Fracturing with Jello

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Lab Worksheet | **SECONDARY STUDENTS**

BACKGROUND

Shale is the most common type of rock found to hold fragments of organic material required to produce oil and gas. Since this material is locked in layers of rock, simply drilling through the formation is not enough to retrieve and release the liquid hydrocarbons. Instead, the rocks must be broken (or fractured) using a highly-pressurized water solution.

Fracturing fluid is an essential component of the shale gas extraction process. Water makes up 98% to 99.2% of the fluids used for fracture treatments. The remaining 0.8% consists of friction-reducing additives, which allow the oil and natural gas to flow easily from the reservoir into the well.

This activity aims to demonstrate how fracturing fluid, under pressure, is able to create a fissure in the rock layer. Students will be able to see the syrup come out at a high velocity to crack the gelatin. The gelatin, however, will not hold the syrup in like other rock materials will. After the activity, discuss with students how this activity can be re-modeled.

QUESTION

How does a liquid behave when injected into a solid under pressure?

MATERIALS

For gelatin blocks:

- ❑ Large measuring cup
- ❑ Loaf pan (small or large work well)
- ❑ Non-stick cooking spray
- ❑ Spatula
- ❑ Unflavored gelatin
- ❑ Wire whisk

For activity (per group):

- ❑ 20 cc Syringe (oral dosing syringe works well) or turkey injector
- ❑ 50 mL Breakfast syrup
- ❑ Plastic knife
- ❑ 1 Dinner plate
- ❑ 1 Flexible straw
- ❑ Plastic wrap
- ❑ Tape
- ❑ 1 Push pin

TEACHER PREPARATION

Gelatin blocks can be prepared the night before the activity or even further ahead of time and refrigerated until used in class. The instructions below can prepare 2-3 blocks of gelatin in a small loaf pans. Adjust the recipe to accommodate more students if needed.

Prepare gelatin blocks with the following instructions:

1. Fill the large measuring cup with ½ cup of water.
2. Sprinkle 3 packets of gelatin over the water and swirl to mix.
3. Add boiling water to the gelatin to fill to four cups. Whisk to dissolve the gelatin.
4. Spray the bottom of the loaf pan with cooking spray and pour the hot gelatin solution into the loaf pan. Refrigerate overnight.
5. Have paper towels and warm water available for syrup spills during activity.

Fracturing with Jello

INSTRUCTIONS

1. Your teacher will provide you with a block of gelatin on a plate.
2. Insert a straw into the side of the gelatin block, parallel to the plate, about 2/3 of the way into the gelatin.
3. Bore out the hole with the straw so a hole is left in the gelatin.
4. Poke about 10 holes in another straw. The holes should be near the end, away from the elbow, in two lines on opposite sides of the straw. The holes should be about 10 mm apart, and about 10 mm in from the end of the straw.
5. Seal the end of the straw with tape, without covering the holes.
6. Attach the other end of the perforated straw, nearest the elbow, to the syringe with tape. Wind it around the straw and syringe several times to give a good seal.
7. Pull the plunger out of the syringe.
8. Fill the syringe with breakfast syrup, allowing it to run into the straw. Keep filling the syringe as the level goes down until the entire syringe and attached straw is full of syrup.
9. Quickly replace the plunger into the syringe. This will keep the syrup from running freely out of the straw, but it still might drip a bit.
10. Insert the perforated straw, filled with syrup and with syringe attached, into the bored hole in the gelatin block.
11. Using very firm pressure, quickly inject the syrup into the gelatin block and observe the fracturing pattern of the gelatin.
12. Pull the straw back out of the gelatin block.

CONCLUSIONS

1. Draw a picture of what you observe happening to the jello and the syrup.

2. What happened with the syrup and jello in this system? Why did they behave this way?_____

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3. How does the syrup simulate fluid in the process of hydraulic fracturing? _____

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