LAB REPORT

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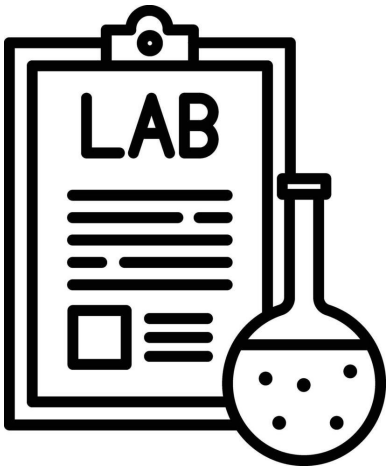


Quick Note:
In our lab report we only added things that were relevant to our experiment we conducted like observations, variables, materials, etc. This does not contain me and my partners full work. If you would like to see our full work that includes our hypothesis and background research alongside much more please refer to our logbook!

Logbook:
https://docs.google.com/document/d/1wFFXvJzpl42PJl6xXmxpOzJO7SQ5-kKhtOp0uYF14tw/edit?usp=sharing

Variables:

Controlled -
Our controlled variables for this experiment include: the type of yeast we use (red star active yeast), the graduated cylinders we use, the same environment for the growth to occur, water temperature, oxygen exposure, amount of natural substance added, the time for the yeast to grow, amount of sugar that was added for each trial 5g (this is just how much sugar we added to each graduated cylinder not the amount of sugar in each natural substance), light exposure,and the same mixing methods

Manipulated-
The manipulated variables in this experiment include: the type of natural substance added. For example, yeast growth was tested with the addition of substances like green tea, vinegar, honey, lemon juice, and baking powder. By changing only the identity of the substances while keeping all other conditions the same, the experiment will be able to show the noticeable effect that each substance had on yeast growth.

Responding -
The responding variables in this experiment include: how much the yeast grows/ foams . Firstly, we will measure the vertical growth of the yeast to find the amount of growth in height. Secondly, we will also find the mass of the yeast by weighing the final weight of the yeast in the graduated cylinder after each trial.

Uncontrolled -
Our uncontrolled variables for this experiment include: small changes in the room temperature,the fact that one of the natural substances was a different state of matter and that it was a solid (baking powder), slight differences in air circulation, measurement errors when pouring liquids in the graduated cylinders alongside yeast as there is no way to get perfect

measurements, minor differences in yeast activity between samples, and the evaporation of liquid over time (the 60 minutes we took to do our trial). We tried our best to reduce the impact of these uncontrollable circumstances and their impact on our results.

Materials

- Red star active dry yeast
- Warm water (35 degrees Celsius) (900ml or 0.9 liters)
- Sugar (5g per trial, 90 grams total)
- Thermometer (measure the water's temperature)
- Green tea
- Vinegar
- Honey
- Lemon juice
- Baking powder solution
- Graduated cylinders
- Stirring sticks or spoons
- Timer
- Labels or sticky notes
- Marker
- Paper towels
- Notebook or data table sheet
- Ruler
- Photography device

Procedure

1. Label all graduated cylinders with the respective natural substances (3 each). Include 3 separate natural substances at all..
2. Get the liquids and natural substances that you need: warm water (35 degrees Celsius), brew green tea and prepare the control sample, which will just have yeast, sugar, and water. (35 degrees Celsius), measure vinegar, lemon juice,baking powder and honey (try to keep the temperature consistent).
3. Pour 50 ml of warm water into each graduated cylinder, including the control graduated cylinders, to give all yeast the same conditions to start off.
4. Add 5g of sugar to each graduated cylinder and stir gently. (Sugar provides energy for the yeast to grow and produce foam).
5. Add the natural substances to each of the respective labeled graduated cylinders. Do not add anything to the control graduated cylinders.(Add 15 ml of each natural substance.)
6. Place all the graduated cylinders in the same warm location (30-35 degrees Celsius) to ensure the yeast grows at a similar rate with the same conditions
7. Add 1 gram of yeast to every graduated cylinder and stir gently. Start your stopwatch for the test.
8. Perform 3 trials for each natural substance, and try to keep conditions the same for each trial. These conditions include the temperature of the water, location of the graduated cylinders during testing, and the amount of substance added.
9. Measure the foam height for each of the natural substances at 0, 5, 10, 15, 30, 45, and 60 minutes using the built in measurements on the graduated cylinder.
10. Record observations for each of the graduated cylinders, such as foam height, bubbles, colour, smell, and any contamination or formation of bacteria. Take photos if possible.
11. At 60 minutes, record the final foam height for each of the individual trials.
12. Calculate the average foam height for each natural substance by adding the results of each of the three trials and dividing by three. Also, do this for the control graduated cylinders
13. Measure and record the mass of each of the graduated cylinders and note it down, as well as the average.

Observations Baking Powder Trial 1

When we added the baking powder to its respective graduated cylinder we already noticed that the baking powder had already reacted with the water and sugar producing foam and bubbles.

0 minutes
The height of the yeast when added to the baking powder solution rose to 59 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes

The height of the yeast after being added to the baking powder solution rose to 60 ml in 5 minutes. (Bubble formation occurred and the top of the solution started to form a light brown substance)

10 minutes
The height of the yeast after being added to the baking powder solution rose to 64 ml in 10 minutes. (More bubbles formed)

15 minutes
The height of the yeast after being added to the baking powder solution rose to 69 ml in 15 minutes. (at the bottom of the graduated cylinder there was baking powder and at the top the yeast had started to grow and foam to create a semi-solid substance at the top.)

30 minutes
The height of the yeast after being added to the baking powder solution rose to 71.5 ml in 30 minutes. (The foam started to expand more)

45 minutes
The height of the yeast after being added to the baking powder solution rose to 72 ml in 45 minutes. (More layers of foam began to form)

60 minutes
The height of the yeast after being added to the baking powder solution rose to 78 ml in 60 minutes. (the foaming continued until the solution rose to 78ml)

Final mass of baking powder - 194.50 grams

Observations Baking Powder Trial 2

0 minutes
The height of the yeast when added to the baking powder solution rose to 60 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes
The height of the yeast after being added to the baking powder solution rose to 62 ml in 5 minutes. (Visible bubble formation began to occur near the surface)

10 minutes
The height of the yeast after being added to the baking powder solution rose to 65 ml in 10 minutes. (More bubbles formed)

15 minutes

The height of the yeast after being added to the baking powder solution rose to 65 ml in 15 minutes. (A thin layer of foam became visible at the top.)

30 minutes
The height of the yeast after being added to the baking powder solution rose to 68 ml in 30 minutes. (visible foam expansion occurred)

45 minutes
The height of the yeast after being added to the baking powder solution rose to 70 ml in 45 minutes. (uneven layers of foam were beginning to be produced.)

