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STUDENT VERSION

Slime Spread

Brian Winkel, Director, SIMIODE
Clhardon OH 44024USA
BrianWinkel@simiode.org

Abstract: We offer a video [2] showing real time spread of a cylinder of slime and challenge students to build a mathematical model for this phenomenon.

SCENARIO DESCRIPTION

Inspired by the article [1] we decided to see if we could model the spread of slime.

We found a recipe (among oh so many!) for making slime on the Internet (see the Appendix below for details) and set out a "cylinder" of slime on a polar graph paper grid. In a video we made and posted on YouTube [2] we enable the viewer to see the radii of the slowly expanding circular "puddle" or "glob" of slime using a cookie cutter mold to hold the cylinder of slime in place until initial release of the slime disk.

Here, we offer the opportunity to create several models, truly empirical models based on shape and empirical models based on "behavior," but none of these models are really based on first principles of physics. We further encourage differential equations models in which the rate of growth of the area of the "glob" is modeled.

We collected the data in a 65 degree Fahrenheit room using an iPad 4 and Time Lapse Video feature and made a video [2] of the phenomena which we posted on YouTube. We turned out a 1/4 cup (or 59.14 cm^3) measuring cup's worth of slime in the form of a cylinder and videoed its spread on a polar plot graph paper.

We present a screen shot of the video [2] in Figure 1.

In the video the time in the lower left is on an iPhone. We read off the radius of the approximate circle on the tick marked axis on the polar grid lines to the right of the slime "puddle." The original amount of slime was approximately 1/4 cup or 59.14 cm^3.

Data Collected from the resulting mp4 movie SlimeSpread [2] which can be played with most media player software was made with home made slime using a cookie cutter mold to hold until

Figure 1. Screen shot of paused video [2] of spread of slime for collecting data with which to compare a modeling result.

release of the slime disk. The data we collected is offered in Table 1 in the form of time in seconds (s) and area of the slime circle (estimated from the radius using the tick marked axis on the polar grid lines) in centimeters (cm^2).

We offer a plot of the data in Figure 2 to give the reader some idea of the process of the spread of slime. Notice how the growth slows down as time goes by.

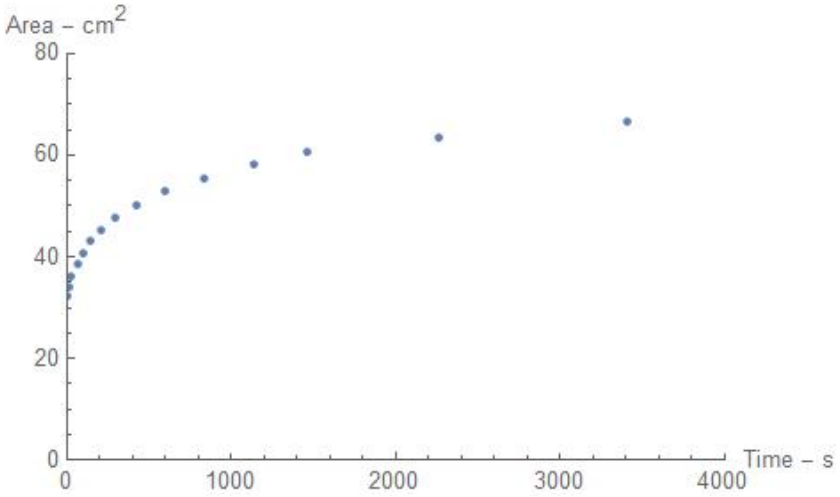

Figure 2. Plot of the collected data from the Spread of Slime video [2].

Time (s)	Area (cm^2)
0.	32.1699
7.954	34.2119
23.884	36.3168
59.979	38.4845
95.973	40.715
144.016	43.0084
203.952	45.3646
295.954	47.7836
419.936	50.2655
591.95	52.8102
832.519	55.4177
1140.52	58.088
1459.48	60.8212
2258.49	63.6173
3406.46	66.4761

Table 1. Data collected from the Spread of Slime video [2].

APPENDIX - VIDEO DESCRIPTION

We present here the description offered for the SlimeSpread Video on YouTube[2].

Here we present a video of the Spread of Slime for the collection of data in an attempt to model the spread of slime using a differential equation or empirical model.

We collected the data in a 65 degree Fahrenheit room using an iPad 4 and Tome Lapse Video feature. We turned out a 1/4 cup measuring cup's worth of slime in the form of a cylinder and videoed its spread on a polar plot graph paper whose length units are in cm.

The time in the lower left is on an iPhone. We read off the radius of the approximate circle on the tick marked axis on the polar grid lines to the right of the slime "puddle."

The original amount of slime was approximately 1/4 cup or 59.14 cm^3.

Here is a sample of the data we obtained in (time, and right hand radius read) format:

data = {(1.959, 3.2), (9.913, 3.3), (25.843, 3.4), (61.938, 3.5), (97.932, 3.6), (145.975, 3.7), (205.911, 3.8), (297.913, 3.9), (421.895, 4.0), (593.909, 4.1), (834.478, 4.2), (1142.476, 4.3), (1461.437, 4.4), (2260.446, 4.5), (3408.416, 4.6)}.

Time is measured in seconds and radius is measured in cm.

Recipe for slime used in this video

4 oz Elmer's glue

1 tsp laundry borax

3/4 cup of water

food coloring

Dissolve the laundry borax in 1/4 cup of water. Combine the food coloring, glue, and 1/2 cup of water in a bowl. Stir in the borax solution. The mixture will congeal immediately. Drain off any excess water and store slime in a sealed container. The slime will last for at least a week in the refrigerator, but will lose moisture with time and handling. Actually in sealed jar it lasts for months!

REFERENCES

[1] Single, R. 1999. Difference Quotients, Derivatives, and Data Modeling with Slime. *PRIMUS*. 9(3): 279-288.

[2] SlimeSpread. 2018. Video of Spread of Slime. https://www.youtube.com/watch?v=Bvx1Et2Sg_w. Accessed 19 May 2020.