Problem No.25- Piles of Powder
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Problem statement

A **powder** of your choice is poured onto a table, e.g. through a tube or a funnel. Investigate how the **height** of the pile depends on time. Investigate how the **shape** of the pile depends on time.

Theory - What is a powder?

A **powder** is a dry, bulk solid composed of many very fine particles that may flow freely when shaken or tilted. Powders are a special subclass of granular materials**.** Also, the **crystalline structure** of the powders should be mentioned in the theory as an important feature that will probably affect the final result.

Hypotheses

1. The thicker the granules of the powder, the more it spreads when falling

2. The bigger the diameter of the beaker, the faster it falls

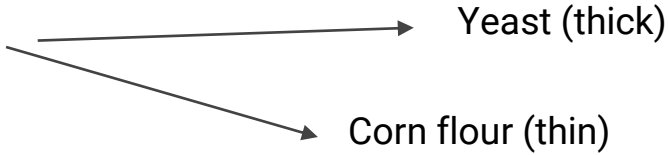
3. the bigger the height we drop the powder from,, the more it spreads

Parameters tested and constants

Height that we let the powder fall

Diameter of the test tube that contains the powder

Kind of the powder and its mass



Temperature, Humidity and the surface of the table kept stable

Experimental Setup

We used:

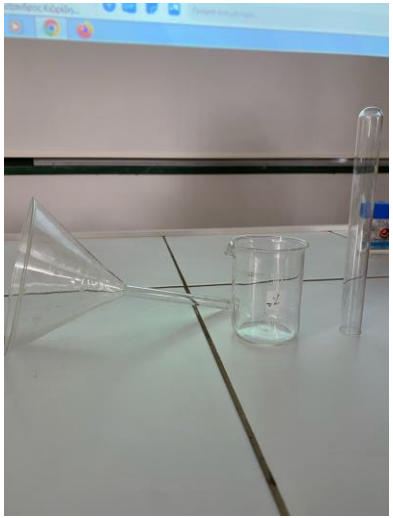
- Yeast and corn flour as powders (3gr every time)
- A test tube and a beaker (1.5 and 5.2 diameter)
- A scale
- A ruler to measure the height (8 and 30 cm)

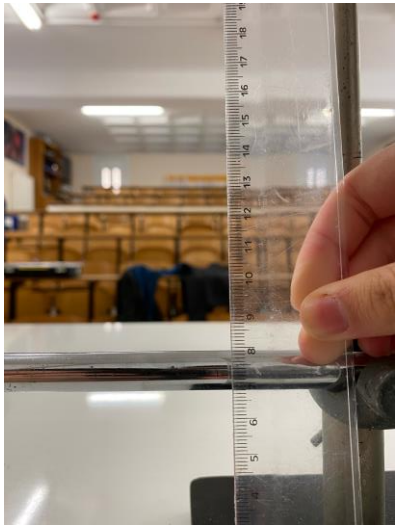
All the experiments we conducted

1. 3gr yeast, 30 cm height, tube
2. 3gr yeast, 8cm height, tube
3. 3gr yeast, 30cm height, beaker
4. 3gr yeast, 8cm height, beaker
5. 3gr corn flour, 30cm height, tube
6. 3gr corn flour, 8cm height, tube
7. 3gr corn flour, 30cm height, beaker
8. 3gr corn flour, 30cm height, beaker

Experimental Procedure 1

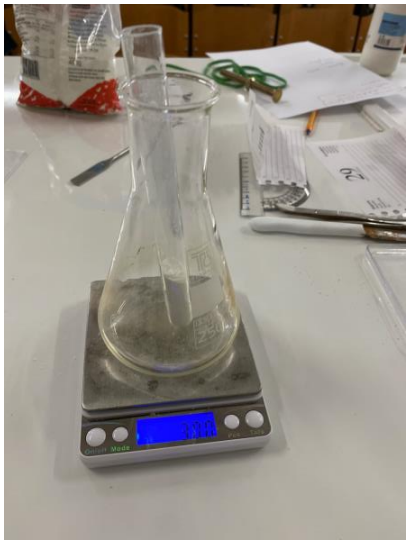
We used a tunnel of diameter equal to 1.5 cm and we dropped it from 30cm. The time of the fall was 2.17 sec while no height of pile was observable. The powder used for the first experiment was the yeast and no height of the pile was observable.



