GENERAL

strawberry dna extraction lab answer key

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Introduction

Strawberries are one of the most beloved fruits worldwide, prized for their bright red color, sweet aroma, and juicy texture. Beyond their culinary appeal, strawberries offer a fascinating window into plant genetics, making them an ideal subject for DNA extraction laboratories in high schools, community colleges, and introductory university courses. The **strawberry DNA extraction lab answer key** is a valuable resource for teachers and students alike, providing a structured guide to the experimental steps, expected results, and critical thinking questions that accompany the hands on activity.

In this comprehensive article, we will explore the scientific background of DNA extraction, walk through a typical strawberry DNA extraction protocol, examine the key concepts that students should grasp, and present a detailed answer key to common lab questions. By the end, educators will have a ready to use reference, and students will gain a deeper appreciation for how molecular biology techniques uncover the genetic blueprint of one of nature's most delicious berries.

Why Extract DNA from Strawberries?

Strawberries (genus *Fragaria*) are a popular model organism for introductory genetics for several reasons:

- High DNA Yield – The fleshy pulp contains many cells, providing ample material for extraction.
- Visible DNA – When the extracted DNA is mixed with ethanol, it precipitates as a fluffy, white string, allowing students to see the results of their work.
- Safety – The procedure requires minimal hazardous reagents, making it suitable for classroom settings.
- Relevance – Understanding DNA extraction is foundational for more advanced topics like PCR, sequencing, and genetic engineering.

Because of these advantages, the strawberry DNA extraction lab is often the first hands on molecular biology experiment students encounter. The lab answer key will help ensure that the learning objectives are met and that students can critically analyze their data.

Overview of the Strawberry DNA Extraction Protocol

The standard protocol for extracting DNA from strawberries involves a series of steps that break open plant cells, solubilize DNA, and precipitate it for visualization. Below is a concise summary of the procedure, which will be referenced in the answer key sections.

1. Sample Preparation – Wash strawberries, remove seeds, and cut into small pieces.
2. Cell Lysis – Add a lysis buffer (containing detergents, salts, and sometimes proteinase K) to break down cell membranes and nuclear envelopes.
3. Protein Removal – Add a protein precipitation solution (often a salt solution with a detergent) to separate proteins from nucleic acids.
4. DNA Precipitation – Introduce cold ethanol or isopropanol to the aqueous phase, causing DNA to aggregate.
5. DNA Recovery – Centrifuge the mixture, discard the supernatant, and wash the DNA pellet with 70% ethanol.
6. Rehydration and Observation – Resuspend the DNA pellet in a small volume of TE buffer or water and

observe the DNA string under a microscope or simply by visual inspection.

Materials Needed

For a typical lab, the following items are required:

- Fresh strawberries (at least 4–5 per group)
- Microcentrifuge tubes (1.5 /mL)
- Lysis buffer (commercial or homemade)
- Protein precipitation solution (e.g., 3 /M sodium acetate with 10% SDS)
- Ethanol (95–100%) and 70% ethanol
- TE buffer (10 /mM Tris HCl, 1 /mM EDTA, pH /8.0)
- Microcentrifuge or high speed hand held centrifuge
- Micropipettes and filter tips
- Vortex mixer
- Ice or a refrigerator for temperature control
- Safety equipment: gloves, goggles, lab coat

Key Scientific Concepts Covered in the Lab

While the protocol itself is straightforward, the strawberry DNA extraction lab addresses several core concepts in genetics and molecular biology. Understanding these concepts will help students answer the questions in the lab answer key and appreciate the significance of their results.

1. Cell Structure and DNA Localization

Plant cells contain a nucleus surrounded by a nuclear membrane, which houses the DNA. Additionally, plant cells have a cell wall composed of cellulose, a rigid structure that must be breached during lysis. Students should recognize that effective DNA extraction requires disrupting both the cell wall and the nuclear envelope.

2. Role of Detergents and Salts

Detergents such as SDS (sodium dodecyl sulfate) dissolve lipid bilayers, while salts help neutralize negative charges on DNA, promoting precipitation. The interplay between these chemicals is crucial for efficient DNA recovery.

3. DNA Precipitation Principles

DNA is insoluble in alcohol when in a high salt environment. Adding cold ethanol or isopropanol reduces DNA solubility, allowing it to aggregate and form a visible pellet. The process can be explained using concepts of solubility and ionic strength.

4. Visualizing DNA

When DNA precipitates, it often forms a white, fibrous string that can be seen with the naked eye. This visual confirmation is a powerful teaching tool, demonstrating that the abstract concept of DNA is a tangible substance.

5. Safety and Lab Ethics

Even though the reagents used are relatively mild, students should practice proper waste disposal, avoid inhalation of aerosols, and respect the principles of responsible conduct of research.

