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BIOLOGY

COMMUNITY SUCCESSION

OBJECTIVE: This experiment will be used to study community succession in milk. We will be using different types of milk which should lead to different organisms growing at different times. Community succession is caused when different organisms change over a period of time. The growth of one community changes the environment which leads to that community's death and the emergence of a new community which continues to occur in succession. Both the environment and the resources available will influence succession.

There are two different types of succession. The first is called primary succession which occurs when there is little or no soil and no living organisms have become established. The second type of succession is called secondary succession which will occur when a disturbance restarts succession at a different point than that which occurred with primary succession.

We will be using four different kinds of milk in this experiment. These four different types will be prepared in different ways in order to determine the types of bacteria that can grow inside of the milk. The whole milk will be treated four different ways, the chocolate, skim, and buttermilk will be treated differently and will only be used in one of the following experiments.

HYPOTHESIS: The milk will, over time, change depending on the type of bacteria that is growing inside of it. The different types of milk that we will be using will be inhabited by different bacteria at different times. The whole milk that has not been treated and is kept at room temperature will have the most bacterial growth while the buttermilk will generate the least bacteria over time. The other milks should, in my opinion, have varying levels of bacteria that falls in between the whole milk at room temperature and the buttermilk that will be kept at room temperature.

COMMUNITY SUCCESSION IN MILK

EXPERIMENT: In this experiment we will be taking seven milk treatments and using them to grow bacteria. The treatments will be as follows:

Treatment 1: Whole milk, kept at room temperature (25 C); 2, 5, and 8 days old.

Treatment 2: Whole milk, kept in a refrigerator (4 C); 2, 5, and 8 days old

Treatment 3: Whole milk, incubated at 374 C; 2, 5, and 8 days old.

Treatment 4: Whole milk, boiled, then cooled to room temperature (25 C); 2, 5, and 8 days old.

Treatment 5: Chocolate milk, kept at room temperature (25 C); 2, 5, and 8 days old.

Treatment 6: Skim milk, kept at room temperature (25 C); 2, 5, and 8 days old

Treatment 7: Buttermilk, kept at room temperature (25 C); 2, 5, and 8 days old.

During this experiment we will use pH paper to measure the pH of each sample of each treatment. We will note each samples odor, color, and consistency. We will pay particular attention to the physical changes in the milks composition and we will also record any odors, particles, "growths", or new liquids.

COMMUNITY SUCCESSION IN MILK

TREATMENT 1: WHOLE MILK KEPT AT ROOM TEMPERATURE (25 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	7	STRONG FOUL	YELLOW TOP WHITE BOTTOM	N/A	DISGUSTING
DAY 5	5	CHEESE SMELL	WHITE	N/A	NONE
DAY 8	6	CHEESE SMILL	WHITE	N/A	CHALKY

RESULTS: The results of this experiment were that as time went by the milk went from a typical milk texture, color, and smell to a more disgusting and foul odor. After this the solution began to stabilize and develop a smell that was more like cheese than milk. By day 8 the texture of the milk was chalky.

CONCLUSIONS: The conclusions from this experiment is that when whole milk is kept at room temperature for more than four days the milk will turn into cheese, or at least it will turn into a cheese like substance. After four days the foul smell will disappear and will begin to smell like cheese rather than milk.

TREATMENT 2: WHOLE MILK KEPT IN A REFRIGERATOR (4 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	7	ODOR IS NORMAL	WHITE	N/A	NO CHANGES
DAY 5	7	SLIGHT SOUR SMELL	WHITE	N/A	SMOOTH LIQUID
DAY 8	7	A MILKY SMELL	WHITE	N/A	NO CHANGES

RESULTS: The results of this experiment we that there were very little changes in the milk over the 8 day period. The pH of the milk remained constant and the color of the liquid remained constant. The odor did change by day 5 and continued to change into day 8. By day 5 the liquid had turned into a smooth liquid similar in texture to water.

CONCLUSIONS: My conclusion is that the cold temperature kept the bacterial growth to a minimum. It does seem that there was some bacterial growth, but not as much as I originally expected. For the most part it seems that the bacteria were not able to grow fast enough for it to have any substantial impact on the milk.

