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Cheese Lab Report

Purposes:
Part 1: To see which curdling agent produces cheese the most effectively.
Part 2: To see if milk or chocolate milk produces heavier/more curds.
Part 3: To see which macromolecules each cheese contains.

Hypotheses:
Part 1: If we mix water, buttermilk, NBC, and FPC, then water will make the worst cheese.
Part 2: If we curdle chocolate milk and regular milk, then chocolate milk will produce heavier/more curds
Part 3: If we test for macromolecules, most results will be negative.

Procedures:
Part 1:

1. Label four 6ml tubes with the type of curdling agent group member.
2. Use a large pipet to transfer 3 ml of milk into each of the 6ml tubes.
3. Use a small pipet and transfer the entire contents of the tubes of fermentation produced chymosin, natural bovine chymosin or buttermilk to the labeled tube containing the milk. For water, fill the small transfer pipet to the bottom of the bulb and add to the labeled tube containing the milk.
4. Cap the tubes and invert the tubes three times and then transfer to 37°C water bath or place at body temperature (armpit) for incubation.
5. Set a timer and check for curdling every 5 minutes, by gently inverting the tube and examining for curds.
6. Record the time (in minutes) when the milk begins to curdle (small or large lumps) or solidified.
7. If the milk had not curdled in 30 minutes, check for curdling every hour.
8. In a data table similar to the Data Table 1, record the time (in minutes) when the milk begins to curdle (small or large lumps) or solidify.
9. Upon return to the lab, during the next work period, determine the amount of curds produced by each treatment.
10. For each treatment, weigh a paper cone and record the empty cone weight.

11. Transfer the entire contents of a tube into a labeled filter paper cone over a suitable collection vessel. Once all liquid has drained through, dry the filter paper with curds overnight.
12. Weigh the dry cone with dry curds. Subtract the dry cone weight. Record the weight of the curds (in mg) by multiplying the mass in grams by 1000.
13. Repeat with each treatment.
14. Create a data table that reports the Rate of Curd Production (weight/time) by each Curdling Agent.
15. Create a bar graph that shows the Rate of Curd Production by each Curdling Agent.

Part 2:

1. Label 2 ml tubes with milk type
2. Use large pipet to transfer 3 ml of milk into one tube and chocolate milk into the other.
3. Use small pipet to transfer FPC into each tub. Use different pipet tip for each.
4. Invert tubes 3 times then incubate.
5. Check curdling every 5 minutes.
6. Record time when milk starts to curdle.
7. If it hasn't curdles by 30 mins then check every hour.
8. Transfer contents of tube to labeled filter over vessel, once it filters, dry paper with curds.
9. Weigh dry cones with dry curds and subtract the dry cone weight from the weight of them together to get the weight of the dry curds.
10. Repeat with both milks
11. Create table that reports rate of curd production for both milks.
12. Create bar graph to go along with this.

Part 3:

-Monosaccharide indicator test

1.Test for glucose: In a test tube, mix 2 ml of cheese solution with 2 ml of benedict's solution. Heat for 2 minutes in boiling hot water bath (100 ml of water in a 250-ml beaker at 100 degrees C) record all color changes and the length of time for each color change to appear.

-Poly Saccharide test

2. Test for starch: In a test tube, mix 2 ml of well-mixed cheese solution with 0.25 ml of

Lugol's Iodine. Gently swirl to mix. DO NOT HEAT. record the color change.

-Protein test

3. Test for protein: place 2 ml of cheese solution in test tube. Wearing goggles and gloves, add 0.5 ml of 10% NaOH and gently vortex to mix. Add 0.25 ml of 5% copper sulfate ($CuSO_4$) and gently mix. The NaOH and $CuSO_4$ mixture is called biuret reagent. Mix well. Record color change after 30 seconds.

-Lipid test

4. Test for lipid(s): Sudan IV. add 6 microliters of Sudan IV to 2 ml of cheese sample. Gently mix, red is negative for lipid test orange is positive test.

