Science Lab

SEED

Viscosity of Liquids

Different liquids have different properties. One of these properties is *viscosity*, the liquid's resistance to flowing. Water, milk, and fruit juice are comparatively thin and flow more easily than thicker, more viscous liquids such as honey, corn syrup, shampoo, or liquid soap.

Viscosity is an important property of drilling fluids. A more viscous fluid is better able to suspend rock cuttings and transport them to the surface. However, more pressure is needed to pump very viscous fluids, resulting in additional wear and tear on the drilling equipment. Viscous fluids are also more difficult to separate from the cuttings.

One way to test the viscosity of a liquid is to see how much time an object takes to sink in it. You can also compare viscosities by comparing the sinking times for different liquids.

Equipment and Materials

To conduct this experiment you will need:

- Water
- Baby oil (or some other easily obtainable light oil)
- Clear or light colored shampoo
- Clear plastic bottle about 444 mL (15 oz) capacity or slightly larger, with tightly fitting cap
- 35 mm film canister or similar small object
- Stopwatch that measures to 0.1 or 0.01 seconds
- Glass marble small enough to fit through the mouth of the bottle
- Permanent marking pen
- Safety goggles
- Chart like the one below to record your results

The Experiment

Here's what to do:

1. On the side of the bottle about 3 cm (1 in) from each end, draw two lines with a permanent marking pen.

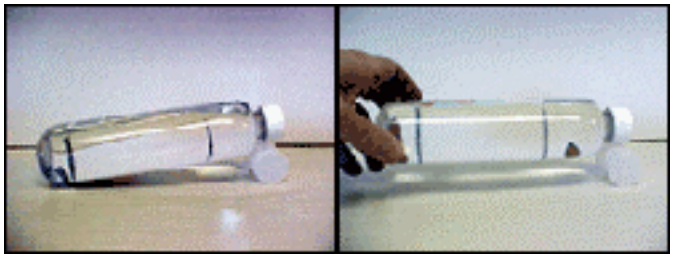
2. Insert a marble in the bottle, fill the bottle to the top with water, and close the cap tightly.

3. Invert the bottle and observe the marble dropping through the water. (It drops very quickly.)

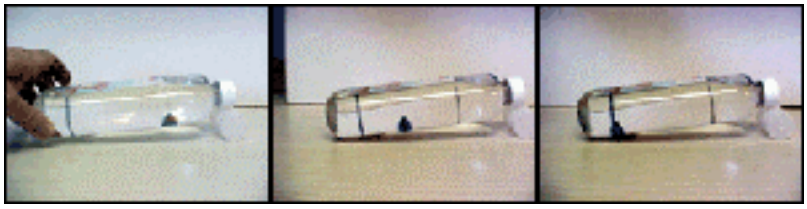
4. With the stopwatch, try to measure the time it takes for the marble to drop from one line on the bottle to the other when you invert it. (This is nearly impossible to do, because the marble drops so quickly. The water is not very viscous.)

5. Let's try another technique. Place the bottle on its side with the cap resting on a film canister or other small object. This makes a gentle ramp for the marble to roll down. If the ramp is not very steep, the marble will roll through the water slowly enough for you to time it.

6. Raise the end of the bottle so that the marble rolls to the cap end.



7. Place the end of the bottle down quickly but gently. Use the stopwatch to measure the time it takes for the marble to roll from one line on the bottle to the other.



8. Record the time in the Water column of the data table opposite Trial 1.

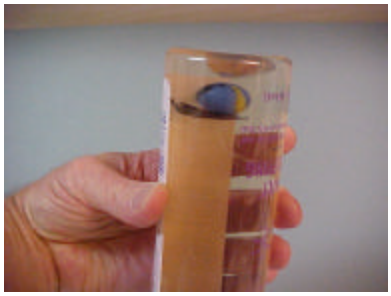
9. Repeat four more times and calculate the average time for the water.

10. Replace the water in the bottle with baby oil. (Or, pour baby oil into an identical bottle with marks in the same places.) Insert a marble and close the cap tightly. Repeat steps #5 through #9 to obtain the results for baby oil.

Time it takes, in seconds, for a marble to roll down a ramp through water and baby oil		
Trial	**Water**	**Baby Oil**
1		
2		
3		
4		
5		
Average Time		

Take a look at **our results.**

11. Optional: For an encounter with a much more viscous liquid, try this experiment with a marble in a bottle of shampoo. Invert the bottle and measure the time it takes for the marble to drop. Depending on the type of shampoo you have, this could take 30 seconds or even more! The shampoo is much more viscous than water. (If you make a gentle ramp with the bottle and let the marble roll down through the shampoo, you might as well get a favorite book to read while you wait! This seems to take forever!)



Viscosity of Liquids
Our Results

We set up a gentle ramp and measured the time it took the marble to roll between the lines in water and then in baby oil.

Time it takes, in seconds, for a marble to roll down a ramp through water and baby oil		
Trial	**Water**	**Baby Oil**
1	**0.9 s**	**1.3 s**
2	**1.0 s**	**1.2 s**
3	**1.0 s**	**1.2 s**
4	**1.0 s**	**1.1 s**
5	**0.9 s**	**1.2 s**
Average Time	**0.96 s**	**1.2 s**

The time for the marble to roll down in the bay oil was greater than the time to roll down the same distance in water. From the data, we see that baby oil has a higher viscosity than water.

Try These Ideas

Here are some additional variations to try. Repeat the experiment using:

- a marble of a different size.

- two other different liquids.

- a taller bottle or a different rolling distance.

Have you wondered what would happen for the same liquid at different temperatures? Good thinking! That's what the Viscosity and Temperature activity is all about. Give it a try! (http://www.seed.slb.com/en/lab/viscosity4/viscosity4.pdf)