TREATMENT 3: WHOLE MILK KEPT AT 37 C

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	6	DISGUSTING	CLEAR BOTTOM, WHITE ON TOP	N/A	NONE
DAY 5	5	STRONG, FOUL SMELL	CREAMY WHITE	N/A	NONE
DAY 8	3	CHEESE SMELL	OFF-WHITE	N/A	CHUNKY

RESULTS: The results of this experiment were that the bacteria were able to multiply rapidly. The pH level of the milk had already changed by day 2. The pH level continued to become more acidic as time went by. The odor of the milk got continually worse until day 8 when the milk began to have a cheese like odor instead of the foul odors recorded during days 2 and 5. By day 8 the treated milk began to have chunks of material inside of the tube.

CONCLUSIONS: My conclusions for this experiment is that the higher temperatures allowed the bacteria to grow faster than if the temperature were lower. The treated milk began to deteriorate almost immediately because of the rapid growth of the bacteria. The color fluctuated between clear and different shades of white. I can conclude from this experiment that the temperature of the milk has an enormous impact on the growth rate of the bacteria. The higher the temperature is the faster that the bacteria will grow.

TREATMENT 4: WHOLEMILK, BOILED, COOLED TO ROOM TEMPERATURE (25 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	6.5	GROSS, PUGENT	WHITE, SEPERATING	N/A	NONE
DAY 5	5	STRONG, FOUL SMELL	WHITE	N/A	CHUNKY
DAY 8	6	SOUR SMELL	BLACK/WHITE	N/A	MOLD SPORES

RESULTS: The results of this experiment are that the bacteria were able to multiply even fast than in the previous experiment. This appears to confirm my conclusions from the last experiment about the higher temperatures increasing the ability of the bacteria to multiply. The color and smell changed considerably over the 8 days that the experiment was done. I was surprised that the pH level of the milk began to increase towards day 8.

CONCLUSIONS: The conclusions of this experiment are that the boiling of the water and then allowing it to cool to room temperature worked even better than the last experiment to stimulate bacterial growth. It does appear however that by day 8 the pH level of the treated milk was beginning to stabilize, possibly because of the existence of the mold spores.

TREATMENT 5: CHOCOLATE MILK KEPT AT ROOM TEMPERATURE (25 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	DARK BROWN	N/A	NONE
DAY 2	6	SHARP, PUGENT	LIGHT BROWN	N/A	THICK
DAY 5	6	STRONG, FOUL SMELL	BROWN/WHITE	N/A	NONE
DAY 8	3	STRONG SOUR	BROWN/WHITE	N/A	NONE

RESULTS: The results of this experiment were that the bacteria were not able to begin affecting the pH level of this treated milk until about one week after this experiment was begun. The bacteria were present and multiplying long before that since the color, texture, and smell began to change by day 2.

CONCLUSIONS: My conclusions to this experiment were that the chocolate in this treated milk was able to withstand the bacteria for some time before the pH level began to change. However, the rapid drop in the pH level by day 8 indicates that the bacteria were able to multiply quickly once they became established in the solution. Perhaps the chocolate helped the bacteria to grow fast because of the sugar that was in it.

TREATMENT 6: SKIM MILK KEPT AT ROOM TEMPERATURE (25 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	7	SOUR, BUT NOT OVERWHELMING	SLIGHTLY WHITE, YELLOW ON TOP	N/A	NONE
DAY 5	4	VERY FOUL SMELL	WHITE	N/A	NONE
DAY 8	4	SLIGHTLY SOUR	OFF WHITE	N/A	NONE

RESULTS: The results of this experiment are that the skim milk was slightly good at maintaining the original pH for a couple of days. By day 5, however, the bacteria had multiplied enough for the pH to have rapidly dropped to 4. The smell and color changed slightly until it began to stabilize and became less foul.

