Name of Student

Name of Professor

Name of Class

Day Month Year

Lab Report

**Introduction**

1. **Carbohydrates**

Carbohydrates as the name indicates; are a group of organic compounds present in living body tissues and food e.g., cellulose, starch and sugars (Hardy et. al., 2015). They contain carbon, hydrogen and oxygen in complex formation; amenable to be broken down into simple elements producing energy necessary for performing tasks. Carbohydrates are termed as the primordial energy sources for living bodies. They are found in fruits, vegetables, grains and milk. As a process of oxidation, they are broken down into glucose and transferred to the body through blood (Hardy et. al., 2015).

1. **Enzymes, their functions and importance**

Enzymes are referred to as catalysts present naturally in human body. They are macromolecules in nature. Their characteristic function is to accelerate the chemical reactions taking place in body (Murphy et. al., 2017). Substrates are the molecules over which enzymes act generating the end product called “product.” Enzymes are always substrate, temperature and pH specific in nature; particular enzymes accelerate particular substrates at specific pH value and temperature e.g., 37 degree Celsius. Typically, they are made up of proteins however; some RNA molecules also act as catalysts. Enzymology is the sub-discipline of biochemistry concerned with the study of enzymes and their mechanisms of action (Murphy et. al., 2017).

1. **Amylase, functions and importance**

Amylase is the enzyme that acts as a catalyst for hydrolyzing starch (a complex carbohydrate) into maltose (a simple carbohydrate) in humans and other living organisms (Stenesh, 1998). This reaction takes place during cellular digestion of food. Carbohydrate rich potatoes and rice acquire slight sweet taste during chewing because our saliva contains smaller amounts of amylase that converts them into simple sugars—sweet in taste. Dietary starch is hydrolyzed by alpha amylase—produced by salivary glands and pancreas—into poly-saccharides, eventually converting into glucose—the simple sugars (Stenesh, 1998). Chemical structure of amylase is as follows:



1. **What is testing? Purpose of experiment**

Experiment is referred to as a research method, scientific in nature aimed at examining the cause and effect relationship between two or more objects, events or phenomena. Experiment is conducted either in laboratory under full-fledge controlled conditions or in natural setting under partial control conditions called field experiments. Experiment is a form of testing in which researcher attempts to verify hypothesis and converts it into proven fact. After controlling all the other extraneous variables, effects of independent variable are investigated on the dependent variable. For example, “base turns red litmus paper” in blue is a hypothesis which will be tested under laboratory conditions. Results will either verify or reject this hypothesis.

The experiment under documentation is the digestion of starch which is highly assisted by amylase enzyme released by saliva and pancreas. Starch is converted into maltose (a trisaccharide) under the action of amylase.

**Hypothesis**

1. I expect that in the amylase tube, starch is being converted into maltose which is then altered to glucose by intestinal enzymes.
2. Amylase will readily convert starch into maltose when it is boiled at 100° for 3 minutes; whether or not the enzyme performs well as without the enzyme

**Methods**

Initially three test tubes will be taken with same amount of starch. These test tubes will be introduced with 2ml distilled water, 2ml amylase and 2ml boiled amylase respectively. As soon as the mixing takes place, two drops from each test tube solution will be removed and introduced with IKI reagent for detecting the maltose. Solution will be removed till 11 minutes consistently. On the other hand; remaining solution will be introduced with Benedict’s reagent and boiling. Hence, three experimental groups will be undertaken experimentation with two conditions:

1. (Starch + distilled water) with IKI and Benedict’s solution
2. (Starch + amylase) with IKI and Benedict’s solution
3. (Starch + boiled amylase) with IKI and Benedict’s solution

In order to measure starch disappearance, one drop of IKI solution will be used. IKI solution is named after Iodine Potassium Iodide. Originally it colors yellow, the presence of starch turns it black. More instantly it turns black, higher the concentration of amylase is. If the result is positive, we will estimate that there is no starch in the solution; more starch has been converted into maltose.

On the other hand, Benedict’s solution will be used to detect presence of maltose in the remaining solution. It is a dark-blue colored alkaline solution. Upon interacting the reducing sugars (maltose) its color gets changed from blue green yellow orange brick red. Blue color means absent maltose; green means traces; yellow means low; orange means moderate and brick red means larger amounts of maltose are present. Amount of Benedict’s solution identical to remaining solution will be added and test tube will be kept in boiling water. If it gives positive results, it will be assumed that starch has been converted into maltose.