60 minutes
The height of the yeast after being added to the baking powder solution rose to 74 ml in 60 minutes. (large amount of foam growth and rise in height)

Final mass of baking powder - 192.84 grams

Observations Baking Powder Trial 3

0 minutes
The height of the yeast when added to the baking powder solution rose to 56 ml at 0 minutes. (The solution seemed more opaque compared to previous trials and turned into a light brown colour)

5 minutes
The height of the yeast after being added to the baking powder solution rose to 56 ml in 5 minutes. (No visible change in the solution)

10 minutes
The height of the yeast after being added to the baking powder solution rose to 58 ml in 10 minutes. (slowly bubbles were forming)

15 minutes
The height of the yeast after being added to the baking powder solution rose to 60 ml in 15 minutes. (bubbles and foam started to gather at the top)

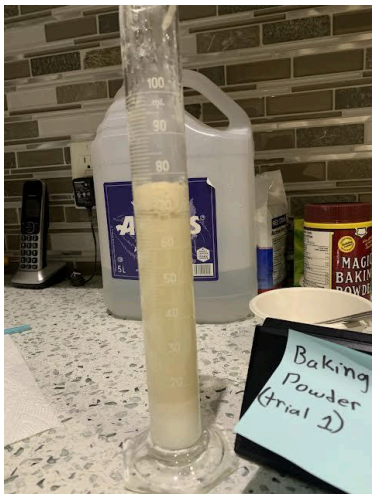
30 minutes
The height of the yeast after being added to the baking powder solution rose to 63 ml in 30 minutes. (weak patches of foam started to form)

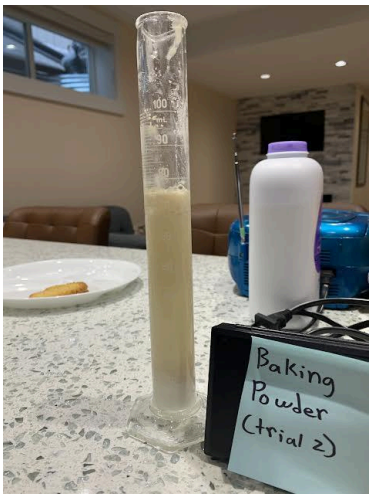
45 minutes

The height of the yeast after being added to the baking powder solution rose to 69 ml in 45 minutes. (sudden foam expansion was happening)

60 minutes
The height of the yeast after being added to the baking powder solution rose to 73 ml in 60 minutes. (moderate but uneven foam growth in the last 15 minutes)

Final mass of baking powder - 191.66 grams





Observation Control Trial 1

0 minutes
The height of the yeast when added to the control solution rose to 53 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes
The height of the yeast after being added to the control solution rose to 54 ml in 5 minutes. (The top of the solution started to form a light brown substance.)

10 minutes
The height of the yeast after being added to the control solution rose to 54 ml in 10 minutes (small amounts of bubbles started to form)

15 minutes
The height of the yeast after being added to the control solution rose to 57 ml in 15 minutes. (more bubble formation started to occur and the substance started to rise.)

30 minutes
The height of the yeast after being added to the control solution rose to 62 ml in 30 minutes. (

more bubble formation started to occur and on the side of the graduated cylinder bubbles were forming)

45 minutes
The height of the yeast after being added to the control solution rose to 71 ml in 45 minutes. (foam started to form)

60 minutes
The height of the yeast after being added to the control solution rose to 71.5 ml in 60 minutes. (foam gradually increased)

Final mass of controlled - 186.38 grams

Observation Control Trial 2

0 minutes
The height of the yeast when added to the control solution rose to 54 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes
The height of the yeast after being added to the control solution rose to 55 ml in 5 minutes. (A thin light brown layer started to form on the top.)

10 minutes
The height of the yeast after being added to the control solution rose to 56 ml in 10 minutes (bubbles began to rise through the solution)

15 minutes
The height of the yeast after being added to the control solution rose to 56 ml in 15 minutes. (more bubbles began to form throughout the solution)

30 minutes
The height of the yeast after being added to the control solution rose to 59 ml in 30 minutes. (foaming began to occur at the top of the solution)

45 minutes
The height of the yeast after being added to the control solution rose to 63 ml in 45 minutes. (small layers of foam began to start forming on the top)

60 minutes
The height of the yeast after being added to the control solution rose to 66 ml in 60 minutes. (foam slowly increased)

Final mass of controlled - 184.92 grams

Observation Control Trial 3

0 minutes
The height of the yeast when added to the control solution rose to 55 ml at 0 minutes. (The yeast mixed with the water and turned the solution into a light brown colour)

5 minutes
The height of the yeast after being added to the control solution rose to 56 ml in 5 minutes. (A few small bubbles started to cling to the side)

10 minutes
The height of the yeast after being added to the control solution rose to 56 ml in 10 minutes (more bubbles were being formed)

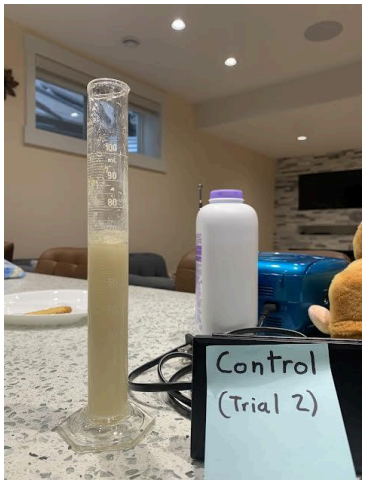
15 minutes
The height of the yeast after being added to the control solution rose to 57 ml in 15 minutes. (Thin layers of foam were being noticed)

30 minutes
The height of the yeast after being added to the control solution rose to 50 ml in 30 minutes. (there was steady but slow foam formation)

45 minutes
The height of the yeast after being added to the control solution rose to 64 ml in 45 minutes. (more foam was forming)

60 minutes
The height of the yeast after being added to the control solution rose to 67 ml in 60 minutes. (foam was slowly increasing in very small amounts)

Final mass of controlled - 185.21 grams



Observations Honey Trial 1

0 minutes
The height of the yeast when added to the honey solution was 67 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes
The height of the yeast after being added to the honey solution was 68 ml in 5 minutes. (the yeast and water mixed together and most of the honey was still sitting at the bottom and the top of the solution started to form a light brown substance.)

10 minutes
The height of the yeast after being added to the honey solution was 68 ml in 10 minutes. (The honey started to mix with the yeast and water and the colour started to become darker.)

15 minutes
The height of the yeast after being added to the honey solution was 68 ml in 15 minutes. (The honey started to mix with the yeast and water and the colour started to become darker.)