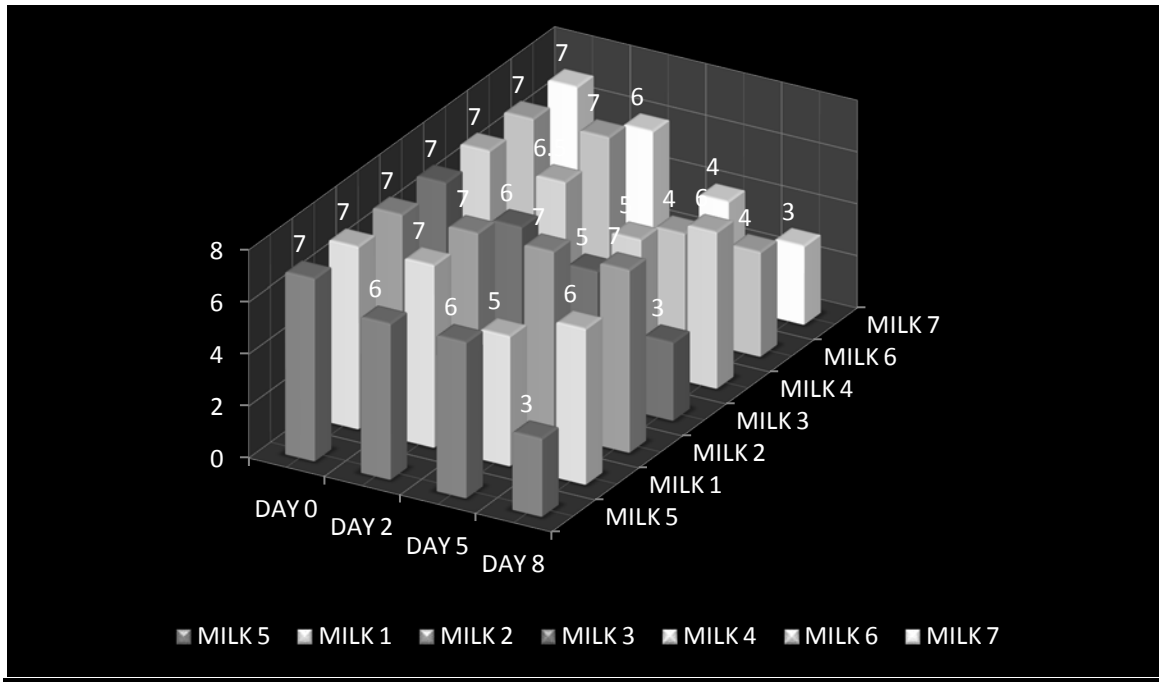
CONCLUSIONS: The conclusions for this experiment are that the skim milk was not a good area for bacterial growth for the first 2 days. Around day 5 the bacteria was able to grow sufficiently so that the pH dropped by 3.

TREATMENT 7: BUTTERMILK DEPT AT ROOM TEMPERATURE (25 C)

DAY	PH	ODOR	COLOR	BACTERIA	COMMENTS
DAY 0	7	NONE	WHITE	N/A	NONE
DAY 2	6	NOT OVERWHELMING	WHITE	N/A	NONE
DAY 5	7	SOUR SMELL	WHITE	N/A	YOGURT
DAY 8	3	SLIGHT SOUR SMELL	WHITE	N/A	NONE

