Does the air resistance/density of fluids affect the speed in which objects can move through them?

Aim: To analyse the effect of fluid density on the speed at which objects can move through them.

Hypothesis: That the bobby pin will move slower through the salt solution than the normal water due to the increased density of this mixture.

Introduction:

The density of a substance is the relationship between the mass of the substance and how much space it takes up (volume). For example a cubic centimetre of air would be lighter than the same amount of water, this is due to the difference in density as the atoms in water are more tightly packed. Density can be affected by the mass of atoms, their size, and how they are arranged within a material. In this experiment we are attempting to see if the density of a fluid affects the speed at which objects are able to move through them. To test this, two identical glasses were filled with the same amount of either normal tap water or a solution of water and salt. Next a bobby pin was dropped into both solutions and the time it took to sink to the base of the cup was recorded. It was predicted that the greater density of the salt water will result in the pin taking longer to fall to the bottom of the mixture.

Variables:

Plain water/salt water solution (independent variable) on the time it takes for a pin to sink to the bottom of the solution (dependant variable)

Method:

Materials

- 800mL of water
- Two equal sized glasses (cups, jars, containers, etc.)
- 3 tbsp. of salt
- 2 bobby pins
- A teaspoon
- Stopwatch

Procedure

1. Both glasses were filled with 400mL of water each.
2. In one of the glasses 3 tbsp. of salt was added, this solution was then mixed until the salt dissolved.
3. The amount of time it took for a bobby pin to sink to the bottom of each solution was recorded using a stopwatch.
4. Step 3 was repeated 6 times for each solution, and a teaspoon was used to remove the bobby pin from the glass after each trial.

Results:

Solution	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Average
Salt water	0.72sec	0.8sec	0.58sec	0.6sec	0.58sec	0.64sec	0.653sec
Tap water	0.53sec	0.48sec	0.68sec	0.71sec	0.5sec	0.68sec	0.596sec

This table displays the recorded times that it took for the bobby pin to sink to the bottom of the cup in both the salty and salt-free solutions. After 6 trials the average time it took for the pin to reach the bottom of the salt water was 0.653 seconds whilst in the tap water solution the average time was 0.596 seconds.

Discussion:

It was initially assumed that the bobby pin would move slower through the salt solution due to the increased density of this mixture. Through testing this hypothesis was proven to be correct. It was found that after 6 trails the average time for the salt water was 0.653 seconds whilst in the tap water solution the average time was 0.596 seconds. However this was measured using a stopwatch which can be seen in the varying times that were recorded. It is likely that this method would have been quite unreliable and sensitive to human error. Future experimenters should aim to repeat this experiment with more accurate forms of measurement (using more advanced technology), and could also apply this theory to liquids that have an even higher density so the difference in results is more obvious. In conclusion the hypothesis was supported overall but there is a high probability that this was down to chance due to the unreliable way in which results were collected.

References:

Universe Today. 2016. *What Is Air Resistance? - Universe Today*. [ONLINE] Available at: http://www.universetoday.com/73315/what-is-air-resistance/. [Accessed 21 October 2016].

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