30 minutes
The height of the yeast after being added to the honey solution was 68 ml in 30 minutes. (The honey was still sitting at the bottom and the dark brown yeast solution was on top.)

45 minutes
The height of the yeast after being added to the honey solution was 72 ml in 45 minutes. (At the top the yeast had started to grow and foam to create a semi-solid substance at the top.)

60 minutes
The height of the yeast after being added to the honey solution was 79 ml in 60 minutes. (

Intense foaming for the honey solution and dark brown colour for the final result)

Final mass of honey - 196.37 grams

Observations Honey Trial 2

0 minutes
The height of the yeast when added to the honey solution was 66 ml at 0 minutes. (the yeast powder mixed with the water and the solutions colour changed to light brown)

5 minutes
The height of the yeast after being added to the honey solution was 67 ml in 5 minutes. (the yeast and water mixed together and most of the honey was still sitting at the bottom and the colour started to become darker in shade.)

10 minutes
The height of the yeast after being added to the honey solution was 67 ml in 10 minutes. (The honey still was at the bottom and the yeast started to mix with the honey)

15 minutes
The height of the yeast after being added to the honey solution was 67 ml in 15 minutes. (most of the honey still settled at the bottom as it was slowly mixing with the yeast.)

30 minutes
The height of the yeast after being added to the honey solution was 69 ml in 30 minutes. (the honey started mixing more thoroughly with the solution.)

45 minutes
The height of the yeast after being added to the honey solution was 73 ml in 45 minutes. (the honey started to form foam exponentially creating a thick layer at the top.)

60 minutes
The height of the yeast after being added to the honey solution was 81 ml in 60 minutes. (Intense foaming for the honey solution and dark brown colour for the final result)

Final mass of honey - 198.05 grams

Observations Honey Trial 3

0 minutes
The height of the yeast when added to the honey solution was 63 ml at 0 minutes. (the yeast powder mixed with the water and the solution's colour changed to light brown and the honey

instantly settled at the bottom.)

5 minutes
The height of the yeast after being added to the honey solution was 64 ml in 5 minutes. (Thin layers of foam began to form on top of the surface.)

10 minutes
The height of the yeast after being added to the honey solution was 66 ml in 10 minutes. (The solution started to mix with the honey and foam was settling on the surface)

15 minutes
The height of the yeast after being added to the honey solution was 70 ml in 15 minutes. (The foam rose up to 70 ml and then settled down at 68ml)

30 minutes
The height of the yeast after being added to the honey solution was 68 ml in 30 minutes. (the foam collapsed but the foam was still growing)

45 minutes
The height of the yeast after being added to the honey solution was 72 ml in 45 minutes. (more dense foam was starting to form at the surface)

60 minutes
The height of the yeast after being added to the honey solution was 77 ml in 60 minutes. (thick foam formation in the last 15 minutes)

Final mass of honey - 195.48 grams

Observation Lemon Juice Trial 1

0 minutes
The height of the yeast when added to the lemon juice solution rose to 65 ml at 0 minutes. (The lemon juice solution was blurry and half of the yeast floated at the surface and half of it settles at the bottom)

5 minutes
The height of the yeast when added to the lemon juice solution rose to 66 ml in 5 minutes. (More of the yeast powder was rising to the top)

10 minutes
The height of the yeast after being added to the lemon juice solution rose to 67 ml in 10 minutes.(patches of of white started to become visible on the top of the substance)

15 minutes
The height of the yeast after being added to the lemon juice solution rose to 68.5 ml in 15 minutes. (Thin layers of foam began to form)

30 minutes
The height of the yeast after being added to the lemon juice solution rose to 69 ml in 30 minutes. (Thin layers of foam began to form)

45 minutes
The height of the yeast after being added to the lemon juice solution rose to 70 ml in 45 minutes. (some more thin layers of yeast began to form)

60 minutes
The height of the yeast after being added to the lemon juice solution rose to 70 ml in 60 minutes. (no change)

Final mass of lemon juice - 188.42 grams

Observation Lemon Juice Trial 2

0 minutes
The height of the yeast when added to the lemon juice solution rose to 65 ml at 0 minutes. (The solution appeared cloudy and most of the yeast settled quickly at the bottom.)

5 minutes

The height of the yeast when added to the lemon juice solution rose to 65 ml in 5 minutes. (No visible change in the solution)

10 minutes
The height of the yeast after being added to the lemon juice solution rose to 66 ml in 10 minutes.(Faint white specks began to form on the surface)

15 minutes
The height of the yeast after being added to the lemon juice solution rose to 67 ml in 15 minutes. (Very thin layer of foam began to form)

30 minutes
The height of the yeast after being added to the lemon juice solution rose to 67 ml in 30 minutes. (Thin layers of foam formed but collapsed)

45 minutes
The height of the yeast after being added to the lemon juice solution rose to 67 ml in 45 minutes. (Minimal change and no significant foam formation)

60 minutes
The height of the yeast after being added to the lemon juice solution rose to 68 ml in 60 minutes. (Foam was present but only in a few thin layers)

Final mass of lemon juice - 187.90 grams

Observation Lemon Juice Trial 3

0 minutes
The height of the yeast when added to the lemon juice solution rose to 65 ml at 0 minutes. (The solution seemed very cloudy and the yeast instantly settled at the bottom)

5 minutes
The height of the yeast when added to the lemon juice solution rose to 65 ml in 5 minutes. (No visible change)

10 minutes
The height of the yeast after being added to the lemon juice solution rose to 65.5 ml in 10 minutes.(Bubbles began to form on the top)

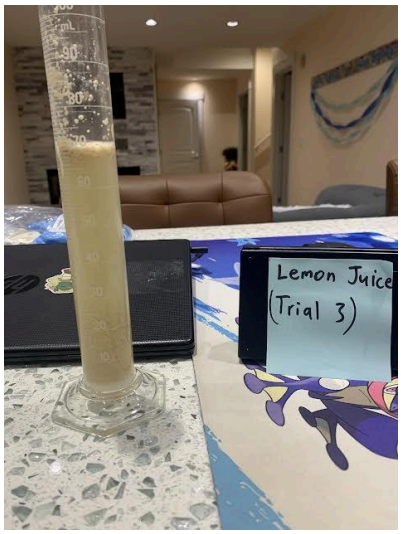
15 minutes
The height of the yeast after being added to the lemon juice solution rose to 67 ml in 15 minutes. (A few patches of foam were forming at the sides)