Data/Observations:

Agent	Curding Time (min)	weight of cone and curds (g)	Weight of cone (g)	Weight of curds (g)	rate (mg/min)
Buttermilk	1440	1.778333333	1.113333333	1.053333333	2.017783333
Chymosin (FPC)	5	2.321666667	0.9166666667	1.403333333	280.6666667
Rennin (NBC)	490.1666667	1.47	0.9266666667	0.7183333333	15.86858974
Water	2160	1.71	1.073333333	1.2	0.5260416667

This graph shows the class averages for everyone's curdling experiments. FPC was by far the fastest and water was farthest behind.

Part 1:

Curdling agent	Curdling time (min)	Weight of cone & curds (g)	Weight of cone (g)	Weight of Curds (g)
Chymosin (FPC)	5	7.67	1.18	6.49
Chymosin (NBC)	1440	1.88	1.15	.73
Buttermilk	1440	1.36	.94	.42
Water	2880	1.97	1.15	.82

This is the graph of my groups personal test results. Our NBC and water are the only agents that had a time that was significantly off of the classes average. My water took especially long compared to everyone else's.

Part 2:

Type of Milk	Weight of cone & curds (g)	Weight of cone (g)	Weight of curds (g)
Whole Milk	2.84	2.05	.79
Chocolate Milk	2.69	2.04	.65

This is the table of our experiment for part 2 where we changed a variable. It is showing the weight of the curds made by chocolate and whole milk.

Part 3:

Molecule Tested	Indicator	Test result
monosaccharide	Benedict's solution	Orange+
polysaccharide	Lugol's iodine	No change-
protein	Biuret reagent	Light purple+
lipid	Sudan IV	Light red+

This is the table showing what we tested for and what we used to test for different molecules. Then it shows what the color change that we observed was and if the results were positive or negative.

Analysis:

Part 1: The graphs show that FPC was easily the most effective curdling agent with NBC behind it in a strong second. Buttermilk took the third longest and water was by far the longest. For our personal experiment, NBC and buttermilk were equal as they both curdled overnight so we didn't have a chance to record exactly what time. Although, the class averages show a lead for NBC. The FPC had the highest weight of curds which virtually means it yielded the most curds. The rest of the agents fall in line with their previous order when it comes to weight and rate of curd production. My hypothesis was correct in stating that I think the water would make the worst and slowest cheese. My group-mate got many more curds than the average which may be an error in the

procedure or possibly by chance. And we could not get accurate time for the other three agents because we had to leave them at school overnight and we could only record the days passed. To improve this lab, we could have a longer block of time to conduct research to get more accurate times because we were constrained to just 2 periods of class time. In the future we could test to find the exact curdling times or we could change variables like the milk, which we did in part 2.

Part 2:
The chocolate milk produced less curds which means my hypothesis was wrong. I assumed this because chocolate milk has more than just milk so it would curdle faster but the whole milk was quickest. We tried putting FPC in both milks so it would go faster and produce more curds but we got significantly less curds tan we did the first time. Again I am not sure what this is due to, bu it most likely has to do with some proportions being wrong while setting up the test tubes. Next time we could take more time to think about the experiment and execute better. Now we could think about how milk would react with other agents and make tons of new combinations.

Part 3:
We found out that there was glucose(monosaccharide), protein, and lipids in our cheese. My hypothesis was incorrect because ¾ of the results were positive and i thought they were going to be negative. We were very rushed at the dn of this lab so we did not take a ton of time on this. Wee did get it done however and got all of the results. Maybe next time we should have more time so we can take our time and do the lab diligently and with care. Now we could check all sorts of things to see if they are in the cheese.

Conclusion:
We discovered that FPC (chymosin) is the best agent for curdling cheese. The class mixed milk with different curdling agents and let them heat and curdle, creating “cheese”. Everyone took down observations and their data while doing this so we could get a large sample size of what worked and what didn’t. FPC curdled in 5 minutes while the other agents took exponentially longer, sometimes around 30 minutes, sometimes around 2 days and in between depending on the agent used. The FPC also made the most cheese. This means that the FPC was the most effective way to make the cheese and optimizes the whole process. Finding that out was the whole purpose of the lab so I would say we accomplished our goal. Later, my group found out that whole milk is still better for making curds than chocolate milk, just slightly though. The weight of all the curds was more for whole milk than chocolate which pretty much means it made more

total curds. This means that chocolate cheese would not only be gross but it would be harder to make and once again we debunked another question we had about the process which was will chocolate milk make more/heavier curds.