Dilatancy Phenomenon

Summer STEM Project 2019
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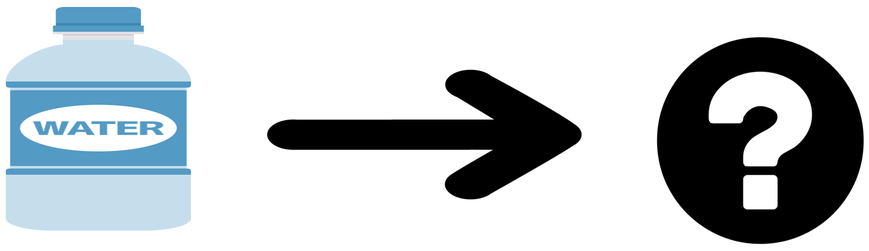
~ Introduction ~

Dilatancy is the volume change observed in granular materials when they are subjected to sheer deformations.
I read a book about Dilatancy Phenomenon before. At that moment I decided to research it.
I wanted to check the Golden ratio and to check what happens if the conditions are changed.

Hypothesis



I think liquids can only mix with water because oil does not mix with it.

and

I think the Golden ratio will be 10:13 because I think 10:10 will be too little and 10:15 will be too big.

Golden ratio

・water100ml ・starch10ml	water:starch(ml)
	10:01 ×
	10:02 ×
	・ ・
	・ ・
	・ ・
	10:15 ○
	10:16 ○
	10:17 ◎
	10:18 ○
	・ ・
	10:20 △
	10:21 △
	10:22 ×
	・ ・
	・ ・
	・ ・

Experimental method

1. Put 100ml water in a container.
2. Add 10ml of starch.
3. Mix and check.
4. Repeat steps 2 and 3 until dilatancy happens.

Result

×…No dilatancy
△…Hardened by weak force
○… Dilatancy was made
◎… Golden ratio

Turn water into another liquid

Orange juise		Tea		Oil	
10:01	×	10:01	×	10:01	×
10:02	×	10:02	×	10:02	×
・	・	・	・	10:03	×
・	・	・	・	10:04	×
・	・	・	・	10:05	×
10:17	○	10:14	△	・	・
10:18	○	10:15	○	・	・
10:19	◎	10:16	◎	10:15	×
10:20	○	10:17	○	10:16	×
10:21	×	10:18	×	10:17	×
10:22	×	10:19	×	・	・
・	・	・	・	・	・
・	・	・	・	・	・
・	・	・	・		
Soy sause		Milk		Sparking water	
10:01	×	10:01	×	10:01	×
10:02	×	10:02	×	10:02	×
・	・	・	・	・	・
・	・	・	・	・	・
・	・	・	・	・	・
10:16	△	10:18	△	10:15	○
10:17	○	10:19	△	10:16	○
10:18	◎	10:20	○	10:17	△
10:19	○	10:21	○	10:18	×
10:20	△	10:22	×	10:19	×
10:21	×	・	・	・	・
・	×	・	・	・	・
・	・	・	・	・	・
・	・				
・	・				

- Dilatancy phenomenon was not seen in oil.
- Dilatancy phenomenon was observed in Orange juice, Tea, Soy sauce, Milk, and Sparkling water.
- Dilatancy phenomenon was best seen in orange juice.
- Milk and Sparkling water did not show the Dilatancy phenomenon well.
- Most liquids have a best Dilatancy phenomenon ratio of 10:15.

Discussion

Conditions for seeing the Dilatancy phenomenon:

- Liquid contains water.
- Liquid does not contain oil.
- Water and oil do not mix with starch because they repel each other.

Impressions

I'm glad I tried this experiment and it was fun. I want to try various experiments in the future.

https://www.ed.tus.ac.jp/~kaken/column/001_dilatancy.html
https://www.ctv.co.jp/hapiene/program/20180331/index.html