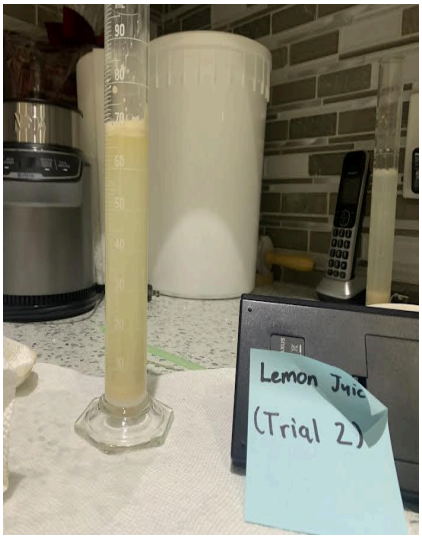
30 minutes
The height of the yeast after being added to the lemon juice solution rose to 66 ml in 30 minutes. (No major change and a few patches of foam were still attached to the side)

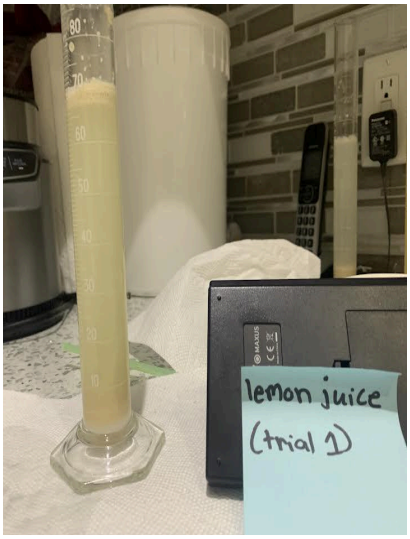
45 minutes
The height of the yeast after being added to the lemon juice solution rose to 66 ml in 45 minutes. (No visible change)

60 minutes
The height of the yeast after being added to the lemon juice solution rose to 66.5 ml in 60 minutes. (No foam formation except for a few patches on the side)

Final mass of lemon juice - 189.67 grams







Observations Vinegar Trial 1

0 minutes
The height of the yeast when added to the vinegar solution rose to 65 ml at 0 minutes. (The yeast powder mixed with the vinegar and changed to a more cloudy substance while half the yeast floated at the top and half of it settled at the bottom.)

5 minutes
The height of the yeast when added to the vinegar solution rose to 66 ml in 5 minutes. (More of the yeast powder was rising to the top)

10 minutes
The height of the yeast after being added to the vinegar solution rose to 67 ml in 10 minutes. (The yeast started to rise and float at the top)

15 minutes
The height of the yeast after being added to the vinegar solution rose to 67 ml in 15 minutes. (small very thin patches of foam formed on the top)

30 minutes
The height of the yeast after being added to the vinegar solution rose to 69 ml in 30 minutes. (a thin layer of foam started forming)

45 minutes
The height of the yeast after being added to the vinegar solution rose to 70 ml in 45 minutes. (thin layers of yeast formed)

60 minutes
The height of the yeast after being added to the vinegar solution rose to 71 ml in 60 minutes. (More thin layers of foam formed but no major changes)

Final mass of vinegar - 189.76 grams

Observations Vinegar Trial 2

0 minutes
The height of the yeast when added to the vinegar solution rose to 65 ml at 0 minutes. (The yeast unevenly moved through the solution forming a few clumps and the substance became cloudy)

5 minutes
The height of the yeast when added to the vinegar solution rose to 66 ml in 5 minutes. (A few bubbles started to cling to the side of the cylinder)

10 minutes
The height of the yeast after being added to the vinegar solution rose to 66 ml in 10 minutes. (small bubbles began to form)

15 minutes
The height of the yeast after being added to the vinegar solution rose to 67 ml in 15 minutes. (Thin layer of foam began to form)

30 minutes
The height of the yeast after being added to the vinegar solution rose to 68 ml in 30 minutes. (More bubbles began to form at the top)

45 minutes

The height of the yeast after being added to the vinegar solution rose to 69 ml in 45 minutes. (Thin layers were still forming)

60 minutes
The height of the yeast after being added to the vinegar solution rose to 70 ml in 60 minutes. (Thin layers of even foam were formed)

Final mass of vinegar - 188.60 grams

Observations Vinegar Trial 3

0 minutes
The height of the yeast when added to the vinegar solution rose to 65 ml at 0 minutes. (The yeast separated in multiple different clumps around the solution and the solution became more blurry and cloudy.)

5 minutes
The height of the yeast when added to the vinegar solution rose to 65 ml in 5 minutes. (Only a few bubbles had formed at the surface of the solution)

10 minutes
The height of the yeast after being added to the vinegar solution rose to 67 ml in 10 minutes. (A thin layer of foam began to form)

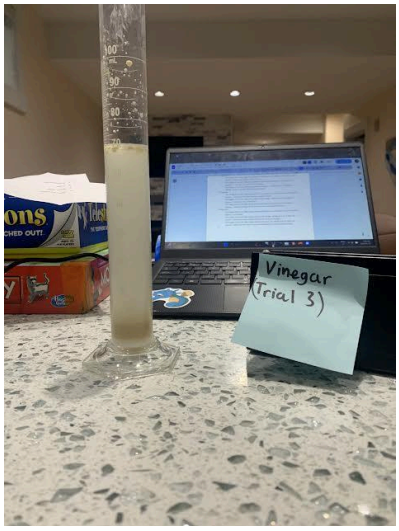
15 minutes
The height of the yeast after being added to the vinegar solution rose to 68 ml in 15 minutes. (More thin layers were forming)

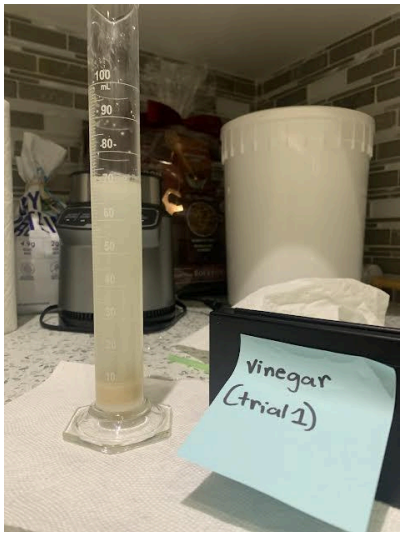
30 minutes
The height of the yeast after being added to the vinegar solution rose to 69 ml in 30 minutes. (Foam growth remained consistent)

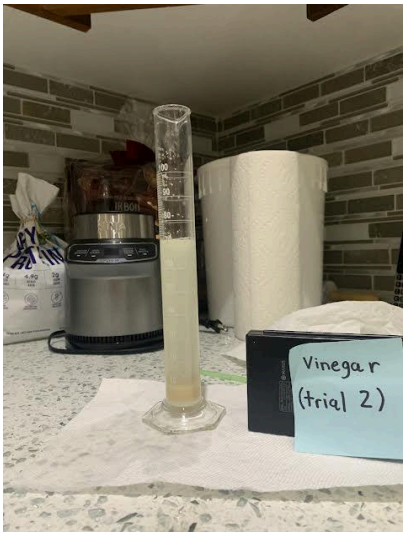
45 minutes
The height of the yeast after being added to the vinegar solution rose to 70 ml in 45 minutes. (Foam was expanding and sticking to the side of the cylinder)

60 minutes
The height of the yeast after being added to the vinegar solution rose to 73 ml in 60 minutes. (In the end, there were thin but sturdy layers of foam)

Final mass of vinegar - 187.98 grams







Observation Green Tea Trial 1

0 minutes
The height of the yeast when added to the green tea solution was 65 ml at 0 minutes. (The yeast mixed with the green tea evenly but no other visible difference was noted.)

