

# Digestion of carbohydrates in relation to ph. levels essay sample



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## 1. 0 Introduction

The human body is constantly working to remain healthy and functioning. In order to achieve this, the body needs a constant supply of energy as well as other vital nutrients. This is absorbed from the food we eat through a process called digestion. Digestion takes place in several organs with the help of enzymes and certain pH levels.

## 1. 1 Background Information

This experiment has been constructed to test the effect of pH level on the reaction time of amylase breaking down starch. Amylase and glucoamylase are the enzymes present in human saliva used to begin the break down process of carbohydrates. When not enough of these enzymes are produced to regulate the decay of these foods, diastase, a natural form of amylase, helps in the process.(Grosz, 2012) pH levels of 1, 4, 7, 9 and 14 will be tested. Based on research, it is predicted that the starch will be ' digested' fastest at the highest acidic levels due to the fact that the enzymes used in the stomach for digestion consist of pure acid.

## 1. 2 Mouth/Oesophegus

Once food enters the mouth, teeth grind the food it into a soft paste while the tongue shapes it into a ball called a bolus for swallowing. Saliva at a pH of approximately 5. 6 to 7. 9 begins the digestion, chemically using special proteins called enzymes.(livestrong. com, 2012) These break down large molecules into smaller molecules that can be absorbed along the body's digestive tract. Muscular contractions known as peristalsis along this tract, moves the food downward though the oesophagus and the lower

oesophageal sphincter. This is a muscle which closes to ensure no food re-enters the oesophagus once swallowed. (National Geographic, 2012)

### 1. 3 Stomach

The stomach is a large muscle that acts as a temporary storing containing whilst mixing and liquefying the food. It has the ability to hold large meals for a long time. During this period stomach juices begin the process of chemical and enzymatic digestion. Enzymes such as pepsin which breaks down proteins, and lipase which attacks fats, work with Hydrochloric acid to dissolve the stomach contents and also destroy potentially harmful bacteria. The final product, a liquid paste called chyme, remains in the stomach until two sphincter muscles release it into the duodenum. (National Geographic, 2012)

### 1. 4 Small Intestine

Measuring about 6 metres in length the small intestine is separated into three parts- the duodenum, jejunum, and ileum. (National Geographic, 2012) This is where major absorption into the bloodstream occurs of essential nutrients.

### 1. 5 Large Intestine

The remainder waste is pushed into the large intestine where thousands of small villi and harmless bacteria mixed with dead cells combine to form solid faeces. Along the section of the tract water is absorbed from the waste into the body before being defecated.

### 1. 6 Other Key Players

Food is energy. Nutrients are absorbed through the blood stream from the <https://assignbuster.com/digestion-of-carbohydrates-in-relation-to-ph-levels-essay-sample/>

liver where red blood cells distributed this energy to organs such as the brain, heart and kidneys as well as muscles and tissues that also require energy. (Answers. com, 2012) Enzymes are dispersed into the duodenum from the pancreas. Connected to this is a duct called the gall bladder which produces bile, an acidic liquid waste product from the liver used to break down fats. (National Geographic, 2012) The liver plays a vital role in relation to the digestive system as it absorbs nutrients, ' creating energy giving glycogen from sugary carbohydrates and converting dietary proteins into new proteins needed for our blood.' (Answers. com, 2012) Imperative vitamins, minerals and proteins are stored for when they are required in the body. The liver also destroys and discards unwanted chemicals such as alcohol. Damage to the liver can result in a series of health issues.(About. com, 2012)

### 1. 7 Problems In the Digestive System

The human digestive system is affected by both the external and internal environment so it is important to remain a healthy balance. If not, the result can be uncomfortable and in the long term can cause abdominal pain, unusual bowl movement and other severe symptoms. Colitis, diverticulitis, gastroenteritis, heartburn and ulcers are just a few common problems that occur in the digestive system. (Astill, 2012) Basic causes of digestive discomfort can be due to stress, antibiotics, poor diet, drugs and environmental toxins.( Cochrane, 2011) Therefore it is crucial to avoid alcohol and other drugs, maintain a balanced diet including foods from all five food groups (refer to appendix), consume only prescribed medicine,

avoid potentially harmful chemicals and remain calm, ensuring 7-9hours of sleep a day. (Morgenthaler, 2012)

2. 0 Aim: To test at what pH level amylase works the fastest using a range on pH levels from pH 1 to pH14. 3. 0 Hypothesis

The starch will be digested fastest at the highest acidic (pH1) level. pH above 6 will not be effective in digesting the starch.

