Name(s)

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Project Number

J0801

Project Title

Sending Sound Waves through Citrullus lanatus as a Model for Hidden Tunnel Detection

Abstract

Objectives/Goals

The objective was to determine whether sound waves could detect secret tunnels and sinkholes in the ground. Watermelons were used as a model of the ground, and holes represented tunnels. I hypothesized a 15,000 Hz sound wave would be able to detect holes with a 22.8 to 240 millimeters width.

Methods/Materials

Materials needed include watermelons, a sound resistant box lined with bedding foam, a knife with a 2 cm wide blade, a wooden spoon, a support rod, a 1/2 inch PVC pipe x 77.5 cm length, a 1.8 cm diameter steel ball, and a magnetic rod. A computer containing the application, Audacity and two Apple products (preferably an iPhone and iPad) containing the speaker application, Tone Generator and the microphone applications, Voice Memos and Soundbeam, are also required.

306 Hz, 500 Hz, 5,000 Hz, 10,000 Hz, and 15,000 Hz sound waves were sent through the same watermelon with selected hole sizes (2 cm x 4 cm x 11.5 cm, 2 cm x 6 cm x 11.5 cm, and 8 cm x 6 cm x 11.5 cm) to search for a pattern or a difference. The same procedure was performed for knocking the watermelon with a spoon, a fist, and dropping a steel ball at a set location. Each test was recorded through three different microphone software.

Results

The data collected showed no correlation for change in amplitudes vs. hole sizes. There was a decreasing shift of peak frequency for knocking tests from the unaltered watermelon to one after a hole was made. There was a change of waveform for the 500 Hz and ball drop tests that could be seen in all the watermelon after any hole was made. The higher the density of the watermelon, the larger the drop of peak frequency when a hole was made (for spoon knocking data).

Conclusions/Discussion

Due to inadequate microphone and data acquisition sampling rates, no clear evidence was found at 15,000 Hz. To my surprise, the lower frequencies and the knocking tests were able to detect the holes. The data greatly supported the main objective. The results proved that a hole can be detected by sound waves in a watermelon. The data did show that the project is plausible to perform in real life using sound to detect tunnels in the ground.

Summary Statement

I sent sound waves through watermelons with cut-out cavities in them, as a model for a novel method for the detection of underground tunnels.

Help Received

My parents helped glue the board; Sarah Rines (my science teacher) provided science fair advice.