5 minutes
The height of the yeast when added to the green tea solution was 67 ml at 5 minutes. (More of the yeast powder was rising to the top and a white substance started to form on the top.)

10 minutes
The height of the yeast after being added to the green tea solution was 68 ml in 10 minutes. (A thin layer of foam began to form)

15 minutes
The height of the yeast after being added to the green tea solution was 69 ml in 15 minutes. (More thin layers of foam began to form on the top)

30 minutes
The height of the yeast after being added to the green tea solution was 73 ml in 30 minutes. (Large amounts of foam began to form)

45 minutes
The height of the yeast after being added to the green tea solution was 76 ml in 45 minutes. (Intense foaming and the formation of a semi-solid substance)

60 minutes
The height of the yeast after being added to the green tea solution was 78 ml in 60 minutes. (

Major foam formation occurred and the foam was intensely growing)

Final mass of green tea - 191.83 grams

Observation Green Tea Trial 2

0 minutes
The height of the yeast when added to the green tea solution was 65 ml at 0 minutes. (The yeast mixed evenly throughout and the solution was yellow)

5 minutes
The height of the yeast when added to the green tea solution was 66 ml in 5 minutes. (The yeast started to slowly rise towards the surface)

10 minutes
The height of the yeast after being added to the green tea solution was 67 ml in 10 minutes. (thin, uneven foam began to form)

15 minutes
The height of the yeast after being added to the green tea solution was 72 ml in 15 minutes. (Consistent foam began to form with a few layers)

30 minutes
The height of the yeast after being added to the green tea solution was 73 ml in 30 minutes. (Solution colour became darker and foam growth slowed)

45 minutes
The height of the yeast after being added to the green tea solution was 74 ml in 45 minutes. (Thicker foam began to form)

60 minutes
The height of the yeast after being added to the green tea solution was 76 ml in 60 minutes. (Thick layers of foam with a semi-solid substance formed at the top)

Final mass of green tea - 190.80 grams

Observations green tea trial 3

0 minutes
The height of the yeast when added to the green tea solution was 65 ml at 0 minutes. (The yeast evenly mixed but the solution became visibility darker)

5 minutes
The height of the yeast when added to the green tea solution was 66 ml in 5 minutes. (The bubbles started forming on the top of the solution)

10 minutes
The height of the yeast after being added to the green tea solution was 70 ml in 10 minutes. (A thin layer of foam began to form)

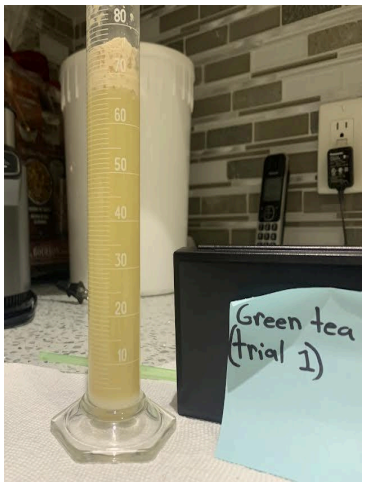
15 minutes
The height of the yeast after being added to the green tea solution was 71 ml in 15 minutes. (More thin layers were forming)

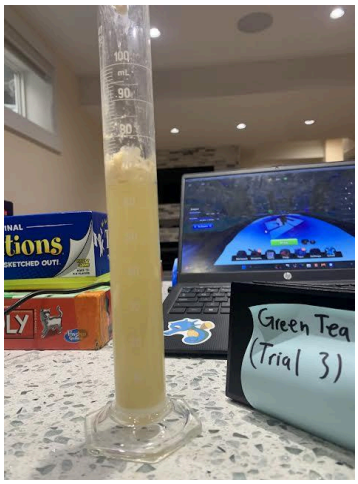
30 minutes
The height of the yeast after being added to the green tea solution was 73 ml in 30 minutes. (Thick foam formation in a steady, even pattern)

45 minutes
The height of the yeast after being added to the green tea solution was 76 ml in 45 minutes. (Thicker foam and the formation of a semi-solid substance occured)

60 minutes
The height of the yeast after being added to the green tea solution was 79 ml in 60 minutes. (Intense foam formation and a dark colour in the solution)

