Optimization of Euglena and their measurement methods

Abstract

This study conducted two experiments to identify effective methods of cultivating euglena and turning it into a viable food supply. The first experiment compared different organic substances to determine which best promotes euglena growth. The second refined these conditions further. Results showed that among various materials tested, brown rice produced the highest increase in euglena. The findings suggest that iron content, which is abundant in brown rice, may play a significant role in euglena proliferation.

Introduction

Background

Euglena has the potential to contribute to the solution of global hunger. Currently, around 735 million people suffer from hunger worldwide, and this number continues to rise. One major factor contributing to this trend is global warming. Climate change, caused by the accumulation of greenhouse gases such as CO_2, has led to frequent natural disasters and agricultural disruption. For instance, in Niigata Prefecture, Japan, droughts related to climate change prevented rice cultivation—an example of how environmental issues are directly tied to food insecurity.

Human activities, including deforestation, combustion of fossil fuels, and transportation, have drastically increased atmospheric CO_2. Trees play a critical role in absorbing CO_2, but large-scale deforestation since the 18th century has diminished this natural carbon sink.

Reforestation is important, but slow. To combat climate change and hunger simultaneously, we must find alternative solutions.

Euglena may be part of that solution. Like plants, it performs photosynthesis, converting CO_2 into oxygen, thus contributing to carbon reduction. However, unlike most plants, euglena grows quickly and requires less time to mature. Additionally, it is rich in nutrients such as vitamins, minerals, and amino acids. If euglena can be cultivated efficiently and consumed safely, it could offer a sustainable food source for regions affected by hunger.

Therefore, this study explores euglena's potential to reduce atmospheric CO_2 while serving as a nutritional food source.

Hypothesis

Euglena can be cultivated more efficiently using certain organic substances, particularly rice-based materials. It was hypothesized that among various types of rice, brown rice will lead to the highest increase in euglena due to its nutrient and iron content.

Experiment 1

This experiment aimed to determine which organic material best promotes the growth of euglena. Previous studies suggested that rice, yeast, and liquid fertilizer may be effective. All three were tested and it was found that rice resulted in the greatest increase the number of euglena cells.

Experiment 2

The second experiment examined which type of rice is most effective for euglena cultivation.

While prior studies mentioned rice as a good medium, they did not compare different rice types. White rice, black rice, sticky rice, and brown rice were tested.

Experiment 3

To ensure accuracy, a preliminary study was conducted to account for inconsistencies in euglena distribution within the medium. A measurement protocol was established using a hemocytometer and microscope to standardize cell counting.

Materials

Experiment 1:

- 3 plastic bottles (500 mL)
- Euglena medium
- 1 g liquid fertilizer
- 1 g yeast
- 1 g white rice

Experiment 2:

- 4 plastic bottles (500 mL)
- 1 g each of white rice, unpolished rice, sticky rice, and brown rice
- Euglena medium (4 mL total)
- Hemocytometer (×16)
- Microscope
- iPad for recording data

Experiment 1 procedure

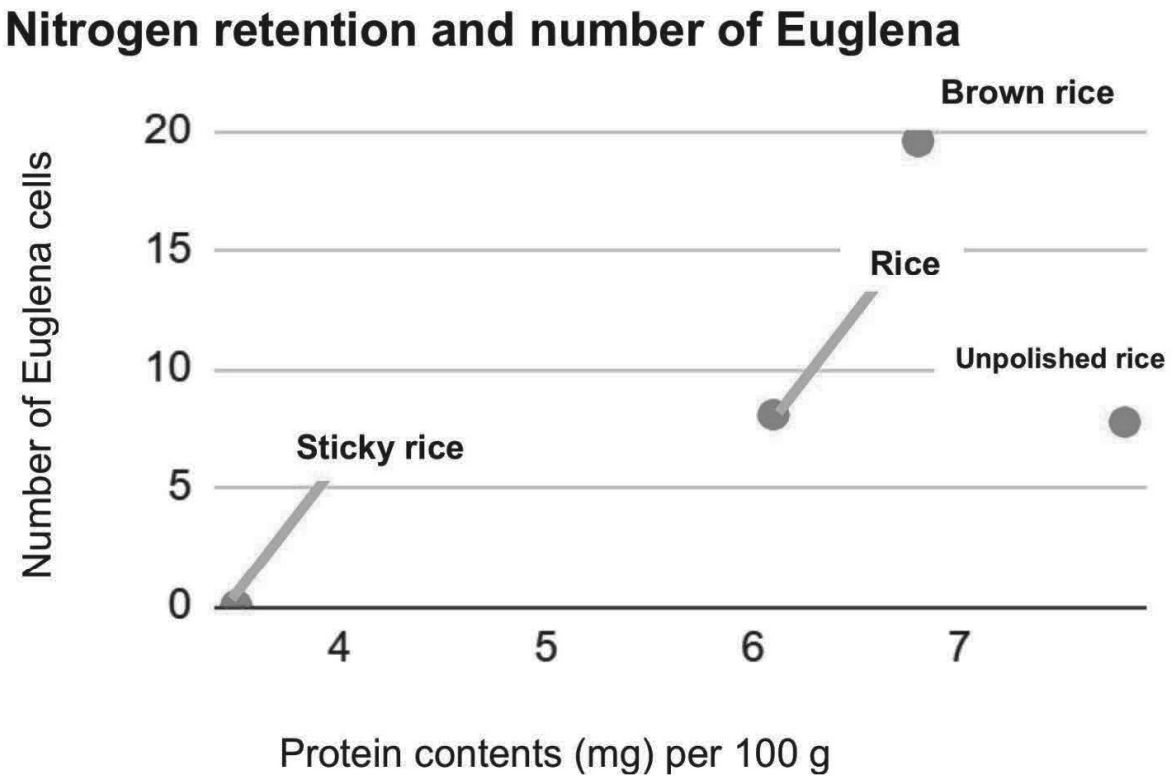
1. Add 200 mL of water to each plastic bottle.
2. Add liquid fertilizer,rice and yeast in each plastic bottle.
3. Add 1mL euglena medium
4. Seal the bottles
5. Wait a month
6. Watch euglena cells with slide glass
7. Measure euglena cells.

