How Does Various Amounts of Sugar Affect the Yeast Population in 24 Hours?

Kevin Schulze
2/28/2011
IB SL Biology
Mr. McGuire

Introduction

Yeast is a unicellular organism and some of them are used for the making of. Fermentative yeast use sugars and convert them into carbon dioxide and alcohol to produce and create energy. With this energy they reproduce themselves asexually, and so the yeast population consists of both life and death, just like our population.

Objective

The objective of this experiment is to see the relationship between population and food, in this case, sugar.

Research Question

I will investigate how each amount of sugar relatively changes the yeast population in 24 hours.

Hypothesis

My hypothesis is that the yeast population will increase as the amount of sugar increases because reproduction will require energy and sugar is energy for the yeast. However, there will be a point where it hits the limit, as you can see on a S-Curve graph, and so there will be a point where it doesn't increase as much.

Variables

Independent Variables

The independent variable in this experiment was the amount of sugar, used as the food energy of the yeast population. The different amounts of sugar that will be used in this experiment will be, 0g, 1g, 2g, 3g, 4g and 5g. This is the independent variable because this is the variable that will be altered, while the others will be controlled.

Dependent Variables

The dependent variable in this experiment was the yeast population. This will be recorded through the observations through the microscope. This is the dependent variable because it depends on the independent variable, as sugar affects the yeast population.

Constant Variable

To ensure that the outcomes and occurred only because of the independent variables and not other factors, a set of variables were controlled and kept constant throughout the whole experiment.

Amount of Water: It is known that it is important to keep the concentration of yeast and sugar the same, as they are the two main factors in this experiment. We will have different results if we did not have constant amounts of water for each. So especially when I was dealing with those two main factors I kept the amount the same, and we used distilled water just so that we will have the best results we can get.

Temperature: The temperature was another factor that was important to this experiment that may have affected the lab data. We cannot have one hot set while the others are in a cold temperature, since it is putting the objective of this experiment in a totally different direction. So, in this experiment the temperature used was simply room temperature.

Type of Beaker: To let the yeast population grow within the given time, we used the same type of beaker. This was to decrease the amount of inaccuracy. Even if there was an error in the beaker, it will apply to all of the trials, keeping the results as accurate as possible.

Type of Weight Scale: In order to weigh the sugar that we used in the experiment, I used the same type of weight scale. This was to decrease the inaccuracy as possible, just like that of the beaker above.

Type of Sugar: In this experiment, I used the same type of sugar, glucose. There are many types of sugar, and each of them may lead to different results. To keep the results as accurate as possible, I used the same type of sugar.

Type of Microscope: In order to count the yeast population, we used the magnifications of the microscope. We counted with the same magnification, the strongest one, and we used the same type. This was to avoid any errors and changes in the result with the other microscopes.

Time: Since we are measuring the yeast population, I had set a certain limit of time, which was 24 hours. By making it 24 hours, I had the same given time for each trial, making the result as accurate as possible.

Apparatus, Quantity

500mL Beaker (6)
Yeast Population (5g)
Glucose Sugar (0g, 1g, 2g, 3g, 4g, 5g)
100mL Distilled Water (6)
Room Temperature Room (1)
Weight Scale (1)
Microscope (1)
Dropper (1)
Slide and Cap (6)

Procedure

1. Obtain any necessary apparatus and materials for the experiment.
2. Get a set of yeast population with 5g of yeast provided from your teacher/advisor.
3. Get 6 500mL Beakers, and put 100mL of distilled water in each.
4. Take the weight scale to scale out 0g, 1g, 2g, 3g, 4g, 5g of glucose sugar.
5. Put each weighed sugar in separately so that it won't get mixed up.

6. Put each sugar set in each of the beakers.
7. Drop 10 drops of the yeast population into the beakers, and be sure to mix them well.
8. Take out a part of each solution, and place it on the slide.
9. Look at the slide with the microscope, and observe the yeast population.
10. The beaker with 0g of sugar will play a role as a constant, and so you do not have to record the data of before 24 hours.
11. After 24 hours, do the same thing as step #9, and now this time record the count of each yeast population in the beakers.
12. Repeat steps 2-11, until you get all the results.