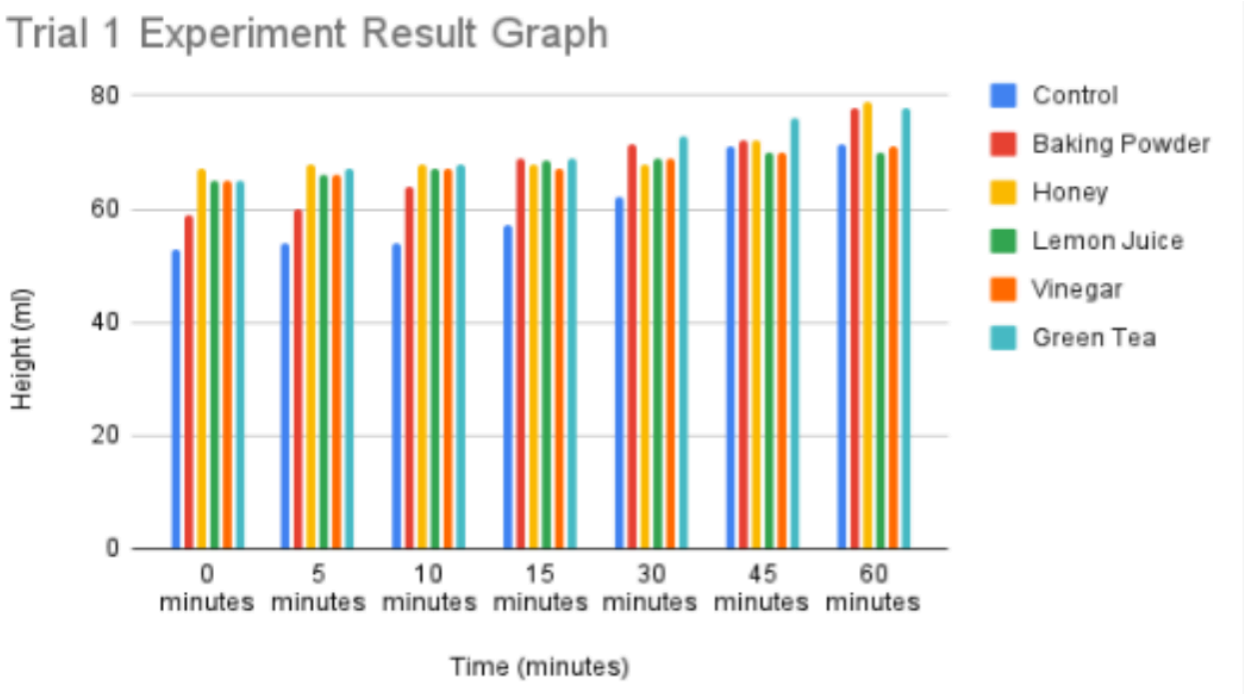
Final mass of green tea - 192.53 grams



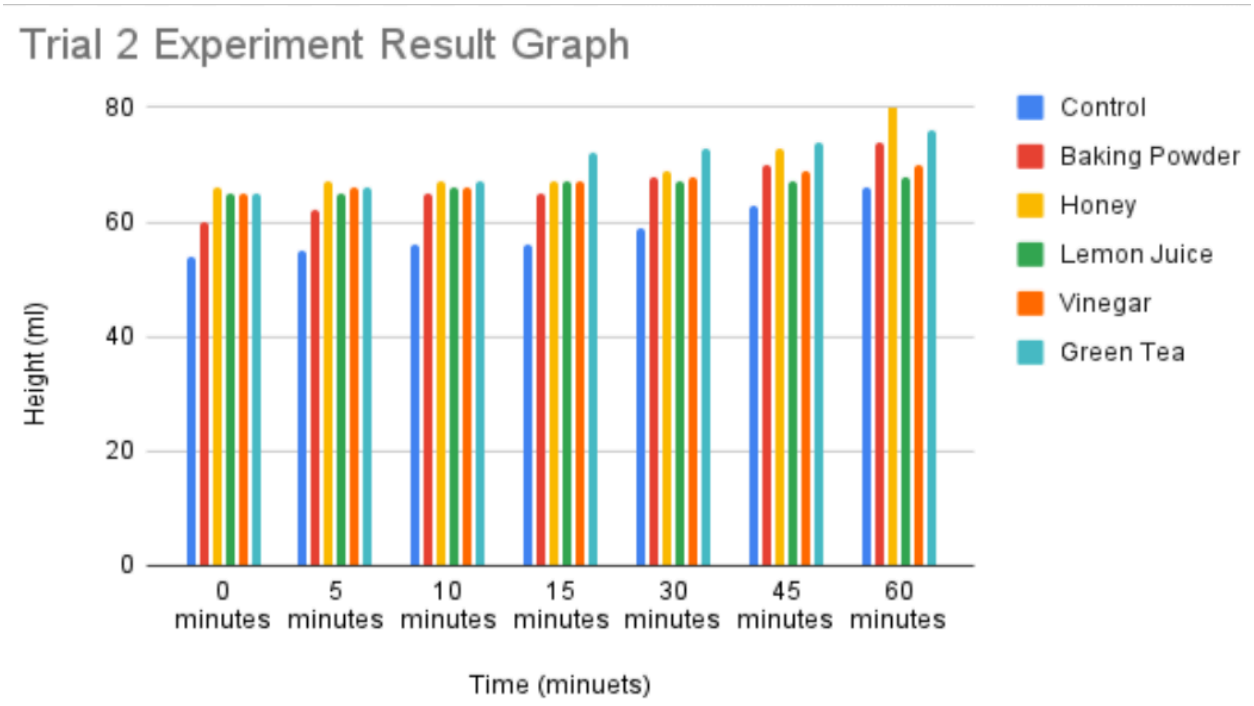


Results

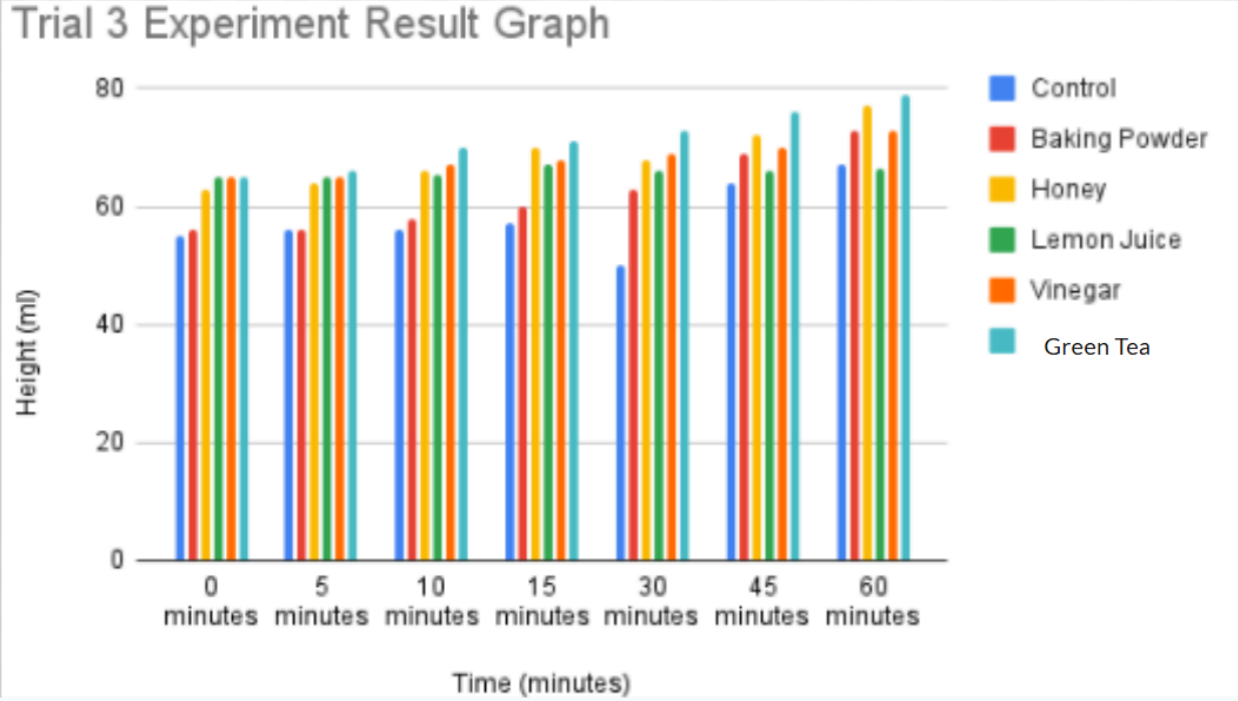
Trial 1 Experiment Result Table	Control	Baking Powder	Honey	Lemon Juice	Vinegar	Green Tea
0 minutes	53	59	67	65	65	65
5 minutes	54	60	68	66	66	67
10 minutes	54	64	68	67	67	68
15 minutes	57	69	68	68.5	67	69
30 minutes	62	71.5	68	69	69	73
45 minutes	71	72	72	70	70	76
60 minutes	71.5	78	79	70	71	78



