

How Does Biotechnology Help Clean Up The Environment?

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Teacher's Guide

Introduction

The objective of this lesson is to introduce students to one of the most important issues affecting human life and health in the 21st century, the application of modern biotechnology to the problems of environmental pollution.

This lesson provides visual and interactive methods to help clean up the environment and reduce oil pollution. It also introduces students to the concept of biotechnology. These concepts will stimulate students thinking skills and answer the following questions: How does bacteria feed on oil and break it into smaller particles? What is the result of this degradation?

Segment 1

In this lesson, we will explain the concept of environmental petroleum pollution. We will discuss how Biotechnology helps to clean the environment. This paragraph begins with a video of one of the worst oil spills in recent history, emphasizing the seriousness of this type of pollution on marine wildlife and environments. To understand the application of biotechnology in such situations, the student must have a basic understanding of life sciences, which is usually given in intermediate and secondary school.

Segment 2

In this segment, we discuss how biotechnology provides environmental solutions for a wide range of marine issues. This is achieved through the use of unique microorganisms.

The student will recognize the types of microorganisms which degrade crude oil. Some microorganisms work faster and more efficient than others depending on the environmental factors surrounding them, as well as other internal factors (enzymes). The student will become familiar with the concept of biotechnology and its role in developing solutions to many of the environmental issues of the 21st century.

Segment 3

In this part of the program, we discuss biodegradation to speed up the elimination of pollution such as oil spills from the environment. It is considered an environmentally friendly way to degrade oil and convert it into less harmful materials such as carbon dioxide and water. Here we discuss the role the enzymes that bacteria need to decompose the complex hydrocarbons in oil.

The bacteria uses a complex hydrocarbon (like oil) as the sole source of nutrition and convert it into water and CO₂.

In order to enhance understanding, there is a display showing the types of fossil fuels as they decompose into CO₂ and water.

Segment 4

This segment talks about the sources and types of bacteria used, as well as how these bacteria are isolated.

We discuss the indigenous nature of these microorganisms, which are already found in oil. We also discuss the different types of these bacteria. We show how to isolate the bacteria from contaminated soil samples in a laboratory using a series of steps.

Segment 5

In this section we discuss the concept of bacterial growth and its role in carrying out the process of biodegradation. As clarification, we display a graph of bacterial growth (known as the growth curve) and we investigate the nutrients that they require in order to grow. We explore the concept of bacterial growth through the process of cell division using petroleum as the sole source of carbon.

We explore the following questions: How many bacteria are needed to remove oil from a contaminated source? How can we improve the ability of bacteria to decompose crude oil?

We discuss the role of catalysts such as glucose, nitrogen and phosphorus in the process and how their use increases the capacity of bacterial biodegradation.

Segment 6

In this part of the program we learn about the role of modern biotechnological tools that enhance the ability of bacteria to degrade crude oil. These mechanisms include genetic engineering. Animations are present to reinforce the ideas presented.

Segment 7

One of the main goals of the entire lesson is to show students the role of microorganisms combating environmental pollution, how they conduct their task and to introduce students to the enzymes within bacteria that make it all possible. The entire lesson is centered on using microorganisms to clean up the complex hydrocarbons present in crude oil. Prior to the conclusion we touch upon other natural ways to clean the environment such as wave action, sunlight and water. We conclude with a reminder that that environment is our responsibility and we must work hard to keep it clean and protected from hazardous materials.

