A look at methods for cleaning oil spills from water

Cassie Saunders Grade 11
Holy Cross School,
Eastport, NL

Introduction

Oil spills are a highly toxic result of breaking pipelines and shipping accidents of oil tankers that put just about 1.3 billion gallons per year in U.S waters.

While the goal of cleaning oil spills is to contain them away from coastlines and to work efficiently, this project will focus on the most common methods used to remove oil from our oceans and to determine which method is best.

Purpose

The purpose of this project is to compare and examine the different methods for cleaning oil spills and determine which would work best.

Question

What is the most successful method for cleaning oil from oceans?

Hypothesis

The most successful way for cleaning oil from water will be the use of a dispersant and absorber.

Variables

Independent

- Cleaning method.

Dependent

- Amount of oil collected.

Controlled

- Amount and type of oil used.
- Amount of water used.

Materials

- 4 cups canola oil (½ cup for each test and ½ cup to receive mass)
- 28 cups cold water (4 for each test)
- 9x13 glass dish
- Blue food dye
- Dish detergent
- Small containers labelled #1-7
- String
- Cotton rounds
- Weighing scale

Procedure

Type of cleaning method	Object used
1. Absorber	Sponge
2. Dispersant	Dish detergent
3. Boom	String
4. Skimmer	Cotton rounds
5. Skimmer and Boom	Cotton rounds and String
6. Absorber and Dispersant	Sponge and dish detergent
7. Dispersant and Skimmer	Dish detergent and cotton rounds

1. Use a scale to determine the mass of each of 7 plastic containers; label each container (1 to 7)
2. Prepare a 9x13 glass dish and lay on a flat surface.
3. Add 4 cups of water to the dish.
4. Prepare 4 cups of oil by adding several drops of blue food coloring to better observe the oil.
5. Pour ½ cup of the oil into the center of the water.
6. Add the object to the tray that represents the first cleaning method.
7. Leave the object in the tray to absorb as much oil as possible.
8. Remove the object and place in the appropriately labelled container.
9. Discard the contains of the glass dish.
10. Repeat step 2 to 9 to test each cleaning method.
11. Leave all containers for 2 days to allow any water to evaporate.
12. Use a scale to measure the mass of each container and their contents.
13. Subtract the masses in step 12 from the mass of each container determined in step 1 to determine the amount of oil collected.
14. Determine the mass of 1/2 cup of oil.
15. Compare the masses in steps 13 and 14 for each method to determine the percentage of oil removed.
16. Record all data in the log book.

Procedure Continued

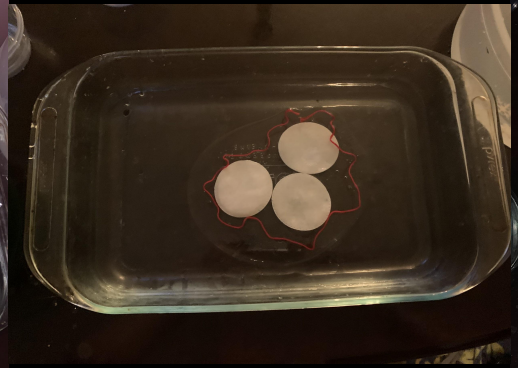
Materials

Absorber

Dispersant

Boom

Skimmer



Skimmer and boom

Absorber and dispersant

Dispersant and skimmer

Results

A combination of dispersant and skimmer was the best method as it resulted in the highest amount (76.57%) of oil being removed.

All results can be found in the following tables and figures.

Results Continued

Table 1: Mass (g) of oil removed using different methods of removing oil from water.

Method used	Mass of oil collected (g)
Absorber	13.8
Dispersant	N/A
Boom	3.6
Skimmer	44.0
Skimmer and boom	28.2
Absorber and dispersant	7.7
Dispersant and skimmer	51.0

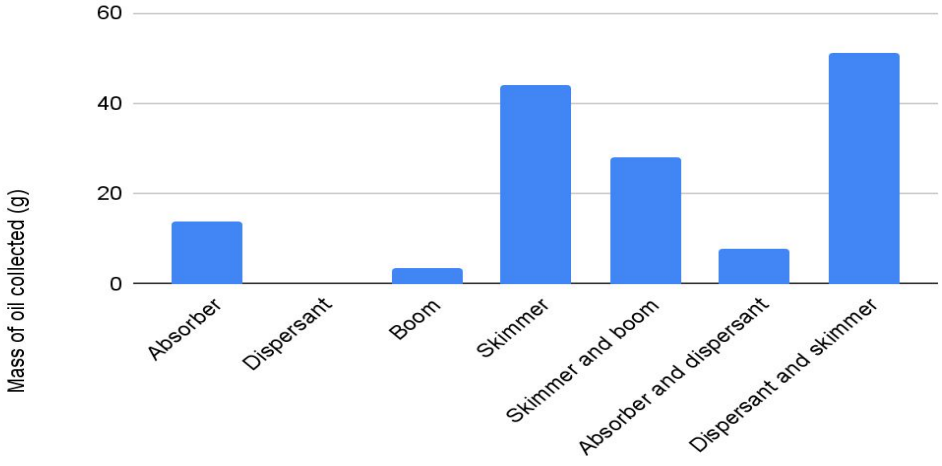


Figure 1: Mass(g) of canola oil removed by different methods

Note: mass of ½ cup of oil was 66.6 g

Results Continued

Table 2: Percentage of canola oil removed from water using different methods.