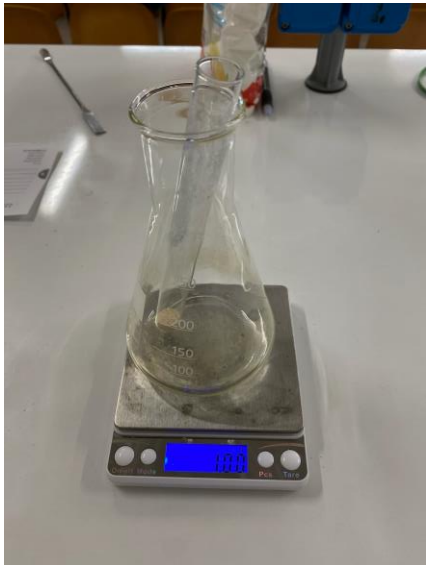


Experimental procedure 2

We used the same tunnel with the powder to be the yeast equal to 3 gr. The time of the fall was equal to 1,17 sec from a height of 8cm. Again, no height was observable.

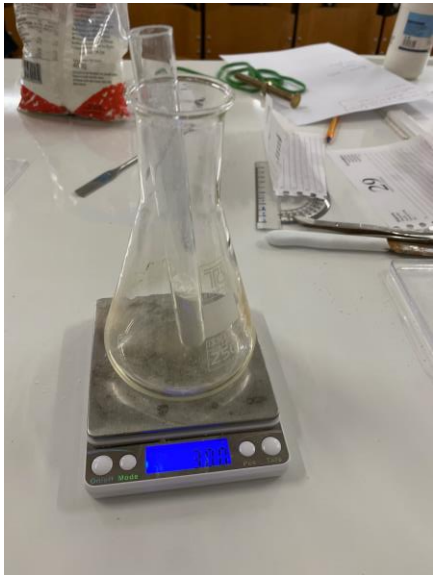


Experimental procedure 3 & 4



- For this experimental procedure we used the same tunnel and powder, however we let the tunnel from a height equal to 8 cm. The time of the fall was equal to 1,74 sec. The powder was the same and no height of pile was observable again.
- With the same tunnel using yeast equal to 1gr from the same height we observed no height again.

Experimental procedure 5&6



- In this experiment we used a tunnel with a diameter equal to 1,5 cm using Corn Flour this time equal to 3gr from a height equal to 8cm. The time of the fall was equal to 2,3s.This time the height was observable.
- As a second part of this procedure we used the same tunnel and substance but this time from a height equal to 30cm. This time the height of the pile was smaller than the previous one.

Experimental procedure 7&8

- In this experimental procedure we used a tunnel of 3gr with a diameter equal to 5,2cm and we dropped the powder - yeast- from a height of 30cm. The tie of the fall was 0.775sec. The height was observable.
- The difference in the second part of this experimental procedure was that the same substance (Corn Flour) was dropped from a height of 8cm. The total time of the fall was 0.8sec. The height of the pile seemed to be the bigger from the previous height.

Hypotheses/Conclusions

1. The thicker the granules of the powder, the more it spreads when falling

CONFIRMED

the yeast spread more than the corn flour

2. The bigger the diameter of the beaker, the faster it falls

CONFIRMED

the powders fell faster when we used the beaker than when we used the tube

3. the higher we drop the powder from, the more it spreads

CONFIRMED

when we dropped the powders from 30cm, they spread more

Appendix-Possible errors

1) Hygroscopancy of the materials.

2)The way we let the tunnels.

- Both temperature and humidity were being observed by an arduino microcontroller (sensor : DTH 22)

Bibliography

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http://www.thefreshloaf.com/node/22131/density-instant-dry-yeast

https://www.sciencedirect.com/topics/engineering/friction-pile

https://en.wikipedia.org/wiki/Powder

Thank you for your attention!

Report, **Team Fryganiotis GR**
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