

**Department of Biology and Biochemistry Biol111**

**Exp #6: Cellular Activity**

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**Cellular activity**

**Objectives:**

**1.The aim of the photosynthesis experiment:** to see the effect of different factors such as light and temperature on the rate of photosynthesis.

**2.The aim of the fermentation experiment:** to measure the volume of CO₂ produced during the fermentation of different carbohydrates by yeast cells under an aerobic conditions.

**Introduction:**

**- the issue we are studying is:** what is the effect of different factors on cellular activities (photosynthesis and fermentation) on measuring the volumes of O₂(ml) and CO₂(ml)?

**Materials and method:**

**- in the photosynthesis experiment:** we used 7 funnels and filled each with 10 Geranium leaves, then we inserted the funnel upside-down in the Beakers, we added 0.5% sodium bicarbonate (NaHCO₃) to each as a source of CO₂, and then we closed the funnels that is filled with the Geranium leaves and the sodium bicarbonate (NaHCO₃) using up-down graduated test tubes that is also filled with sodium bicarbonate (NaHCO₃) ,to measure the volume of O₂ in (ml) that will be seen as (O₂) bubbles that moves to the Top of the graduated test tubes, and finally we highlighted each Beaker by different course of light (40W, 150W, Dark, room light) and different temperatures(ice bucket, 50 C, room temperature), we took notes and measured the volume of the O₂ every 10 minutes in (ml) to each, and we took the beaker that has the room temperature and room light as the control that we will compare each beaker with; to see the difference and the effect of these factors on the O₂ production, because the photosynthesis depends on the O₂ volume ( the more oxygen produced the higher rate of photosynthesis) as the following equations:

**1)** 6CO₂ + 12H₂O −−−−Light + chlorophyll−−−−→ C₆H₁₂O₆ + 6O₂ +6H₂O

**2)** H₂O → O₂ +2H⁺ + 2e⁻ **3)** NADP⁺ → NADH **4)** CO₂ → Organic Compound

**- in the fermentation experiment:** we brought 5 flasks that are each filled with different carbohydrate (Sucrose, Glucose, Galactose, Molasses, Water) and we added 10% of each to another 5 fermentation tubes, then we added more 10% of fermented yeast solution to the fermentation tubes, then we set all of the 5 fermentation tubes in a water that has a temperature of 3 C (because it is the temperature that the yeasts bacteria lives in ), and then we measured the volume of the CO₂ every 5 minutes in (ml), and we took the tube that contains water as the control tube that we will compare each fermentation tube with; to see the difference and the effect of these carbohydrates on the production of CO₂, because the fermentation depends on the CO₂ volume (the more CO₂ produced the higher rate of fermentation) as the following equation:

C₆H₁₂O₆ −−−−fermentation−−−−−−→ 2C₂H₅OH + 2CO₂ + ATP and Heat

**Data:**

**\_\_** we collected the volumes of O₂ in the photosynthesis experiment every 10 minutes, and the volume of CO₂ in the fermentation experiment every 5 minutes.

**\_\_** we observed the effect of each factor on booth experiments.

**Results:**

**Table1: Volume of O₂ (ml) collected in the graduated test tubes under different environmental conditions for 80 minutes:**

| **Time (mins)** |  **Dark**  **/** **Room temp** |  **Room Light /** **Room temp**  **CONTROL** |  **40 Watt Light /** **Room temp** | **150 Watt** **Light**  **/** **Room temp** |  **On ice**  **/** **Room temp** | C  **/** **Room temp** |  **With water** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **0**  | **0**  | **0**  | **0**  | **0**  | **0**  | **0**  | **0** |
| **10**  | **0**  | **0.15**  | **0**  | **0.3**  | **0**  | **0.06**  | **0.1** |
| **20**  | **0**  | **0.15**  | **0.1**  | **0.4**  | **0**  | **0.08**  | **0.2** |
| **30**  | **0**  | **0.25**  | **0.12**  | **0.42**  | **0**  | **0.1**  | **0.25** |
| **40**  | **0**  | **0.26**  | **0.15**  | **0.5**  | **0**  | **0.2**  | **0.25** |
| **50**  | **0**  | **0.5**  | **0.30**  | **0.85**  | **0**  | **0.3**  | **0.25** |
| **60**  | **0**  | **0.57**  | **0.35**  | **0.9**  | **0**  | **0.9**  | **0.25** |
| **60**  | **0**  | **0.65**  | **0.37**  | **1.0**  | **0**  | **0.9**  | **0.25** |
| **80**  | **0**  | **0.65**  | **0.39**  | **1.1**  | **0**  | **1.0**  | **0.3** |