**Controls for starch:** as mentioned above, for detecting starch, IKI solution will be used. For the comparison of results with its negative and positive controls; it will be generated as follows. For negative control, IKI will be mixed with water in spot plate. This will indicate no color change (absent starch), in the second well, IKI will be mixed with starch solution—acting as positive control—giving black color; third well will be introduced with IKI solution and maltose giving away brown color.

**Controls for maltose:** 2ml of water, maltose and starch will be introduced with 2ml Benedict’s solution and will be heated for 4 minutes in water bath. In water and starch test tubes, its color remained blue (indicating no color change) acting as negative controls. Whereas positive control e.g., maltose will turn the reagent brick red.

**Results**

**Table 1**

*Tabular representation of IKI color change in control and experimental groups (STARCH)*

|  |  |  |
| --- | --- | --- |
| **Experimental group**  | **IKI color change**  | **Starch presence** |
| Water  | Yellow  | No  |
| Starch  | Black  | High  |
| Maltose  | Brown  | No  |
| Starch + water (0 min) | Black  | Yes  |
| Starch + water (0-11min) | Black | Yes |
| Starch + water (11min) | Black | Yes |
| Starch + amylase (0 min) | Black | Yes |
| Starch + amylase (0-11min) | Light Brown | Moderate  |
| Starch + amylase (11min) | Light Brown | Moderate |
| Starch + boiled amylase (0 min) | Light Brown | Moderate |
| Starch + boiled amylase (0-11min) | Brown | Low  |
| Starch + boiled amylase (11min) | Brown  | Absent  |

**Table 2**

*Benedict’s solution color change in control and experimental groups (MALTOSE)*

|  |  |  |
| --- | --- | --- |
| **Experimental groups**  | **Benedict’s color** | **Maltose present**  |
| Water  | Blue  | No  |
| Starch  | Blue  | No  |
| Maltose  | Brick red  | Yes  |
| Starch + water  | Blue  | No  |
| Starch + amylase  | Orange | Moderate  |
| Starch + boiled amylase  | Brick red  | High  |

**Statement of results; Time:**

1. The time taken by the first test tube (water + starch solution) in the digestion of maltose is greater than 11 minutes.
2. The time taken by the second test tube (amylase + starch solution) in the digestion of maltose is 4 minutes
3. The time taken by the third test tube (boiled amylase + starch solution) in the digestion of maltose is less than 4 minutes

**Statements of results, color:**

1. After 11 minutes, color of first test tube (starch + water) remains unchanged e.g., blue for Benedict’s solution whereas IKI solution turns black.
2. After 11 minutes, color of second test tube (starch + amylase) becomes orange for Benedict’s solution whereas IKI solution turns light brown.
3. After 11 minutes, color of third test tube (starch + boiled amylase) becomes brick red for Benedict’s solution whereas IKI solution turns brown.

**Discussion**

In first test tube (starch and water), the color of Benedict’s solution remains unchanged whereas IKI solution turns black indicating that no maltose detected and only starch is present; digestion is not taking place at all. IKI solution took greater than 11 minutes to manifest slight digestion.

In second test tube (starch and amylase), the color of Benedict’s solution becomes orange whereas IKI solution turns light brown indicating that moderate amount of maltose is detected and low amount of starch is present; digestion is moderately taking place but at comparatively fast pace. IKI solution took only 4 minutes to manifest complete digestion.

In third test tube (starch and boiled amylase), the color of Benedict’s solution becomes brick red whereas IKI solution turns brown indicating that larger amount of maltose is detected and only a fraction of starch is present; digestion is taking place too swiftly. IKI solution took less than 4 minutes to manifest complete digestion.

The above mentioned results verify the hypotheses that:

1. I expect that in the amylase tube, starch is being converted into maltose.
2. Amylase will readily convert starch into maltose when it is boiled at 100° for 3 minutes; whether or not the enzyme performs well as without the enzyme.

Hence, it can be concluded that for the digestion of complex carbohydrates e.g., starch, amylase enzyme is highly effective as compared to the digestion with the absence of amylase. On the other hand, boiled amylase is more efficient than simple amylase. This experiment successfully demonstrated that amylase enzyme is essential for the digestion of nutrients with respect to time. Enzymes lessen the time required for digestion and we get energy from what we eat more instantly.

Works cited

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Works Cited