

## Effect of Different Substrates on Fermentation by Yeast

### Background:

Yeast respire anaerobically  
Glucose  $\rightarrow$  ethanol + CO<sub>2</sub> (+ 2ATP)

### Aim:

To find the effect of different substrates on fermentation by yeast.

### Apparatus:

Bunsen Burner	Boss
Safety Mat	Trough
Tripod	Stop Clock
Gauze	Scales
Beaker	Boats
Thermometer	Matches
6 Test Tubes	Pipette
Bung	Spatula
Delivery Tube	Oil
Measuring cylinder	Yeast
Water	Substrates (Glucose, Fructose & Starch)
Clamp Stand	

### Diagram:

### Hypothesis:

In my investigation I will change the different substrates & measure the amount of Carbon Dioxide gas collected. Using a monosaccharide (Glucose), a disaccharide (Fructose), and a polysaccharide (Starch) as the substrates.

I think that the glucose will produce the most Carbon Dioxide gas, as it is a monosaccharide, and will be easier to break down as it has fewer bonds to break. We do not know what yeast can do, we know that it can break down glucose, but we do not know if it can break down starch into glucose to release carbon dioxide. So this experiment should help me to see what yeast can do.

**Plan:**

Collect and set the apparatus up as shown in the diagram.

Heat the water to 40°C.

Weigh out 1g of yeast, 2g of substrate and 3ml of water, and put in the test tube.

Place a layer of oil over the top of this.

Start the stop clock, and leave the test tube to stand at room temperature for 10mins.

After 10mins, place the test tube in the heated (40°C) water, place the bung on top, and time for a further 10mins.

After 10mins, read the amount of Carbon Dioxide collected in the measuring cylinder, and record your results.

Do the same for the other substrates, and repeat your readings.

**Results:**

Sugar	Carbon Dioxide collected (ml) 1 <sup>st</sup> test			Carbon Dioxide collected (ml) 2 <sup>nd</sup> test			Avg. (ml)
	Start	End	Total	Start	End	Total	
Monosaccharide	0.0	0.0	0.0	0.5	2.5	2.0	<b>1.0</b>
Disaccharide	0.0	0.5	0.5	2.5	3.0	0.5	<b>0.5</b>
Polysaccharide	0.5	0.5	0.0	3.0	5.5	2.5	<b>1.3</b>

**Observations:**

Glucose produced the most amount of froth, and starch the least.

**Graph:**

See over page.

**Conclusion:**

I have found the effect of different substrates on fermentation by yeast. From my results I can see that the polysaccharide produced the most carbon dioxide, and the disaccharide the least amount. The polysaccharide (Starch) produced 1.3ml of Carbon Dioxide, and the disaccharide (Fructose) only 0.5ml. This is clearly shown on my graph.

**Evaluation:**

The results that I have gained are not reliable. This is because the first set of results taken was clearly wrong. I thought that there might have been an air leak in the bung or delivery tube, so I changed them for the second set of results, which appeared to work better. I then did not have enough time to take a third set, so this leaves my results unreliable. Even if I had obtained this third set of results, my readings would not have been accurate, as there were many human errors that occurred. For example the water could have been hotter than 40°C, if this were the case then the enzymes would have become denatured, and would not have broken down the substrate at its greatest rate of reaction. I may not have shaken the contents of the test tube with the water well enough, and the substrate may not have dissolved properly so the reaction

would not have worked to its best ability. There may not have been enough enzyme, or even substrate, so the reaction would not have worked at its best. There may have been a leak in the delivery tube or bung, as I discovered in my first attempt, and so the results would be inaccurate. If the measuring cylinder were tilted when I read off my results then I would have inaccurate data. Because of these inaccuracies, I believe that all of my results are anomalies. If I were to improve on this experiment, and do it again I would change a few things. I would try to prevent air escaping by putting Vaseline around the rim of the bung, I would repeat all of my results at least 3 times to make them accurate and reliable. I would try to ensure I did not heat the water higher than 40°C so not to denature the enzymes, I would shake the contents to make sure all the substrate was dissolved, and I would make sure there was enough of both enzyme and substrate. This would make my results a lot more accurate and reliable.