CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

33710

Project Title

The Effects of Vibrational Force on Dilatants

Abstract

Objectives/Goals

The goal of this experiment is to see how vibrational force affects the properties of dilatant fluids and how the effects can be implicated in new technology.

Methods/Materials

This experiment will be testing two dilatant fluids called oobleck and ethylene glycol by inducing vibrations into the fluids. The proposed experiment begins by making oobleck out of cornstarch and water and obtaining 1 1/2 cup of ethylene glycol. A speaker will be connected to a TV amplifier and a frequency change kit. Pour the fluid into the speaker, and make sure that all variables are kept controlled except the frequency of the vibration. Using the frequency kit, measure how long a ruler takes to sink to the bottom of the speaker (4 inches) at every 300 Hz all the way to a maximum of 1800 Hz. The time it takes for the ruler to sink is indirectly measuring the viscosity of the fluid at each frequency level. Test each frequency several times from 300-1800 Hz for the fluid, and repeat procedure for the second fluid. Record and graph all measurements taken.

Results

An analysis of the results shows a positive correlation between the the frequency of the vibration and the time of the ruler. As the frequency was moved higher and higher, the viscosity of the fluid increased to the point where the ruler took almost 13 seconds to sink in a four-inch depth. Faraday waves were present during the experiment and a viscosity change could clearly be seen. The viscosity of the fluid stopped increasing after 1800 Hz, and results recorded with a frequency of below 300 Hz were not valid enough to be recorded.

Conclusions/Discussion

It can be concluded that vibrational force does increase a dilatant fluid's viscosity, as the time of the ruler shows. Between 0 and 1800 Hz, there was an 8 second increase in time, a huge increase compared to the small change in the frequency. From analyzing, dilatants probably form hydro-clusters from the vibrations as resistance, so the clusters increase the viscosity. This unique property can be widely used in modern industry development, such as an liner for pipes to resist pressure, shock resistance for a variety of vehicles, hydraulic pressure buffers, and even as possible bulletproof resistance armor for combat. Uses of dilatant fluids are still hypothetical but are being widely experiment by industrial companies.

Summary Statement

Dilatant fluids have previously almost no use in the industry; this project will see how vibrational force affects dilatants and how this concept can be used.

Help Received

Awknowledgements go to my father for providing the right supplies and assistance for constructing the frequency kit.