The Strawberry DNA Extraction Lab – Step by Step

Below is a detailed protocol that can be followed in the classroom. Teachers can adapt the quantities based on the

number of students and available equipment.

Preparation (15 minutes)

1. Wash the strawberries thoroughly under running tap water to remove dirt and pesticides.
2. Remove seeds by cutting the fruit in half and scooping out the seeds with a spoon.
3. Cut the fruit into small cubes ("H1 /cm³). Place each sample in a labeled microcentrifuge tube.
4. Pre cool the lysis buffer on ice if possible.

Cell Lysis (10 minutes)

1. Add 200 /µL of lysis buffer to each tube.
2. Seal the tubes and vortex for 30–60 /seconds to ensure thorough mixing.
3. Incubate the tubes at 37 /°C for 5–10 /minutes to aid the action of any enzymes in the buffer.

Protein Precipitation (5 minutes)

1. Add 200 /µL of protein precipitation solution to each tube.
2. Cap the tubes and vortex vigorously for 30 /seconds.
3. Let the mixture sit on ice for 5 minutes to allow proteins to precipitate.

DNA Precipitation (5 minutes)

1. Carefully transfer the upper aqueous layer ("H400 /µL) to a new tube.
2. Add 400 /µL of cold 100% ethanol to the aqueous phase.
3. Mix gently by inverting the tube 3–5 times.
4. Let the mixture stand at room temperature for 5 minutes.

Pellet Recovery (5 minutes)

1. Place the tubes in a microcentrifuge and spin at 14,000 /rpm for 5 minutes.
2. Carefully decant the supernatant without disturbing the pellet.
3. Wash the pellet with 200 /µL of 70% ethanol.
4. Spin again at 14,000 /rpm for 3 minutes.
5. Decant the ethanol and allow the pellet to air dry for 5–10 minutes.

Rehydration and Observation (5 minutes)

1. Resuspend the pellet in 50 /µL of TE buffer.
2. Gently tap the tube to dissolve the DNA.
3. Observe the DNA string under a light microscope or simply by eye. Students should see a white, fibrous strand.

Frequently Asked Questions – Lab Answer Key

Below is a collection of common questions that students may encounter during the lab, along with comprehensive answers. These can be used as a study guide or a grading rubric.

Question 1: Why do we use a lysis buffer containing SDS?

Answer:SDS is an anionic detergent that solubilizes lipid membranes, including the plasma membrane and nuclear envelope. By disrupting these membranes, SDS releases the chromatin and other cellular components into solution, allowing DNA to be extracted. Additionally, SDS denatures proteins, preventing them from interfering with the DNA precipitation step.

Question 2: What happens if we skip the protein precipitation step?

Answer: Proteins would remain in the solution and could co precipitate with DNA when ethanol is added. This

would result in a cloudy pellet that is difficult to handle and would reduce the purity of the DNA. The presence of proteins can also interfere with downstream applications like PCR.

Question 3: Why is ethanol added at a cold temperature?

Answer: Cold ethanol reduces the solubility of DNA by decreasing the kinetic energy of water molecules, encouraging DNA strands to aggregate. Moreover, low temperatures help stabilize the DNA and prevent degradation by nucleases that might be present.

Question 4: How can we confirm that we have successfully extracted DNA?

Answer: The most immediate confirmation is the visual appearance of a white, fibrous string after adding ethanol. This string can be held with tweezers and observed under a microscope. For more quantitative confirmation, one can run a small aliquot on an agarose gel or use a spectrophotometer to measure absorbance at 260 /nm.

Question 5: What safety precautions should be taken when handling SDS and ethanol?

Answer:SDS is a skin irritant; students should wear gloves and eye protection. Ethanol is flammable, so it should be handled away from open flames, and spills should be cleaned promptly. All chemicals should be disposed of according to local regulations.

Question 6: Why does the DNA pellet appear fluffy and white?

Answer:DNA is a long polymer that, when precipitated, forms a network of strands. The white color arises from the scattering of light by the dense aggregation of DNA molecules. The fluffiness indicates that the DNA has been fully precipitated and is not dissolved.

Question 7: How does the pH of the lysis buffer affect DNA extraction?

Answer: The pH of the lysis buffer should be around 7.5–8.0 to maintain the stability of DNA and the activity of any included enzymes. A highly acidic or alkaline environment can denature DNA or promote degradation, leading to lower yields.

Question 8: What would cause a low DNA yield?

Answer: Possible causes include inadequate lysis (insufficient time or buffer concentration), incomplete removal of proteins, evaporation of ethanol, or contamination with RNase that degrades RNA. Additionally, using old or degraded strawberries can reduce the

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