1.2

1 

0.8 

0.6 

0.4 

0.2 

0 0 10 20 30 40 50 60 70 80

 Dark 

 CONTROL  40 Watt Light 150 Watt Light  On ice  50 ̊C  With water

**figure1: Volume of O₂ (ml) collected in the graduated test tubes under different environmental conditions for 80 minutes**

**Table2: volume of CO₂ (ml) collected in the fermentation tubes for 40 minutes :**

| **Time (mins)**  | **Sucrose**  | **Glucose**  | **Galactose**  | **Molasses**  | **Water** **CONTROL** |
| --- | --- | --- | --- | --- | --- |
| **0**  | **0**  | **0**  | **0**  | **0**  | **0** |
| **5**  | **0**  | **0**  | **0**  | **0**  | **0** |
| **10**  | **0**  | **0**  | **0**  | **0**  | **0** |
| **15**  | **0**  | **0**  | **0**  | **0**  | **0** |
| **20**  | **1.5**  | **2.5**  | **0**  | **3.0**  | **0** |
| **25**  | **2.5**  | **4.5**  | **0**  | **3.9**  | **0** |
| **30**  | **3.4**  | **4.5**  | **0**  | **4.5**  | **0** |
| **35**  | **4.0**  | **5.0**  | **0**  | **4.9**  | **0** |
| **40**  | **4.5**  | **5.0**  | **0**  | **5.0**  | **0** |

6

5

4 

3 

2 

1 

0 0 5 10 15 20 25 30 35 40

**figure2: Volume of CO₂ (ml) collected in the fermentation tubes for 40 minutes**

****Sucrose Glucose Galactose Molasses CONTROL



**-Discussion:**

as shown in **figur1** we noticed that the volume of the O₂ was increasing in a fast way in the beaker that was highlighted to 150 Watt Light comparing with the CONTROL, and on the other hand we can see the results when the breaker was set in the darkness gave us a zero volume of O₂, these results proofs for us that the amount of light highlighted to the beakers effects the rate of photosynthesis, as following: the more light collected by the chlorophyll pigments, the more O₂ obtained from the H₂O splitting molecules by the light's ATP, the more protons (H⁺) obtained which are provides the energy, so the more NADH obtained that needed in the second process of the photosynthesis (Calvin cycle), the more rate of photosynthesis the chloroplasts can make.

also we noticed that the volume of the O₂ a increa ing in a fa t ay in the ea er that ha a temperat re of C comparing with the CONTROL, and on the other hand we can see the results when the breaker was set in the ice bucket gave us a zero volume of the O₂, these results proofs for us that the temperatures of the beakers effects the rate of photosynthesis, as following: the more heat the plants gets, the more O₂ obtained from the H₂O splitting molecules bye the heat's ATP, the more protons (H⁺) obtained which are provides the energy, so the more NADH obtained that needed in the second process of the photosynthesis (Calvin cycle) , the more rate of photosynthesis the chloroplasts can make.

in the sum of both results of the light and the temperature, we can say that they gave us the same results to the photosynthesis General equation :

6CO₂ + 12H₂O −−−−Light + chlorophyll−−−−−−→ C₆H₁₂O₆ + 6O₂ +6H₂O

and in **figure2** we noticed that the results for the Glucose fermentation tube and the Molasses fermentation tube were close in the volume of the CO₂ , which was increasing very fast comparing with the CONTROL, and we can notice that the Sucrose fermentation tube had a smaller volume of the CO₂, on the other hand we can see the results in the Galactose fermentation tube and Water(CONTROL) fermentation tube gave us a zero volumes of the CO₂, these results proofs for us that the volume of CO₂ effects the rate of fermentation as following : the more CO₂ obtained, the more rate of fermentation. and as the fermentation General equation: C₆H₁₂O₆ −−−−fermentation−−−−−−→ 2C₂H₅OH + 2CO₂ + ATP and Heat.

**Conclusion:**

there were no errors in both experiments and we concluded that the volume of the O₂ effects the rate photosynthesis and the volume of the CO₂ effects the rate of fermentation .