

DNA EXTRACTION USING BANANA

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I. Introduction

All living things, bananas and people included, pass on information from one generation to the next using the same basic material, DNA. Within every living organism, most cells contain a complete set of DNA instructions. The information in DNA tells our bodies how to develop, grow, and work. It also controls many of the features that make an organism unique. DNA or deoxyribonucleic acid is found in all living things. Its natural shape is called a double helix and when seen under extremely high-powered microscopes, it looks kind of like a ladder twisted into a spiral shape.

These instructions are in segments of DNA called genes. Genes, along with other parts of our DNA that turn genes on and off, hold information for how our body develops and functions. They produce molecules called proteins that do most of the work in the body. Variants of genes, called alleles, are responsible for differences in hair color, eye color, and earlobe shape.

DNA extraction is a method to purify DNA by using physical and/or chemical methods from a sample separating DNA from cell membranes, proteins, and other cellular components. Friedrich Miescher in 1869 did DNA isolation for the first time.

Although DNA is an incredibly small molecule, in large quantities, it can be seen. In this lab activity, I will extract DNA from a papaya. One of the reasons fruits work so well is that they are soft and easy to pulverize. Banana (*Musa acuminata*) have 523-megabase genome doubled-haploid genotype. Some fruits are polyploidy meaning that they have more than two of each type of chromosome.

There are three basic steps in DNA extraction. First, the cell must be lysed (broken open) to release the nucleus. Next, the nucleus must also be opened to release the DNA. Lastly, once the DNA is released, it must be precipitated out of solution. Several reagents are required to complete the extraction procedure—salt, detergent, and alcohol. Both the cell and nuclear membranes are composed primarily of lipids. In order for the cell to be lysed, the lipid walls must be broken down. The manual grinding and detergent solutions accomplish this. Soap molecules mix with fats or lipids, causing structures made of lipids to break apart.

Isopropyl alcohol is used to precipitate the DNA. In water, DNA is soluble. However, when it is in Isopropyl alcohol, it uncoils and precipitates. The addition of salt solution provides the DNA with a favorable environment by contributing positively charged atoms that neutralize the normal negative charge of the DNA, allowing the DNA to clump together.

II. Key Terms

- DNA: Deoxyribonucleic acid, which is the hereditary material in cells that contains the instructions for producing the cell and enabling it to function
- Extraction: A procedure to obtain a substance by chemical or mechanical action
- Filtrate: The material collected after a solution or mixture passes through a filter
- Precipitate: Solid material that comes out of solution as a result of a chemical or physical change

III. Advance Preparation

1. Prepare DNA Extraction Buffer: 100 ml of liquid soap, 15 g of table salt, 100 ml of hot water.
2. Obtain Precipitation Buffer (95% ethanol or isopropyl) and store in the freezer.
3. Peel skin off ripe fruit and cut fruit pieces into 1-inch squares.

IV. Materials

- ☐ 1 large banana
- ☐ 200 mL isopropyl alcohol
- ☐ 1 tbsp table salt
- ☐ 10 drops of liquid soap containing sodium dodecyl sulfate
- ☐ 100 mL hot water
- ☐ 100 mL cold water
- ☐ Narrow glass
- ☐ Glasses
- ☐ Gauze



V. Procedure

The first step is to prepare a precipitating solution. combine 1 tbsp table salt and 10 drops of liquid soap containing sodium dodecyl sulfate in a glass (in my case, I used a dishwashing liquid). Add 100 mL hot water. Stir well.



1 tbsp table salt



10 drops of liquid soap



100 mL hot water



Stir well Place a peeled banana in a glass. Add 100 mL cold water and 5 tablespoons of precipitating solution. Blend the mixture thoroughly (since we don't have a blender, I manually mixed and stir the mixture until the banana dissolved to the precipitating agent).



Peel skin off ripe fruit and cut fruit pieces into 1-inch squares and 100ml of water



5 tablespoons of precipitating solution



Mix thoroughly

Filter the puree through several layers of gauze (I used a strainer and a alcohol free wet tissue as a gauze). Carefully add 200 mL ice-cold isopropyl alcohol by pouring the liquid down the side of the glass. Observe the formation of a white mass in the alcohol layer.



Filter the puree



200 mL cold isopropyl alcohol

VI. Result and Discussion

The bananas were mashed with saltwater before anything else was added. But this was a special step preparing for the addition of the dish soap. Once the dish soap helps release the DNA, this salt will help the DNA strands to stick to each other in clumps large enough for you to see.

Dish soap can help split apart the membranes (the outer "skin") that hold cells together. These membranes are made of a type of molecule called lipids. When you think of lipids, think of fats and oils. Dish soap "cuts through grease" because it actually separates those greasy molecules from each other. Now, the molecules that make the membranes around cells and the nucleus (which holds DNA) are lipids. So, when dish soap is added, the cell membrane and the nuclei are broken apart, releasing the DNA.

The DNA clumps are soluble (can be dissolved) in some liquids, but not in alcohol. So, adding alcohol helps the clumps of DNA to form.



DNA formed fibers, somewhat like cotton candy. The thin clear sheets that are seen in the alcohol is the extracted DNA.

Diagrammatic representation of DNA extraction from banana (*Musa acuminata*). The process involves mechanical disruption, detergent-mediated cell lysis, filtration, and alcohol-induced DNA precipitation, resulting in visible DNA fibers. By Candidato Aiman



VII. References

1. Gupta N. (2019). DNA Extraction and Polymerase Chain Reaction. *Journal of cytology*, 36(2), 116–117. https://doi.org/10.4103/JOC.JOC_110_18

2. MEL Science. (2019, June 27). Home DNA extraction [Video]. YouTube. <https://youtu.be/nq3raQX2mlA>
3. Macdonald, H. (2004) Geologic Puzzles: Morrison Formation, Starting Point. Retrieved Sept 9, 2004, from <http://serc.carleton.edu/introgeo/interactive/examples/morrisonpuzzle.html>