Amylase activity in germinating seeds

Amylase is an enzyme found in the germinating seeds. Imbibition process causes the release of growth plant (gibberelin) which stimulates the synthesis of amylase. Amylase activity is affected by many factors such as temperature, pH, enzyme concentration, substrate concentration, and the presence of any inhibitors or activators.[1]Amylase enzyme in the green bean seeds works best at specific range of temperature. The cotyledons store food for the use of embryo in the form of starch. Amylase enzyme breaks down starch into maltose, a chain of two glucose molecules Maltose then breaks down into glucose. Glucose is used for the growth of plumule and radicle. When this process happens, the seeds are said to undergo germination process. The emergence of plumule and radicle indicate that the seeds have germinated. In germinated seeds, the blue colour of the Benedict’s solution change to brick-red precipitate indicating the presence of glucose while maintaining the yellowish-brown colour of the iodine solution indicating the absence of starch. However, in non-germinated seeds, the yellowish-brown colour of the iodine solution change to blue black indicating the presence of starch while maintaining the blue colour of the Benedict’s solution indicating the absence of glucose.

AIM :

To investigate the amylase activity during seed germination

RESEARCH QUESTION:

How does amylase activity affect the rate of seed germination?

HYPOTHESIS:

The higher the amylase activity, the higher the rate of seed germination which is indicated by the higher changes in length of plumule and radicle. Hence, the area of starch agar that represents the absence of starch is bigger and the concentration of brick-red precipitate is lower indicating the presence of small amount glucose.

VARIABLES:

Units

Range

Independent Variable

Different condition of the seeds

Vary the conditions of the green bean seeds by boiling, soaking and drying

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Dependent Variable

Change in length of radicle and plumule

Measure the change in length of radicle and plumule by using the ruler

cm

Table 1 : The independent and dependent variable of the experiment and method to control.

Control variables

Units

Range

The temperature of the incubator

Set the temperature of the incubator at 25°C throughout the experiment

°C

-10 – 110

The time taken for each plate to be left in the incubator

Left each plate for 1 week

–

–

The type of seed used

Use the same type of seed which is green been seeds for each sterile starch agar plate

–

–

The number of seed placed in each plate

Place 5 green bean seeds in each of the sterile starch agar plate

–

–

Table 2: The control variables of the experiment and method to control.

MATERIALS AND APPARATUS :

APPARATUS

Apparatus

Quantity

Test tube

2

Beaker

2

Ruler

1

Microwave oven

1

Marker

1

Razor blade

1

Incubator

1

Pestle and mortar

1 set

Table 3: The list of apparatus.

MATERIAL

Material

Quantity

Benedict’s solution

Some

Iodine solution

Some

Disinfectant

Some

Distilled water

50 ml

Green bean seeds

15

Sterile starch agar plate

3

Table 4: The list of material.

PROCEDURE :

A. PREPARING DIFFERENT CONDITIONS OF GREEN BEAN SEEDS.

Soak 5 green bean seeds in distilled water for 24 hours.

Heat 5 green bean seeds in the microwave oven at 35°C for about 30 minutes.

Boil 5 green bean seeds.

B. INVESTIGATING THE AMYLASE ACTIVITY OF GREEN BEAN SEEDS.

Label 3 sterile starch agar plates with A (boiled green bean seeds), B (soaked green bean seeds) and C (dried green bean seeds)

Cut each seeds of different conditions into half to split the cotyledon by using the razor blade.

Soak the split seeds into disinfectant solution for 10 minutes for sterilization and then rinse twice using the distilled water.

Place 5 boiled green bean seeds in plate A, 5 soaked green bean seeds in B and 5 dried green bean seeds in C by using the forceps.

Place all the labeled plates in the incubator at temperature of 25°C for 1 week.

After 1 week, retrieve all the plates.

Take out the seeds from plate A and cut the radicle and plumule by using the razor blade.

Measure and record the length of radicle and plumule by using the ruler.

Pour iodine solution into sterile starch agar plate until it covers the whole agar for 3 minutes and observe the size of the area represents the absence of starch.

Transfer the seeds including the plumule and radicle into the mortar.

Put a spoonful of sand and 10 ml of distilled water into the mortar.

Grind the mixture using the pestle until it becomes watery mixture.

Pour some of the watery mixture obtained into a test tube and add 2 drops of Benedict’s solution to test for the presence of glucose. Note the colour changes and record the data obtained.

Record all the measurement and observation in a table.

Repeat steps 7-14 for plate B and C.

DATA COLLECTION :

QUALITATIVE DATA

Plate

Condition of the seeds

Observation

A

Boiled green bean seeds

B

Soaked green bean seeds

C

Dried green beans seeds

Table 5: Observation on the change in the colour of iodine solution and Benedict’s solution.

QUANTITATIVE DATA

Plate A

(boiled green bean seeds)

Plate B

(soaked green bean seeds)

Plate C

(dried green beans seeds)

Change in length of the radicle, cm

(± 0. 05)

1

2

3

4

5

6

7

8

9

10

Change in length of the plumule, cm

(± 0. 05)

1

2

3

4

5

6

7

8

9

10

Table 6: The change in length of the radicle and plumule.