CHEMISTRY INVESTIGATORY PROJECT

Title: Study of Digestion of Starch by Salivary Amylase and Effect of pH and Temperature on It

Name: Afzal Malik

Class: XII (PCM)

Subject: Chemistry

Session: 2024–2025

School Name: [Enter School Name]

Submitted To: [Enter Teacher’s Name]

# Certificate

This is to certify that Afzal Malik, a student of Class XII, has successfully completed the Chemistry investigatory project titled “Study of Digestion of Starch by Salivary Amylase and Effect of pH and Temperature on It” during the academic year 2024–2025 under my guidance and supervision. This project embodies the original work carried out by the student under the Chemistry curriculum prescribed by CBSE.

Signature of Subject Teacher  
Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Acknowledgement

I would like to express my heartfelt gratitude to my Chemistry teacher, [Teacher’s Name], for their constant support, encouragement, and valuable insights throughout this project. Their guidance helped me understand the intricacies of biochemical reactions from a chemistry perspective. I would also like to thank my school for providing the necessary facilities and environment for learning.

A special thanks to my parents and friends who supported me directly or indirectly. This project has significantly improved my understanding of enzyme chemistry and the importance of pH and temperature in biochemical processes.

# Aim

To study the digestion of starch by salivary amylase and determine the effects of pH and temperature on the enzyme activity in terms of chemical reaction speed and completion.

# Introduction

The digestion of starch is the first chemical change that occurs in the process of digestion, initiated in the mouth by the enzyme salivary amylase. From a chemistry perspective, this involves the hydrolysis of a polysaccharide (starch) into simpler sugars (mainly maltose). The enzyme acts as a biocatalyst, speeding up the reaction without being consumed.

Enzymes have an optimal range of temperature and pH under which they function efficiently. When these parameters deviate from the ideal range, the enzyme either slows down or denatures, thus halting the chemical reaction. This study investigates how these chemical parameters alter the efficiency of salivary amylase using iodine as an indicator for the presence of starch.

# Theory

Starch, a polysaccharide composed of glucose units, is broken down into maltose by salivary amylase. The reaction is a hydrolysis reaction, involving the addition of water to cleave glycosidic bonds. Chemically:

Starch + H₂O → (amylase) → Maltose

Salivary amylase works most efficiently at around pH 6.8–7.0 and body temperature (~37°C). Deviations from these conditions result in the enzyme becoming less effective or inactive. Iodine solution is used to detect the presence of starch, turning blue-black when starch is present. Disappearance of the blue-black color indicates successful starch digestion.

# Materials Required

- Test tubes  
- Starch solution (1%)  
- Fresh saliva  
- Iodine solution  
- Droppers  
- Beakers  
- Thermometer  
- Water bath  
- pH buffer solutions (pH 4, 7, 9)  
- Timer or stopwatch

# Procedure

1. Prepare four test tubes with equal amounts of starch solution.  
2. Add equal amounts of freshly collected saliva to each.  
3. For temperature variation:  
 - Keep one test tube in an ice bath (0°C)  
 - One at room temperature (~25°C)  
 - One in a water bath at 37°C  
 - One in a hot water bath at 60°C  
4. Wait for 10 minutes and then add iodine solution.  
5. Observe color change to determine starch presence.

6. Repeat similar steps for pH variation:  
 - Adjust pH of three test tubes to acidic (4), neutral (7), and basic (9) using buffer solutions.  
 - Incubate at 37°C for 10 minutes and test with iodine.  
7. Record and analyze results.

# Observations

Observations are based on the color change upon adding iodine. Blue-black indicates the presence of starch (no digestion), while yellowish or no color change indicates successful digestion.

Temperature Test Results:  
- 0°C → Blue-black (no activity)  
- 25°C → Light blue (partial digestion)  
- 37°C → Yellowish (maximum digestion)  
- 60°C → Blue-black (enzyme denatured)

pH Test Results:  
- pH 4 → Blue-black (enzyme inhibited)  
- pH 7 → Yellowish (optimal activity)  
- pH 9 → Light blue (reduced activity)

# Result

The experiment demonstrates that salivary amylase has optimal activity at around pH 7 and temperature close to 37°C. Higher or lower pH values and extreme temperatures result in decreased enzyme activity or complete denaturation, preventing starch digestion.

# Conclusion

This study illustrates the effect of chemical factors such as pH and temperature on enzyme function. From a chemistry standpoint, enzymatic reactions are highly sensitive to environmental changes due to the alteration in molecular structure and kinetic energy. Enzymes like salivary amylase work efficiently under specific chemical conditions, which if altered, can lead to structural changes or complete inactivity.

# Bibliography

- NCERT Chemistry Class XII  
- Chemistry Practical Lab Manual  
- Chemguide.co.uk  
- Wikipedia.org  
- YouTube (Enzyme Activity Experiments)