Experiment 2 procedure

1. Add 200 mL of water to each plastic bottle.
2. Add 1 g of the designated rice type to each bottle.
3. Add 1 mL of euglena medium.
4. Seal the bottles.
5. Incubate the samples for one month.
6. Collect a sample of the medium and place it on a hemocytometer.
7. Count the number of euglena cells using a microscope.
8. Repeat cell counting four times per sample to ensure accuracy.

Results

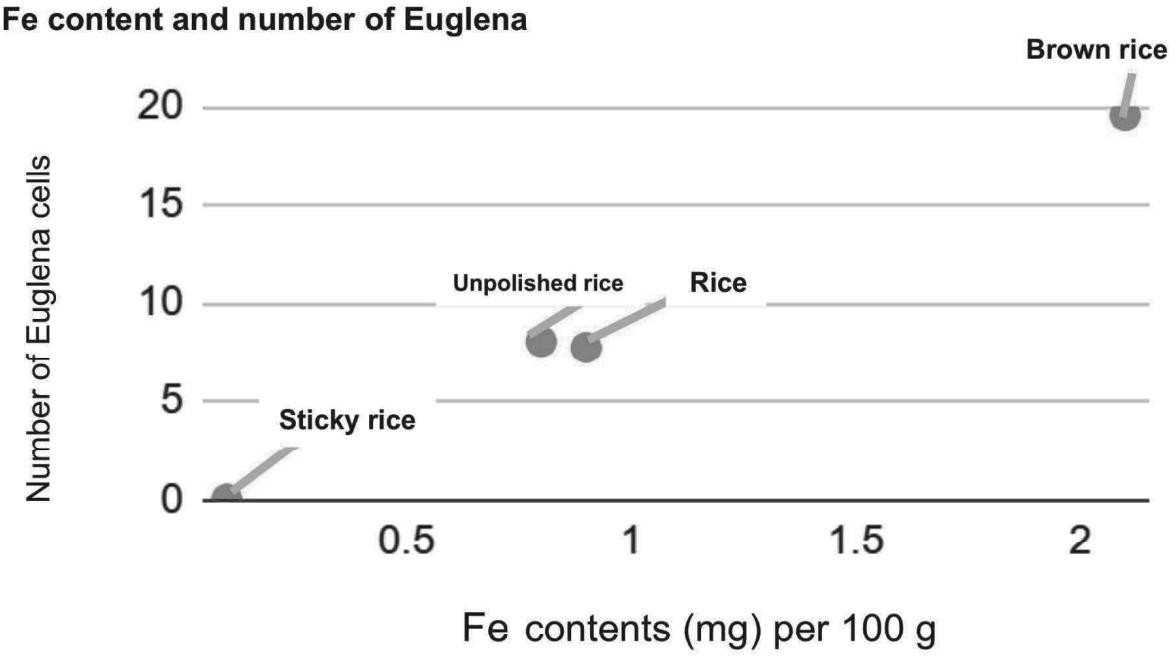
Number of Euglena cells						
	upper left	upper left	upper left	upper left	Total	Average
Brown rice①	14	13	20	27	74	18.5
Brown rice②	42	26	55	12	135	33.75
Brown rice③	25	34	17	28	104	26
Brown rice④	6	5	4	5	20	5
Unpolished rice①	3	0	2	3	8	2
Unpolished rice②	3	2	4	0	9	2.25
Unpolished rice③	18	7	18	12	55	13.75
Unpolished rice④	11	12	17	12	52	13
Rice①		18	9	0	27	6.75
Rice②	7	3	9	6	25	6.25
Rice③	13	10	2	12	37	9.25
Rice④	11	10	6	13	40	10
Sticky rice①	0	0	0	0	0	0
Sticky rice②	0	0	0	0	0	0
Sticky rice③	0	0	0	0	0	0
Sticky rice④	0	0	0	0	0	0



Brown rice resulted in the highest number of euglena cells. This was followed by white rice, black rice, and sticky rice. Although unpolished rice contained the highest nitrogen, it did not promote euglena growth as effectively as brown rice.

The study shows that nitrogen doesn't have a relationship to increase the number of euglena cells.

Discussion



Iron appears to be a crucial factor in promoting euglena growth. Iron is necessary for photosynthesis-related enzymes, and without effective photosynthesis, euglena cannot proliferate. Brown rice had the highest iron content among the samples, which may explain its superior performance. The correlation between iron content and euglena growth suggests that iron may be a key component in designing nutrient solutions for euglena cultivation. If this relationship is confirmed in further studies, euglena-based systems could be tailored to maximize productivity and contribute to hunger solutions.

Conclusion

Brown rice provides the most effective medium for increasing the number of euglena among the materials tested. Given euglena's nutritional value and rapid growth, this organism shows

promise as both a tool for carbon reduction and a future food resource for addressing global hunger.

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