

OIL SPILL CLEANUP (2 HOURS)



In this activity, students will use a variety of materials to attempt to clean up a simulated oil spill.

Overview

Topic: Oil spills

Real World Science Topics:

- An exploration of methods that can be used to clean up an oil spill.
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Objective

Students will simulate an oil spill and test a variety of materials to see which is best for cleaning the spill.

Materials Needed for the Whole Class

vegetable oil
food dye
pitcher
water

Materials Needed for Each Team of 2-4 students

two medium-sized bowls
paper cup
5 mL dyed vegetable oil
smocks (one for each student)
newspaper
cotton balls
paper towels
dish sponges
gauze
twine or rope (0.5 m)
turkey baster
dish detergent
sawdust (can be obtained from a local lumberyard or hardware store)
paper cups
optional: cafeteria trays (clean) to contain small liquid spills

Materials Needed for Demonstration

2 bowls
water
natural bird feather (preferably from a duck, goose, or other aquatic bird; do not use a synthetic feather)
vegetable oil

Materials Needed for Cleanup

old towels
paper towels
dish detergent
buckets
water

Standards Met

National Science Standards Addressed

Content Standard A: Science as Inquiry Students:

- Identify a simple problem and propose a solution.
- Plan and conduct a simple investigation.

Content Standard B: Physical Science

National Math Standards Addressed

Data Analysis and Probability:

- Find, use, and interpret measures of center and spread, including mean and interquartile range.

National Technology Standards Addressed

Use models and simulations to explore complex systems and issues.

Use multiple processes and diverse perspectives to explore alternative solutions.

Contribute to project teams to produce original works or solve problems.

Sources:

National Science Teachers Association

<http://books.nap.edu/html/nse/overview.html#content>

National Council of Teachers of Mathematics

<http://standards.nctm.org/document/chapter5/index.html>

National Educational Technology Standards

<http://cnets.iste.org/currstands/cstands-netss.html>

STEPS FOR OIL SPILL CLEANUP



1. **Warm-up Activity:** Show students a bird feather. Drop the feather in a cup of water. Remove it and show students that the water rolls right off and the feather quickly returns to its previous dry state.

Now drop the feather into a small bowl of oil. Ask students if they think that the oil will come off as easily as the water. Show them that even if you wipe the feather off with a paper towel, it remains oily. Ask the students how they think an oil spill would affect animals like birds. Would birds be able to fly if they were covered in oil? They should be able to see from this simple activity that even a small oil spill could cause a lot of problems for wildlife.

2. Before class, make the dyed oil that students will use to simulate their oil spills. Add several drops of food dye to a bottle of vegetable oil, then shake the bottle vigorously until it is uniformly colored. This activity has the potential to be messy, so newspapers should be laid down on the desks where students will work. Students should wear smocks if they are available to prevent oil from getting on their clothes. Encourage students to be careful when handling the vegetable oil so that it does not spill on the floor.

3. Explain to students that oils are liquids that do not mix with water, but do mix with each other. Discuss the fact that there are many types of oil. Ask them to identify types of oil that they are familiar with. If they do not suggest it, mention that there is a substance called crude oil that is used to make gasoline and heating oil. Tell them that companies ship crude oil around the world in large ships, which occasionally have accidents and spill oil into the ocean. Tell them that in this lab they will use vegetable oil to model crude oil. Crude oil is toxic, while vegetable oil is safe to use as a model.

4. Pour a small amount of the dyed vegetable oil into the bowl of water from the warm-up activity and have the students come and observe what happens when oil is poured into water. Some students may not have seen oil on water, so allow them to examine it closely. Encourage them to push it around or stir it up with a pencil. Once the students are done, have them return to their seats. Ask them to suggest ways that they might remove the oil without removing the water. They might suggest many types of devices, including rags, sponges, or even soap. They should record their answers on the handout.

5. Distribute the Oil Spill Cleanup handout and materials to each group of 2–4 students.

6. Explain to students that, in this activity, they will try to find the best method for cleaning up an oil spill. Their goal will be to remove as much oil from an oil/water mixture as they can.

7. Distribute approximately 5 mL (one teaspoon) of dyed vegetable oil to each group in a paper cup. The colored oil will represent crude oil in this model.

8. Lay out the possible materials that groups can use to clean up their oil spills (such as cotton balls, sponges, gauze, rope, detergent, and paper cups). Allow students to study the different materials. Then, give the groups 15 minutes to brainstorm ways that they can use the materials to clean up the oil. Have them use the handout to record the steps of their planned procedure.

9. When students are done brainstorming their ideas, pour water from a jug or pitcher into one bowl for each group until the bowl is about two-thirds full, and then have the students slowly pour in the vegetable oil so that it settles on top of the water.

10. Next, students should test their cleanup plans. Give students 10 minutes to extract as much oil as they can. Students can use their empty bowls to collect any oil they extract from the water and to put any oily materials that they might use in the activity. Warn students to be careful in transferring oil and water from bowl to bowl, as liquids that end up on the floor are slippery and may be a potential hazard. Instruct the students to record any changes that they make to their procedures. One person should record the changes, and also make notes regarding what parts of the procedure were successful and what parts were not.