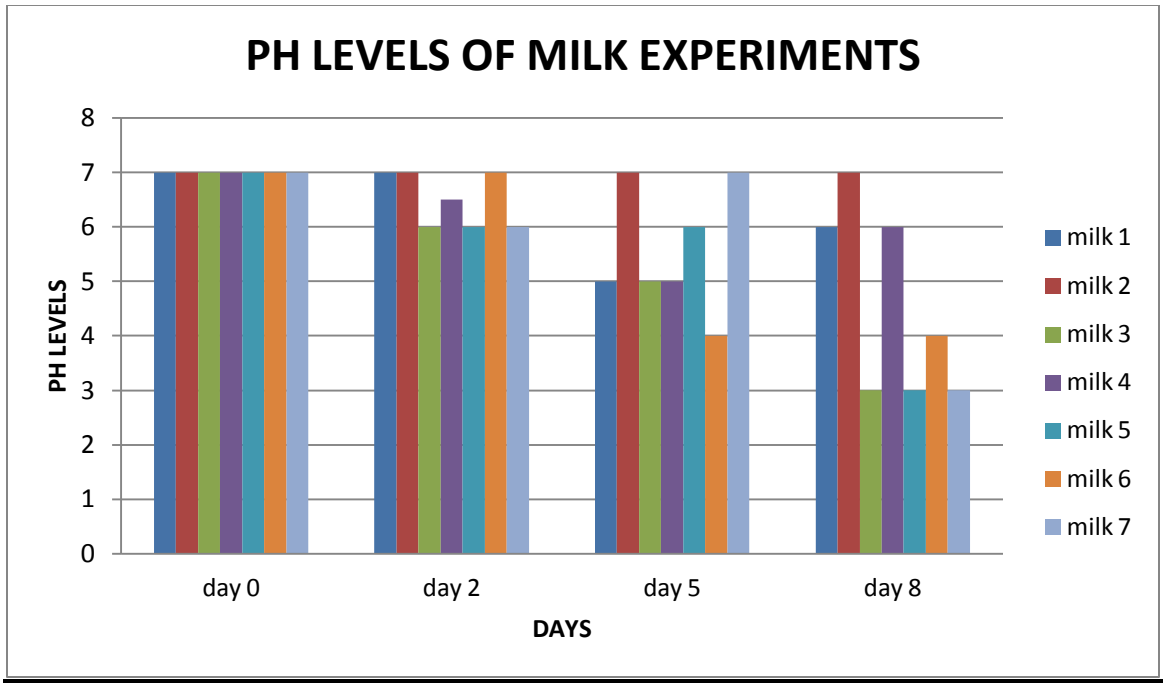
RESULTS: The results of the experiment with the buttermilk were that the bacteria were able to dramatically change the pH levels after day 5. By day 5 the pH level had returned to what it was originally but the milk had turned into a sort of yogurt which would probably explain the change in the pH level. The drop in pH after this point was more than likely due to the fact that the bacteria was allowed to grow unchecked beyond the point of the buttermilks ability to control it.

CONCLUSIONS: The conclusions to this experiment were that the buttermilk will turn into yogurt if left alone for approximately 5 days. After this point, however, if the bacterial growth is not stopped then the milk will begin to deteriorate further until the pH drops suddenly. The bacteria that grew in the buttermilk changed the consistency of the buttermilk until it had changed it to the point that the yogurt would continue to deteriorate quicker than it had over the previous 5 days.



- The chart above shows the different levels of the pH of the treatments

FINAL RESULTS: The results of this experiment are that treatment 4 had the greatest amount of bacterial growth while experiment 2 had the least amount of bacterial growth. This coincides with fact that experiment 4 had the greatest amount of heat applied to the milk treatment and experiment 2 coincides with the least amount of heat being applied to the milk treatment.



FINAL CONCLUSIONS: My final conclusions to this experiment are that the treated milk in experiment 4 was the most effective at allowing the uncontrollable spread of bacteria. This is seen in the fact that the milk was changing at such a fast rate. Also the growth of mold spores indicates that the bacteria were not slowing down their growth as they had in the other experiments that were done. The boiled milk allowed the most growth of bacteria while the milk that was kept refrigerated was able to slow down the growth of bacteria to the point that the milk had barely changed over the course of the 8 days. It is from these two facts that I have come to the conclusion that the amount of heat available to the bacteria is directly proportional to the speed at which the bacteria can grow. Only cooling down the temperature will cause the bacterial growth to be checked.

QUESTIONS PG 231

1) What is biological succession, and why is it important? Biological succession is important since it allows more diversity than would be available if the same organisms lived in the same areas forever.
2) How does succession occur? What factors influence the rate of succession? Succession occurs when one organism lives in an area until it changes the environment to the point of killing itself but making the area more hospitable to a different organism. The factors that influence succession are temperature, location, available resources, and the organism that inhabited the area beforehand.
3) What human activities are based on preventing or slowing biological succession? Humans attempt to stop biological succession by refrigerating milk so that the bacteria don't have a chance to make us sick.
4) In this exercise you studied how microbes affect a rather small ecosystem. In what ways do microbes affect larger ecosystems? If the microbes get large enough it could be possible for them to change the entire planet. One theory on how the earth came out of the "snowball" earth phase was that microbes that exhaled carbon dioxide released enough of the gas over time to change the entire atmosphere of the planet.