CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
J0526

Project Title
Too Salty? Optimizing Salt Concentration for DNA Extraction

Abstract

Objectives/Goals
The process of extracting DNA from a cell is very important in biotechnology. The extraction process involves three main steps: break open the cells, release the DNA from the nuclei, and precipitate the DNA. Salt, among many factors, plays a key role in the DNA extraction process. The objective of this project is to find out which amount of salt (0g, 0.25g, 0.5g, 0.75g, or 1g) will result in the optimum amount of strawberry DNA through extraction. Based on my research, I hypothesized that 0.25g of salt will yield the most amount of DNA compared to the other amounts.

Methods/Materials
I prepared the detergent-salt solution using detergent, water and salt. I mashed strawberries with detergent-salt solution in a Ziploc bag. I heated and cooled the mixture in hot and cold baths. I filtered the mixture and collected the filtrate. I added isopropyl alcohol (2x filtrate) to 15mL of filtrate, slowly down the side of the test-tube. I spooled out the DNA that precipitated into the alcohol layer. I weighed the DNA. I repeated the procedure for each of the measured salt weights in 3 trials.

Results
Observations showed that the optimum amount of salt to extract the most DNA from 50g of strawberries is 0.75g. The final salt concentration in the extraction liquid is equal to 320 mM. The average weight of precipitated DNA increased steadily with the salt weight until it reached its peak at 0.75g of salt. Then, the amount of extracted DNA dropped at 1g of salt.

Conclusions/Discussion
DNA is a double helix with negatively charged phosphate groups in the backbone. The salt neutralizes these charges and lets DNA strands clump together when isopropyl alcohol is added. When released from a cell, DNA typically breaks up into countless fragments. In solution, these strands have a slight negative electric charge. Salt ions are attracted to the negative charges on DNA, effectively neutralizing them, and this allows the many separate fragments of DNA to come together. So by controlling the salt concentration, biologists can make DNA fragments either disperse or clump together, and there lies the secret of separating DNA from cells. I hypothesized that 0.25g of salt (107 mM) would yield the most DNA. My hypothesis was incorrect. This experiment showed that the salt concentration has an effect on the yield of DNA from strawberries and it can be optimized. More trials will give better accuracy to the findings.

Summary Statement
My project focused on optimizing salt concentration to receive the most amount of DNA using strawberries.

Help Received
I would like to thank my science teacher, Mrs. Murthy for providing the guidance and encouragement throughout this project. I also would like to thank my parents for helping and supporting me.