#### 4. 0 Materials

- \*
- \* Test tubes + rack + labels
- \* Universal indicator paper
- \* Starch Solution
- \* Dimple tray
- \* Amylase
- \* Pipette
- \* Timer
- \* pH 4 buffer
- \* stirrer
- \* Sodium Hydroxide (NaOH)
- \* Hydrochloric Acid (HCl)
- \* Tap water
- \* Marker pen
- \* Iodine solution
- \* pH 9 buffer
- \* Glass beaker

## 5. 0 Method

1. Mix buffer at different pH levels of 1, 4, 7, 9 and 14. 5. 1 Making the Buffers

pH 1- Pure HCl

pH 4- Provided in the experiment equipment

pH 7- Tap water (do not use distilled water)

pH 9- Provided in the experiment equipment

pH 14- Pure NaOH

2. Label test tube with pH level to be tested.

3. Place single drops of iodine solution in the dimples on the dimple tray. 4.

Place 8 drops of amylase into test tube, and then 4 drop of buffer. NOTE\* It is suggested to do the neutral control first. This consists of water at a pH of 7 5.

Add 8 drops of starch to test tube and mix. Then start timer. 6. After 10 seconds use the pipette to place one drop of mixture on the first drop of

iodine. The iodine solution should turn blue/black in colour. If it remains

orange, the starch has already " digested". 7. Wait another 10 seconds. Then remove a second drop of the mixture to add to the next drop of iodine. 8.

Always put Waste mixture in beaker. This will be disposed of later. 9. Repeat step 6 until the iodine solution and amylase/buffer/starch mixture remains

orange. 10. Count how many iodine drops are used in the experiment, each equalling 10 seconds of reaction time. 11. Repeat the whole procedure using

another of the pH buffers. 12. Plot graph to display time taken to break down starch against pH or calculate the rate of reaction and plot rate against ph.

## 6. 0 Results

| Trial 1| Trial 2| Trial 3| Total - Average|

pH 1 (Pure Acid)| 170 seconds | 160 seconds | 190 seconds | 173seconds| pH

4 (Acid)| 60 seconds | 70 seconds | 210 seconds

outlier| 65 seconds| pH 7 (Neutral) | 100 seconds | 130 seconds | 120

seconds | 113 seconds| pH 9(Alkaline)| 140 seconds | 120 seconds | 100

seconds | 120 seconds | pH14 (Pure Alkaline)| 160 seconds| 140 seconds|

170 seconds| 157 seconds|

## 7. 0 Analysis/ Discussion

The aim of this experiment was to test and verify at which pH level starch is digested fastest at. This was successfully achieved although results didn't exactly match the research.

The hypothesis predicted that the starch would be fastest digested at the highest acidity levels. This was based on the knowledge that acid reacts fast and is corrosive. This was proven to be incorrect as the fastest recorded time (average) was 65seconds with a pH of 4, followed by pH7 and then pH9. The enzyme that was used in the experiment is called diastase and is found in the body in saliva. Saliva has a pH of approximately 5. 6 to 7. 9. (livestrong. com, 2012) This can vary based on diet. Therefore the achieved results are 1. 6pH below that of the actual enzymes used by the body itself when digesting starch.

It was not expected that the pure acid buffer (pH 1) would result in the slowest reaction of al at 173seconds (average), even slower than that of a complete alkaline solution (pH 14: 157 seconds). A more accurate reliable result could be attained, if the experiment were to be repeated numerous

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times, other minor aspects could also be improved. (refer to ' Errors'). It would also be Interesting to test other enzymes and their reaction with other nutrients such as proteins and lipids as well as the effect of pH on this in order to gain an extensive understanding of the bodies functions.

## 8. 0 Conclusion

To conclude, the results from this experiment showed that the starch was digested fastest at a pH of 4. Although this is not exactly the same as the saliva used to digest starch in the body (pH 5. 6 to 7. 9), this result cannot be relied on as there are many factors that can affect the outcome of the experiment and also factors which may vary in the human body (diet, health, personal characteristics etc.)The body relies on carbohydrates daily though the effect of pH level on the digestion of starch is just one of the many vital balances in the human body.

Despite the unexpected results, this experiment allowed group members to broaden their knowledge both on the subject as well as in the lab; overall a successful experience.

## 9. 0 Errors

Considering this experiment was based a lot on the colour of certain substances and other tricky determinations, it was no surprise that mistakes were found. Improvement could in future be made. These include accurate sized drops of iodine in every dimple tray; ensuring pipettes aren't damaged to avoid mishap when timing and the measuring of the liquids used throughout the experiment could always be more accurate. Due to the fact that the pHs of the buffers were tested with universal indicator paper relying



on personal abilities to identify colours and the digestion of the starch was also based on a change in colour, the outcome is considered to be imprecise. Consequently, it should not be forgotten that science is a situation of trial and error and perfect results can never be expected and should not necessarily be desired either.

#### 10. 0 Acknowledgements

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