periodic table with atomic number 92.

**Biofilm-**An aggregate of microorganisms in which cells adhere to each other and/or to a surface.

**Biotechnology-** A field of applied biology that involves the use of living organisms and bioprocesses in engineering, technology, medicine and other fields requiring bioproducts.

TMW MEDIA GROUP
2321 Abbot Kinney Blvd., Venice, CA 90291
(310) 577-8581 Fax (310) 574-0886
Email: sale@tmwmedia.com
Web: www.tmwmedia.com

Producers & Distributors of Quality Educational Media




# BIOTECHNOLOGY: CLEANING UP WITH MICROBES

**K4551DVD**