Diagram

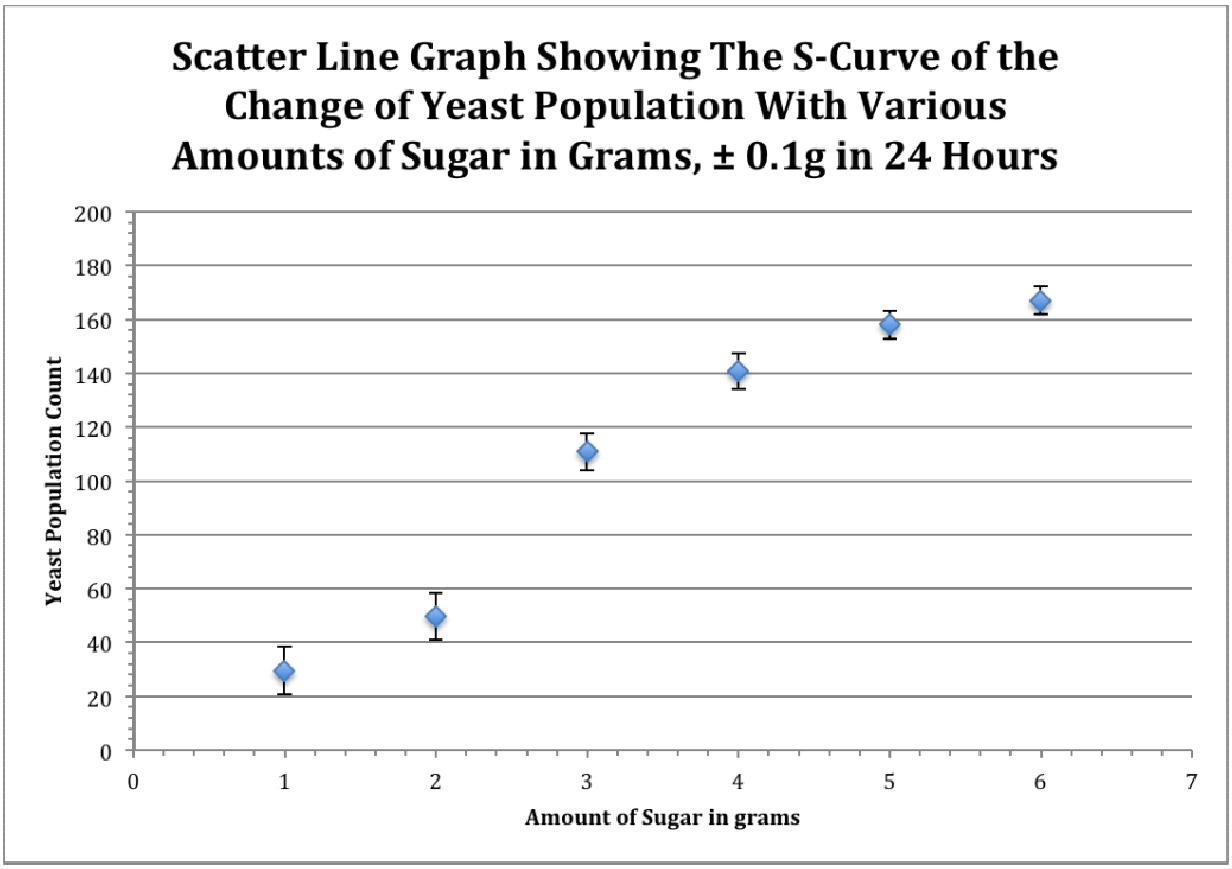
Data Collection

Table: The count of the yeast population of each beaker and trial after 24 hours.

Data Table Showing the Change of Yeast Population in 24 Hours with Various Amounts of Sugar in Grams, $\pm$ 0.1g

Sugar/Trials	1	2	3	4	5	Avg.	STDEV
0.0g	27	15	38	27	40	29.4	9.002221948
1.0g	46	36	57	49	61	49.8	8.749857142
2.0g	107	103	117	106	121	110.8	6.939740629
3.0g	137	135	148	134	150	140.8	6.794115101
4.0g	153	159	162	151	165	158	5.291502622
5.0g	160	166	170	163	175	166.8	5.268775949

Data Processing



Conclusion

As you can see on both the graph and the table, I can say that my hypothesis was correct. The yeast population increased as the amount of sugar increased. There was an exponential growth from 1g and 2g, but gradually slowed down and hit the carrying capacity at 5g. As I said before, there was a S-Curve, and this proved my hypothesis correct.

We can also conclude that if the line of best fit was lengthened, then it was reach the carrying capacity and will be relatively constant.

For 0g of sugar, the count was the starting point for the population to reproduce upon, and as you can see, it increased for 1g of sugar. You can see then a great exponential growth for 1g to 2g of sugar. This shows that the population increased greatly. This is one of the factors in the S-Curve that is important. However, from 3g – 5g, there was not much increase relative, especially from 4g to 5g. This shows how the yeast population reached carrying capacity, and that there will be no more relative increase in the population.

Weaknesses/Improvements

Throughout this experiment, there were many factors and variables that could have been improved that will lead to a better accurate result.

Temperature: The temperature in the room was kept fairly constant, but due to the weather changes and heavy climate change, the temperature has changed slightly throughout the 24 hours. This may have changed the data by a little bit, but still would've given an accurate data. We could've improved this weakness by keeping the room at the temperature we want it, in this case approximately 25 C (room temperature). Also, if we could've done this all at the same time may have made our data more constant. The fact that we have missed some classes in between may have caused the data to vary, but still, we could have kept the temperature the same most likely if we kept it at an environment were the temperature was at room temperature for the whole 24 hours.

Time: The time may have affected the results just like it did for temperature. Due to the school's class schedule, the time was not exactly 24 hours. However, it was fairly close. We could've improved this factor by changing the class schedule. However, this is close to impossible, so I believe that it was a acceptable weakness in the lab.

Sugar: The amount of sugar that we put in was supposed to be accurate and consistent, but due to some errors including spilling and measurement could have cause the data to change a slight bit, but still will affect the data at the end as a result. As an improvement, we could have changed the method to contain and measure our glucose, so that we prevented it from spilling and other errors possible in the method. This may have led to a closer and more accurate data result and graph.

Yeast: The amount of yeast solution affected our lab greatly, and this was one of our weaknesses since we could not assure that we will get a very fair consistency from the amount of yeast population, since it may not have been stirred correctly, not may have been that the dropper we used did leave some remainders of yeast, changing the concentration a little bit but still, affected the data. We could've improved this by using a better dropper if possible, or think of a better method in which we could have both accuracy and consistency. We could've also stirred the concentration more thoroughly, making the solution equally stirred.