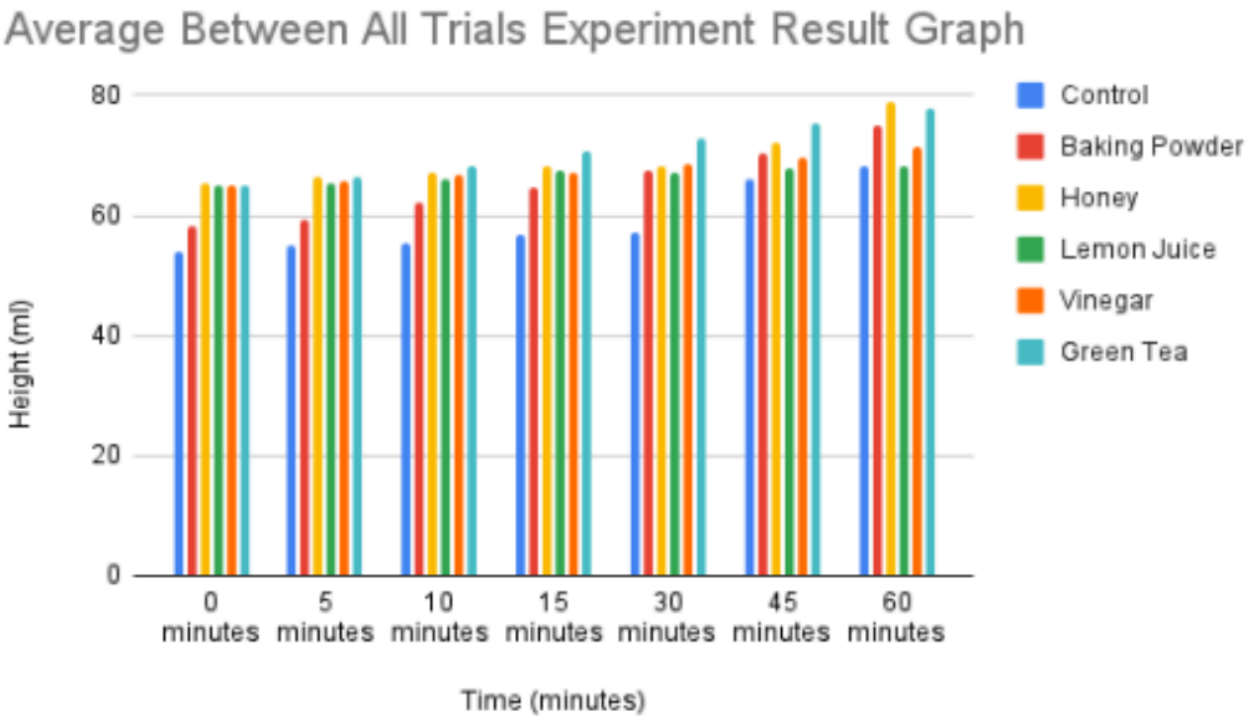
Trial 2 Experiment Result Table	Control	Baking Powder	Honey	Lemon Juice	Vinegar	Green Tea
0 minutes	54	60	66	65	65	65
5 minutes	55	62	67	65	66	66
10 minutes	56	65	67	66	66	67
15 minutes	56	65	67	67	67	72
30 minutes	59	68	69	67	68	73
45 minutes	63	70	73	67	69	74
60 minutes	66	74	81	68	70	76



Trial 3 Experiment Result Table	Control	Baking Powder	Honey	Lemon Juice	Vinegar	Green Tea
0 minutes	55	56	63	65	65	65
5 minutes	56	56	64	65	65	66
10 minutes	56	58	66	65.5	67	70
15 minutes	57	60	70	67	68	71
30 minutes	50	63	68	66	69	73
45 minutes	64	69	72	66	70	76
60 minutes	67	73	77	66.5	73	79

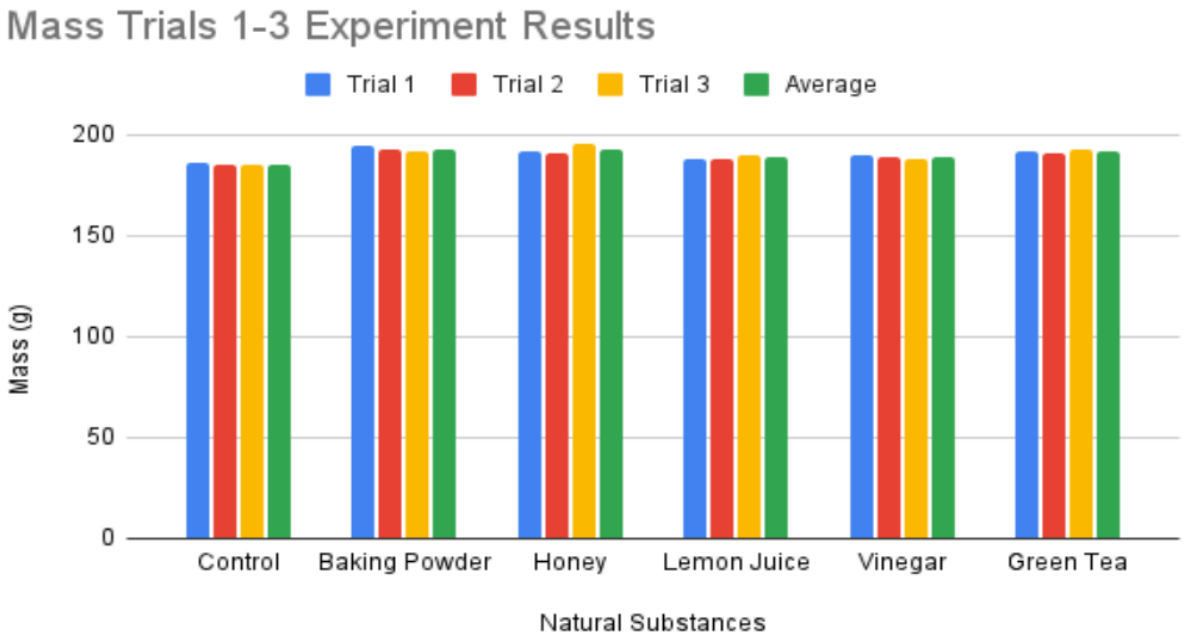


Trial Experiment Average Result Table	Control	Baking Powder	Honey	Lemon Juice	Vinegar	Green Tea
0 minutes	54	58.3	65.3	65	65	65
5 minutes	55	59.3	66.3	65.3	65.7	66.3
10 minutes	55.3	62.3	67	66.2	66.7	68.3
15 minutes	56.7	64.7	68.3	67.5	67.3	70.7
30 minutes	57	67.5	68.3	67.3	68.7	73
45 minutes	66	70.3	72.3	67.7	69.7	75.3
60 minutes	68.2	75	79	68.2	71.3	77.7



