Research Plan

Project Title:

Glow in the Dark: Street Lights from Algae

Submitted by:

Sara Suhail
Grade: VII
School: IMAX Global School, Old Washermanpet
City & State: Chennai, Tamil Nadu

a. Selection of Problem and Background Information

Conventional street lighting consumes electricity and contributes to carbon emissions. With increasing focus on sustainability, there is a need to explore eco-friendly alternatives. Bioluminescent algae (such as dinoflagellates) naturally emit light through a chemical reaction in their cells. They only require salt water, sunlight, and gentle agitation to glow at night.

This project demonstrates how algae can be used as a natural source of lighting for pathways or gardens. Apart from providing light, algae also absorb carbon dioxide and release oxygen during the day, thereby improving air quality and contributing to environmental balance.

b. Problem

Can bioluminescent algae be effectively used as a natural, eco-friendly lighting system for pathways or gardens?
Can hybrid systems (algae + solar LEDs) enhance brightness while remaining sustainable?

c. Hypothesis

If bioluminescent algae are grown in saltwater containers and exposed to sunlight for photosynthesis, then they will glow at night when gently agitated, acting as a sustainable light source.
If combined with solar LEDs, the system may provide brighter illumination without losing its eco-friendly nature.

d. Procedure

1. Prepare saltwater solution and introduce bioluminescent algae culture into transparent glass jars.
2. Place jars in sunlight during the day for photosynthesis.
3. At night, gently swirl or shake the jars to activate bioluminescence.
4. Arrange jars along a pathway or garden on wooden/metal stands like lamp posts.
5. (Optional Hybrid Model) Attach a small solar LED inside the stand to boost brightness.

Proposed Data Collection Table:

Observation Day	Glow Intensity (Low / Medium / High)	Duration of Glow (Minutes)	Notes on Visibility
Day 1	Low	5	Faint blue glow
Day 2	Medium	7	Pathway slightly visible
Day 3	Medium	10	Consistent brightness
Day 4	High	12	Glow more uniform
Day 5	Medium	8	Slight reduction

e. Risk and Safety

- Handle algae culture hygienically to avoid contamination.
- Avoid direct skin contact with nutrient solutions (use gloves).
- Dispose of algae safely after the experiment.
- Prevent overgrowth, which may cause foul odor.
- Ensure jars are placed securely on stands to prevent accidents.

f. Data Analysis

Glow intensity and duration will be observed daily and recorded.
Results will be analyzed by comparing algae-only jars and hybrid (algae + solar LED) models.
Graphs will be plotted showing glow duration vs. days and glow intensity vs. conditions.
The analysis will determine whether algae lighting is feasible for practical pathway/garden illumination.

g. Bibliography

1. Widder, E.A. (2010). Bioluminescence in the Ocean: Origins of Biological, Chemical, and Ecological Diversity. Science.
2. Hastings, J.W. (1996). Chemistries and Colors of Bioluminescent Reactions: A Review. Gene.
3. Richmond, A. (2004). Handbook of Microalgal Culture: Biotechnology and Applied Phycology. Blackwell Publishing.
4. Websites:
- National Geographic – Bioluminescence Articles
- NOAA (National Oceanic and Atmospheric Administration) – Dinoflagellates and Bioluminescence