ENGINEERING DESIGN: Deepwater Horizon Blowout Cleanup: Oil Absorbing Materials

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Background

On April 20, 2010 the deepwater horizon oil drill column exploded. Since then, approximately 210,000 gallons of oil a day have been released into the Gulf of Mexico for a total of ***210 million gallons of oil***. The blowout is at a depth of one mile below the surface of the ocean. Most of the oil rises to the surface of the ocean due to density differences, but some oil gets trapped in underwater currents and travels throughout the ocean. The surface cleanup is what we are looking into with this experiment.

Vocabulary

Absorption:

Adsorption:

Hydrophobic:

Polymer:

Dispersant:

Absorbency (Adsorbancy) Ratio:

MSDS Sheet

Experiment Objective

Our goal is to ***simulate a surface oil spill*** and test different oil absorbing materials for their effectiveness in **oil removal** and **oil recovery**. A variety of both natural and manmade materials will be tested and a conclusion as to which oil cleanup method would best serve the *Deepwater Horizon* blowout will be drawn.

MATERIALS

In order to complete this investigation you will need the following supplies for each group:

Marvel Mystery Red Oil -approximately 25mL
Tap water
4 plastic petrie dishes (2 tops and 2 bottoms)
1 10mL syringe
1 plastic fork (to probe and remove materials)
1 pair of gloves per person
Paper towels to clean up spills

Absorbant Materials

- **wool (raw sheep fleece)**
- **non-woven Wool blanket**
- **Oil Absorbing Polymer**
- **Recycled Cellulose Material**
- **BOOM (nylon stocking) with wool (raw fleece) filling**

OIL SPILL CLEANUP EXPERIMENT **NOTE: Wear GLOVES for these experiments!**

1. Examine the four oil cleanup materials. What do you notice about each one? What are their relative densities to one another? Are any of the materials similar? Record your observations.

2. Fill a petrie dish bottom (deeper half) halfway with water and add 3ml red oil on top.

3. Weigh out approximately 1 gram (approx.) of wool (raw sheep fleece) and record the exact mass, place wool on top of oil in the salt water.

4. Note how the wool soaks up the oil. Slowly stir the wool with a fork. Allow 30-60 sec. for the wool to absorb the oil. Remove the wool, add more oil, replace the wool and continue this process until it appears to be "saturated". When the wool no longer absorbs the oil, the oil will begin to float on the surface of the water. **This is a subjective determination, so have the group agree when the experiment is complete!**

5. **Oil Recovery.** Pick-up wool (**wear gloves!**) and squeeze it out oil into a petrie dish. Measure using a syringe.

6. Record the volume of oil that was absorbed by your wool (raw fleece) and the amount recovered.
   Calculate the Absorbancy Ratio (AR) = ml oil/g wool
   Calculate percent oil recovered = (mL oil recovered/ml oil absorbed) * 100%

7. Repeat steps 2-4 using oil with **1.0 g (approx) non-woven wool blanke**t.
   Calculate AR = ml oil/g oil absorbing polymer.
   Calculate percent oil recovered = (mL oil recovered/ml oil absorbed) * 100%

8. Repeat steps 2-4 using oil with **2 g recycled cellulose** material (use petrie dish top – shallow).
   Calculate AR = ml oil/g recycled cellulose material.
   Calculate percent oil recovered = (mL oil recovered/ml oil absorbed) * 100%

9. Repeat steps 2-4 using oil with **0.25 g (approx.) oil absorbing polymer** (use petrie dish top – shallow).
   Calculate AR = ml oil/g oil absorbing polymer.
   Calculate percent oil recovered = (mL oil recovered/ml oil absorbed) * 100%

10. Repeat steps 2-4 using oil with a **boom material** (1g raw wool in a nylon stocking).
    Calculate AR = ml oil/g recycled cellulose material.
    Calculate percent oil recovered = (mL oil recovered/ml oil absorbed) * 100%

11. **Record your DATA for all absorbant materials tested on the data sheet provided**.
    This data will be later shared with the class for an analysis of the average absorbency ratio (AR) and experimental error (standard deviation).