11. Before moving on to the remainder of the activity, make sure students clean up any oil that may have spilled on to the floor or desks. Use soapy water to clean up any spills.

12. **Wrap-up Activity:** Lead a discussion of the results of the activity. Have groups describe their procedures, identifying which processes worked well and which did not. Ask the students which materials were best for cleaning up the oil slick. There is no one correct answer to this question. If two groups say they both found the same material to be useful, ask them to explain how exactly they used that material. Each group may have used the material in a different way.

Finally, lead a discussion of how the materials they used might be similar to those used to clean up a real-life oil spill. For example, scientists sometimes use floating ropes to contain the oil slick if the water is relatively calm. Then they skim the oil off of the top of the water into boats. If any groups used a similar technique to clean up their oil, have them discuss the effectiveness of the method. Explain that scientists have tried many methods for cleaning up oil spills, including skimming the oil off the water, using detergents to disperse the oil, and using a vacuum to suck up the oil. They have even experimented with using bacteria that can eat oil.

Oil Spill Cleanup Extension Activity

To extend this activity, have students create a more representative ecosystem. Instead of a bowl, students should use a long metal cake pan. In one end, they can add sand to form a beach. They can add small toys (preferably toys with fur or feathers) to represent birds and other wildlife. They could even use a fan to blow the water around and create waves. Have them repeat the original activity, but evaluate how well their methods prevent oil from getting into the sand, and how well they prevent oil from getting on the wildlife.

OIL SPILL CLEANUP BACKGROUND INFORMATION



What is oil?

There are many types of oils. Oils are substances that are liquid at room temperature, that do not mix with water, and that do mix with other oils. In this activity, the students use vegetable oil, which is derived from vegetables and is used for cooking. The type of oil that is involved in large oil spills is generally crude oil, although some spills also involve refined petroleum products such as gasoline.

How do oil spills occur?

Crude oil is found beneath the ground in locations all over the globe. Unfortunately, these locations are usually not close to the areas where the oil is refined and used by the public. To overcome this problem, oil companies use huge tanker ships to transport crude oil around the globe. These ships occasionally have accidents. In the famous Exxon Valdez oil spill, the ship ran aground on an underwater reef. This damaged the tanker's hull and allowed 41 million liters of crude oil to spill into Prince William Sound.

Why are oils spills so bad?

A spill of a large amount of vegetable oil would be harmful, but because the oil is non-toxic to most organisms, it would be less harmful than a crude oil spill. Petroleum-based oils are toxic to many organisms. Because oil does not mix with water, it is hard to remove. Compounding the problem is that oil tends to stick to animals and the sea shore.

How do people clean up oil spills?

There are many techniques that are used to clean up oil spills. Which technique is used depends on the location and the exact makeup of the oil. One popular method is to disperse the oil with a detergent. This is like pouring dish detergent into a sink full of greasy water. Unfortunately, this method does not remove the oil from the water; it simply breaks it down into smaller particles that can drift away. Scientists have found that these particles may damage nearby coral, so this method may not be practical in some situations. Another technique is to use microbes to break down the oil. This is called bioremediation. This technique is mostly used on land because it takes a long period of time for the microbes to consume the oil. Oil in the water will spread more quickly than oil on land, so microbes will not have time to do their work. There are also physical methods for cleaning oil spills. Most of these involve capturing the oily water in containers and cleansing the water off site.

How can I prevent oil from getting into the environment?

While large oil spills grab headlines, they are not the source of most oil in the environment. Most oil comes from smaller sources, such as leaky vehicles or storage tanks. The best way that individuals can prevent oil from getting into the environment is to try to prevent these leaks by keeping vehicles properly maintained. You can also help by not disposing of motor oil by pouring it into a drain or gutter.

Key Vocabulary

Oil: a substance that is a liquid at room temperature, that does not mix with water, and that mixes with other oils

Crude oil: a fossil fuel that is used to make gasoline, heating oil, and other substances

TEACHER HANDOUT FOR OIL SPILL CLEANUP



Name _____ Date _____

What happened to the vegetable oil when it was poured into the water?

[The oil formed a layer on top of the water that spread to cover the whole bowl.]

What do you think you could do to try to remove the oil from the water?

[I think that you could skim the oil from the water with a cup. You could also try to soak it up with a sponge.]

Write your group's plan for removing the oil from the water below.

[Procedures will vary from group to group.]

What changes did your group make to its procedure as the activity moved on?

Write your group's final procedure for removing oil from the water.

Which materials did your group find that worked well? How did you use those materials?

Which materials did not work well? What was wrong with using those materials?

Which material was the best material according to the class? Did your group use that material?
If so, did you use it in the same way as the other groups?

STUDENT HANDOUT FOR OIL SPILL CLEANUP



Name _____ **Date** _____

What happened to the vegetable oil when it was poured into the water?

What do you think you could do to try to remove the oil from the water?

Write your group's plan for removing the oil from the water below.

What changes did your group make to its procedure as the activity moved on?

Write your group's final procedure for removing oil from the water.

Which materials did your group find that worked well? How did you use those materials?

Which materials did not work well? What was wrong with using those materials?

Which material was the best material according to the class? Did your group use that material? If so, did you use it in the same way as the other groups?