Mass Trials 1-3 Experiment Results

Substance	Trial 1 (g)	Trial 2 (g)	Trial 3 (g)	Average Mass (g)
Lemon juice	188.42 grams	187.90 grams	189.67 grams	188.66 grams
Green Tea	191.83 grams	190.80 grams	192.53 grams	191.72 grams
Vinegar	189.76 grams	188.60 grams	187.98 grams	188.78 grams
Honey	191.83 grams	190.80 grams	195.48 grams	192.70 grams
Baking Powder	194.50 grams	192.84 grams	191.66 grams	192.33 grams
Control	186.38 grams	184.92 grams	185.21 grams	185.50 grams



Analysis: The data from our experiment revealed that each material had a different effect on yeast and its growth rate. Lemon juice and vinegar slowed down the yeast growth substantially, while green tea and honey accelerated it substantially. Honey produced the most foam, which means it had produced the most carbon dioxide and active yeast activity. Yet, even though green tea produced more foam, the baking powder mixture had a greater total mass at the end of the experiment of all of our trials. This shows that mass and foam height did not have corresponding results that were similar. This inconsistency in mass and foam data indicates that the two

measurements are not closely related to one another. Foam measures carbon dioxide production and cell growth, relating to the yeast activity. Mass, on the other hand, measures the total weight of the mixture, which can be influenced by other factors like the liquid itself or how much solution was left. This is why we believe baking powder can have more mass, even though green tea has more activity in the mixture.

Abstract:

The purpose of this lab was to see if different natural substances affect the growth of yeast as a model on how different natural substances might affect cancer cells' growth. To conduct this lab the following steps were taken:

Label all graduated cylinders with the respective natural substances (3 each). Include 3 separate graduated cylinders for the control sample, which will have yeast, sugar, and water but no natural substances at all..
Prepare the liquids and natural substances that you need: warm water (35 degrees Celsius), brew green tea (35 degrees Celsius), measure vinegar, lemon juice,baking powder and honey (try to keep the temperature consistent).
Pour 50 ml of warm water into each graduated cylinder, including the control graduated cylinders, to give all yeast the same conditions to start off.
Add 5g of sugar to each graduated cylinder and stir gently. (Sugar provides energy for the yeast to grow and produce foam).
Add the natural substances to each of the respective labeled graduated cylinders. Do not add anything
to control graduated cylinders.(Add 15ml of each natural substance.)
Place all the graduated cylinders in the same warm location (30-35 degrees Celsius) to ensure the yeast grows at a similar rate with the same conditons.
Add 1 gram of yeast to every graduated cylinder and stir gently. Start your stopwatch for the test.
Perform 3 trials for each natural substance, and try to keep conditions the same for each trial. These conditions include the temperature of the water, location of the graduated cylinders during testing, and the amount of substance added.
Measure the foam height for each of the natural substances at 0, 5, 10, 15, 30, 45, and 60 minutes using the built in measurements on the graduated cylinder.
Record observations for each of the graduated cylinders, such as foam height, bubbles, colour, smell, and any contamination or formation of bacteria. Take photos if possible.
At 60 minutes, record the final foam height for each of the individual trials.

Calculate the average foam height for each natural substance by adding the results of each of the three trials and dividing by three. Also, do this for the control graduated cylinders

Measure and record the mass of each of the graduated cylinders and note it down, as well as the average.

From the results of this experiment, we found out that lemon juice and vinegar slowed down the growth of the yeast the most, and green tea, baking powder, and honey allowed the yeast to grow the most.

Conclusion

The result of this experiment showed that each natural substance affected yeast growth in a different way. Lemon juice slowed yeast growth the most. Followed by vinegar, because both substances are highly acidic and lower the pH of the yeast's environment. Yeast grows best in slightly acidic conditions with sugar, so when the pH became too low, the yeast's normal processes were disrupted, causing slower chemical reactions rather than actual yeast growth. Green tea and honey increase yeast growth, with honey producing the most foam because it's high in sugar content, which provides extra energy for the yeast to use to grow and divide. Honey produced a greater amount of yeast, followed by green tea, even though the mass of the baking powder was greater than the mass of the green tea. Although the mass of the baking soda was greater than the mass of green tea, the green tea produced a greater yield of yeast compared to the baking soda

The hypothesis predicted that vinegar would show yeast growth the most, but the results showed that lemon juice was more effective, making the hypothesis partially incorrect. Overall, this experiment showed that pH had a stronger effect on yeast growth than sugar, and very acidic conditions were the most effective at slowing down growth. Due to the fact that yeast and cancer cells share similar ways of growing and dividing. These results help show that changes in the environment, such as acidity and available nutrients, may also influence cancer cell growth, even though yeast is only a model and not cancer itself.

Sources Of Error

One of the errors among us was inconsistent mixing, when we were doing the honey in particular, where the honey sometimes would settle at the bottom even before dissolving totally. Such inconsistency might have caused uneven sugar distribution and thus affected yeast growth. Another mistake was made when the temperature in the room varied, which might have influenced yeast activity, as yeast prefers warm and stable temperatures for growth. Furthermore, foam height may not be a completely accurate measure of yeast growth because some foaming,

especially with baking powder, is a result of chemical reactions rather than biological activity. Thereby, even a slight error in measurements when reading foam height could affect the results. Lastly, the use of natural substances may have been combined with extra ingredients or preservatives that were not controlled and, therefore might have affected yeast grow

Application

One of the ways these experimental results can be used is in cancer research and health science. They can help researchers figure out the impact of conditions like acidity and the availability of nutrients in a cell environment on cell growth. Cancer cells and yeast cells are very similar in the way they grow and divide. This experiment demonstrates that highly acidic conditions can almost completely inhibit cell activity. Besides that, these results are even more relevant to food science and fermentation, which relies on the regulation of pH and sugar levels to control yeast growth. Studying the effect of natural compounds on cell growth will perhaps provide clues to researchers in their fight for the development of drugs that can effectively slow down the uncontrolled division of cells.

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