Detection of Biologically Important Molecules

Objective(s)/Aim(s)

The objective of this experiment was to identify the presence or absence of carbohydrates, proteins, lipids, and nucleic acids in various samples using qualitative chemical tests. Benedict's test was used to detect reducing sugars, the iodine test was used to detect starch, Biuret's test was used to detect proteins, the Sudan test was used to detect lipids, and the Dische diphenylamine test was used to detect DNA.

Introduction

Living organisms contain several major classes of biologically important molecules, including carbohydrates, proteins, lipids, and nucleic acids. These molecules perform important functions within cells. Carbohydrates can provide energy, proteins perform many structural and functional roles, lipids are important for energy storage and cellular membranes, and nucleic acids store genetic information.

Different chemical tests can be used to determine whether a particular type of molecule is present in a sample. Benedict's reagent detects reducing sugars by producing a color change when heated. Iodine reacts with starch and produces a characteristic blue-black color. Biuret's reagent reacts with peptide bonds in proteins and produces a violet or lilac color. Sudan dye can identify lipids based on their interaction with the dye. The Dische diphenylamine test detects DNA by producing a blue color. These tests were performed on different samples to determine which biologically important molecules were present.

Materials and Methods

For Benedict's test, 0.5 mL of each sample was placed into a test tube and 0.5 mL of Benedict's reagent was added. The test tubes were placed in a boiling water bath for approximately three minutes. After heating, the tubes were allowed to cool and their colors were recorded. A green to reddish-orange color indicated the presence of a reducing sugar.

For the iodine test, 0.5 mL of each sample was placed into a test tube and iodine solution was added dropwise. A dark blue-black color indicated the presence of starch.

For the Biuret test, 1 mL of each sample was placed into a test tube and Biuret's reagent was added dropwise. A violet or lilac color indicated the presence of proteins.

For the nucleic acid test, approximately 0.5 mL of the sample was placed into a test tube. Dische diphenylamine reagent was added dropwise until the cloudiness disappeared, and the tubes were heated in a water bath until the characteristic color developed. A blue color indicated the presence of DNA.

For the lipid test, 0.5 mL of each sample was placed into a test tube and two drops of Sudan dye were added. The tubes were swirled and observed. Even mixing of the sample and Sudan dye indicated the presence of lipids, while separation into layers indicated their absence.

Results

Table 1. Results of Biologically Important Molecule Tests

Sample	Benedict's Test	Iodine Test	Biuret Test	Sudan Test	Diphenylamine Test
Water	Blue (−)	No change (−)	No color (−)	Separate layers (−)	Clear (−)
Glucose	Orange (+)	No change (−)	No color (−)	Separate layers (−)	Clear (−)
Sucrose	Blue (−)	No change (−)	No color (−)	Separate layers (−)	Clear (−)
Starch	Blue (−)	Blue-black (+)	No color (−)	Separate layers (−)	Clear (−)
Egg Albumen	Blue (−)	No change (−)	Violet (+)	Separate layers (−)	Clear (−)
DNA Solution	Blue (−)	No change (−)	No color (−)	Separate layers (−)	Blue (+)
Salad Oil	Blue (−)	No change (−)	No color (−)	Red (+)	Clear (−)

Key: (+) = molecule present; (−) = molecule absent.

Discussion/Conclusion

The results demonstrated that the chemical tests were useful for identifying different types of biologically important molecules. Glucose produced a positive Benedict's test, shown by the orange color, indicating that glucose is a reducing sugar. Starch produced a positive iodine test and changed to a blue-black color, confirming the presence of starch.

Egg albumen produced a violet color during the Biuret test, indicating the presence of protein and peptide bonds. Salad oil produced a positive Sudan test, demonstrating the presence of lipids. The DNA solution produced a blue color with the Dische diphenylamine test, confirming the presence of DNA.

The water sample served as a negative control. It did not produce positive reactions in the tests, supporting the conclusion that the observed positive results were associated with the specific molecules being tested. Overall, the experiment demonstrated how qualitative chemical reactions can be used to distinguish among carbohydrates, proteins, lipids, and nucleic acids.

References

1. Chemical Tests to Identify Biologically Important Molecules Laboratory Protocol.
2. Biologically Important Molecules Laboratory Report Sample.

Images