Method used	Oil removed (%)
Absorber	20.72
Dispersant	N/A
Boom	5.85
Skimmer	66.00
Skimmer and boom	42.34
Absorber and dispersant	11.56
Dispersant and skimmer	76.57

Note: mass of ½ cup of oil was 66.6 g

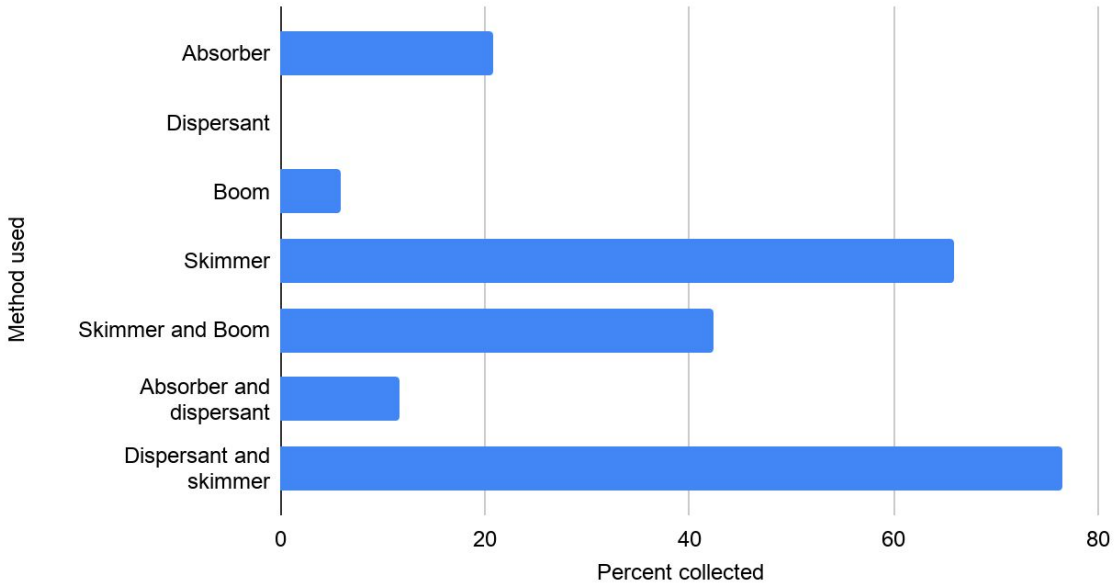


Figure 2: Percentage (%) of canola oil removed from water using different methods.

Discussion

- The reason the hypothesis of an absorber and dispersant was not correct could have been because of an absorbers ability to soak up water. Research supports this because of multiple sources that stated absorbers are not a convenient method due to this fact.
- The dispersant did not give applicable results because it is only used as an oil thinner, not a cleaning method.
- The majority of oil cleaning methods, even in combination are never 100% effective. Only 10-15% of a normal oil spill will be recovered. The results of this experiment show this be true as some of the methods tested collected as little as 2.4% of the oil.

Sources of Error

- Improper dumping and cleaning of the oil in between method testing could have resulted in inaccurate oil amounts.
- Some water may have remained in the absorbers, meaning it was also included in the mass measurements.
- It's possible that a full ½ cup of oil was not always added to the water, meaning there was less to be collected.
- All methods used could have not been considered, meaning the results may not be accurate with real situations.
- Canola oil may not have been the best choice to represent crude oil, a commonly spilled oil.

Conclusion

- From the experiment, the conclusion can be made that in order to clean the majority of an oil spill, the use of a dispersant and skimmer together will result in the highest amount collected.
- The original hypothesis was incorrect however the reason for such a result makes sense. An absorber will not only absorb oil but also water, meaning there could be more water then oil absorbed and result in less oil being removed.
- A dispersant and absorber removed one of the least amount of oil due to the absorbers ability to soak up the water and oil. The results that were collected made this clear because it collected only 5.2% of the oil and even after drying of the absorber, there was not as much oil collected.

References

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Logbook

Method	Amount Collected
Container mass- 9.0g ½ cup of oil mass- 75.6g-9.0=66.6g	
Absorber	13.8g
Dispersant	No results
Boom	3.6g
Skimmer	44.0g
Skimmer and Boom	28.2g
Absorber and Dispersant	7.7g
Dispersant and Skimmer	51.0g

- Most successful order (greatest to least): 7,4,5,1,6,3,2
- Dispersant and skimmer, skimmer, skimmer and boom, absorber, absorber and dispersant, boom, dispersant.
- No oil was collected with the use of just a dispersant, since it only slicked the oil out to make it easier to clean, meaning no notable results.

The End.