An experimental study on the extraction of DNA from a Kiwi fruit

Aim

The aim of this experiment is to extract from a kiwi fruit its DNA, to be able to visualise it and explore its features by, at the same time, apprehending new laboratory skills.

Introduction

Deoxyribonucleic acid is a molecule composed of two polynucleotide chains that coil around each other to form a double helix carrying genetic instructions for the development, functioning, growth and reproduction of all known organisms and many viruses. As a consequence, DNA is the molecule that dictates what we are, and influences the characteristics of an organism more than everything else. There are many reasons for which there is a need for the extraction of DNA. It could be needed to determine the parentage of a child, for the identification of people in the case of crimes, and in the case of fruits as a kiwi, it may be used to compare it to other samples to determine if it has been altered in any way.

Educated guess

By following the appropriate procedure and by using a light microscope it will be possible to visualise the DNA.

Variables

Dependent variables	Independent variables	Controlled variables
X	X	Measurement techniques
X	X	Quantity of each material used
X	X	Amount of time to wait for each procedure to take place
X	X	Solution in which cubes are inserted

Materials

- Actinidia deliciosa (kiwi fruit)
- 5 ml of pineapple juice
- 5 ml of freezed ethanol
- Distilled water
- Measuring cylinder
- 3 bakers
- Filter paper
- Ice
- 100 ml of Water
- Microscope
- 3 grams of table salt
- 10 ml of dish detergent
- Funnel
- Methylene blue
- Slide
- Cover slip
- Plastic spoon
- Sodium chloride (salt)
- Pipette
- Mortar and pestle
- Thermometer
- Erlenmeyer flask
- Test tube
- Electrical heater

Fig. 1 —> Heating of water and Bain-marie

Method

Fig. 2 —> Filtering

The procedure to follow starts by crushing the kiwi fruit with the mortar until it is completely smashed. Afterwards pour 3 grams of salt in a baker containing 100 ml of water and make it dissolve. Slowly add 10 ml of dish detergent in the solution trying to avoid creating bubbles, and this will work as the extraction solution. Then pick up 100 gm from the smashed kiwi and, as before, slowly place them into the solution. Start stirring the whole slowly by using the plastic spoon until the kiwi and the extract solution have mixed sufficiently.

The next step is to create a bain-marie by placing the baker with the solution into a bigger baker containing water heated at 60° C. After waiting for an approximate time of 10 to 15 minutes another bain-marie needs to be performed. This time the baker with the solution need to be placed

into a bigger baker containing cold water and ice, to be able to create a thermal shock. Keep the baker in the cold ice until the mixture inside reaches a temperature of 22° that can be measured by using a thermometer.
Moving on, place on top of an erlenmeyer flask a filter paper, and with the help of a funnel, filter all the mixture. All the materials stuck onto the filter paper can be left apart, while instead 25 ml of the solution need to be poured into a test tube still avoiding creating bubbles. By using a pipette, pick up 5 ml of pineapple juice and pour it in the same test tube in which the solution is located. Pick up also 5 ml of freezed ethanol with the pipette and pour it in the test tube containing the solution and the pineapple. Wait until the DNA fully detaches and creates a layer on top of the solution. Place the DNA on a slide and add a drop of methylene blue on it. Place the cover slip and try and spread the methylene blue adequately through out all the area. Place the slide under the microscope and look at the DNA at 40x of magnification.

Results

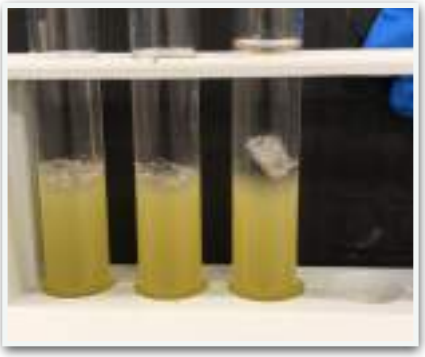

Fig. 3 —> DNA extraction

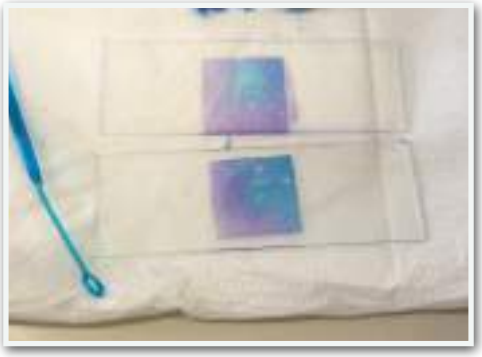

Fig. 4 —> Slide with DNA and methylene blue

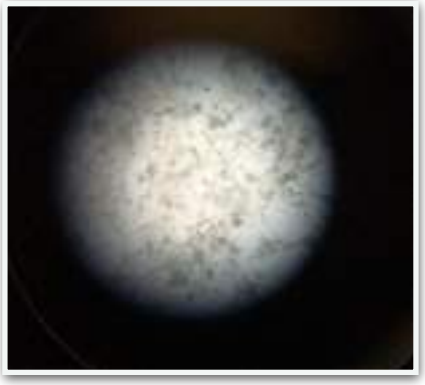

Fig. 5 —> Slide under microscope

Discussion


Fig. 6 —> Bain-Marie

The results showed that extracting DNA is a very simple and straightforward procedure that can be easily done efficiently with basic materials. This is possible because the materials used all have a characteristic that makes all the extraction possible. Starting from the dish detergent, the purpose for which it is used is to brake down the cell structure, and it is able to do it as the lipids contained in the soap go into the membrane and as they are hydrophilic they cause the membrane to rupture.
Pineapple juice instead is used as when DNA is packaged in the nucleus, it is wound tightly around histone proteins. Bromelain enzyme contained in the juice breaks down these proteins and release the DNA with minimal breakage.
As last the freezed ethanol is also essential for the completion of the experiment as it avoids DNA to dissolve and makes it turn solid.

Conclusion

The images collected and analysed support the educated guess which stated that by following the appropriate procedure and by using a light microscope it would have been possible to visualise the DNA. The DNA was clearly visible even with a naked eye, so the extraction method succeeded in bringing the DNA out of the cells.

Evaluation

For this type of experiment there is no need to repeat it several times to obtain more accurate results as the DNA extraction surely succeeds if all the steps are done correctly. Even though there are some points that could have been done better to be able to obtain a better result.
The use of a more professional pipette as an example would result in a better extraction of DNA, as all the materials would be all more accurately measured. Another aspect that could be improved is the dish detergent used which could be replaced with a more suitable material which does not bubble, and by using a higher magnification on the microscope to be able to visualise the DNA more clearly.

References

- https://www.michigan.gov/documents/explorelabscience/EXPERIMENT_-_Extracting_DNA_from_strawberries_571577_7.pdf