2.5 Enzymes - Amylase - evaluation

Instructions:
- Collect your spit which contains amylase
- Time how long your spit takes to break down 2% starch solution

Hints:
- Some information to get you started:
  - Enzymes
  - Starch digestion

Research: *(insert here)*
Starting point:
- *What is amylase?*
- *What substrate does it act upon?*
- *Why might some people produce a greater quantity of amylase?*
- *What does iodine indicate? How does it change colour?*
- *How can you measure the rate of an enzyme controlled reaction?*

Question: How can you design an experiment to test the effect of temperature on amylase?

Variables: *(from the method identify and describe the following variables)*

Independent:
Dependent:
Control:

Here is a sample method:
(include a labeled line drawing of the experimental setup)
If you have trouble with this method here is an alternative

1. *Chew the rubber band and produce as much spit as you can into the plastic beaker in a 5 minute window (6ml minimum) Alternatively use a 2% amylase solution*
2. *Add 1ml of pH7 buffer to a test tube*
3. *Add 10ml of 2% starch solution and 4 drops of iodine into a test tube. Mix my gently swirling - note it should be black/grey.*
4. *Add 2ml of saliva (spit) to the test tube and swirl/10ml 2% Amylase*
5. *Record how long it takes to turn clear/white*. (mins)*
6. ***Repeat 3 times.***
7. *Create a **cold** water bath in a mug or plastic 250ml beaker.*
8. *Repeat step 2-5, this time placing the test tube with the starch/saliva solution into the cold water bath.*
9. *Create a **hot** water bath in a mug or plastic beaker.*
10. *Repeat step 2-5, this time placing the test tube into the hot water bath.*
11. *Record the times taken in an appropriate table and draw a graph to illustrate your results.*

	__Note__ it changes colour quickly (within 1 - 2 minutes) as the enzyme amylase breaks down the starch it will change to clear/white.* ***Tips:* ● *If enzymes become denatured it may never change sop remember to use pH buffer!* ● *Complete 1 trial at a time as it is fast*

Having tried the experiment, what are the strengths, weaknesses and improvements to this method that you would suggest?

Example evaluation:

Strengths and weaknesses and improvements

Strength:*Through trial and error the experiment method was repeated many times by many people.*

Weakness: *Adding the iodine at the start was seen to be a potential problem. A colour change **did not** occur when the iodine was added before but a change in colour could be seen when a sample was placed on a dropper tile and iodine added after.*

Improvement: *It was decided that a reacting mixture would be prepared of a large enough volume to remove samples. A total volume of 30ml in the reacting mixture allowed 1ml samples to be taken every minute for 30 minutes. And the iodine was added to each of these tests.*

Strength: *It was found that human saliva was more effective than the prepared 2% amylase solution. When tested with human saliva, the experiment worked and the mixture changed to colourless after 10 minutes.*

Improvement: *Repeat the experiment with a fresh amylase solution of 3% Try 2:1 ratio 2% amylase to starch. Make sure to mix the mixture thoroughly by shaking*

Weakness*: The colour change was relatively slow (10mins) at room temperature. Increasing the concentration of the amylase will speed up the reaction.*

Improvement: *Increase to 3% fresh stock solution of amylase.*

Weakness: *It was difficult to get the experiment at the exact time, one the minute, as it took time to remove the mixture, add the iodine and look at the colour change. +/-30 seconds each time*
Improvement: *Time using a stop watch and have two people. One to remove the 1ml of mixture each test and one to drop one drop of iodine on the mixture to test for the colour*

Weakness: *the iodine was not reacted evenly in the dimple tile*
Improvement: *mix with the pipette tip ten times before recording the colour change*

Weakness: *recognising the colour change was difficult. Different people see the colour differently*
Improvement: *use the same person to determine the point of colour change*
Use an app on the phone to read a colour change. Make sure to have the same lighting app and phone camera doing this (titration colour cam)
Use a colorimeter to determine a %transmission that is comparable (Alison Gilchrist, Jim Nobbs)

Weakness: *the concentration of the mixture could be different between trials.*
Improvement: *Change the pipette to use a fresh pipette every trial, to minimize waste, wash out the pipettes and dry them after the experiment so that they can be reused.*

Other Improvements and further work:
When investigating a change in temperature, for the reacting mixture, place the mixture in a test tube then remove 1ml every minute using a long 1ml pipette and place into a dropper tile.

Bibliography:

Titrationcolourcam-https://play.google.com/store/apps/details?id=com.color.Titration_ColorCam&pcampaignid=web_share Accessed 24 Jan 2024

"Colorimetry." Colorimetry - an Overview | ScienceDirect Topics, www.sciencedirect.com/topics/chemical-engineering/colorimetry. Accessed 24 Jan. 2024.

EVALUATION SCORE /6					
Conclusion is relevant to research question and data	A detailed conclusion is described and justified which is entirely relevant to the research question and fully supported by the data presented.	A conclusion is described which is relevant to the research question and supported by the data presented.	A conclusion is outlined which is not relevant to the research question or is not supported by the data presented.	RQ answered and related to the results Reference to hypothesis	
Conclusion is compared to scientific context	A conclusion is correctly described and justified through relevant comparison to the accepted scientific context.	A conclusion is described which makes some relevant comparison to the accepted scientific context.	The conclusion makes superficial comparison to the accepted scientific context.	Scientific info with references used to justify conclusion and support it Scientific context to explain results and support data with other published	
Strengths and weaknesses of investigation	Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are discussed and provide evidence of a clear understanding of the methodological issues* involved in establishing the conclusion.	Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are described and provide evidence of some awareness of the methodological issues* involved in establishing the conclusion.	Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are outlined but are restricted to an account of the practical or procedural issues faced.	How reliable is the data Describe each data point Any difficulties in method explained Sources of error in equipment or use of equipment explained Impact of measuring or of other factors explained	
Realistic improvements and extensions	discussed	Some discussed	Few discussed		