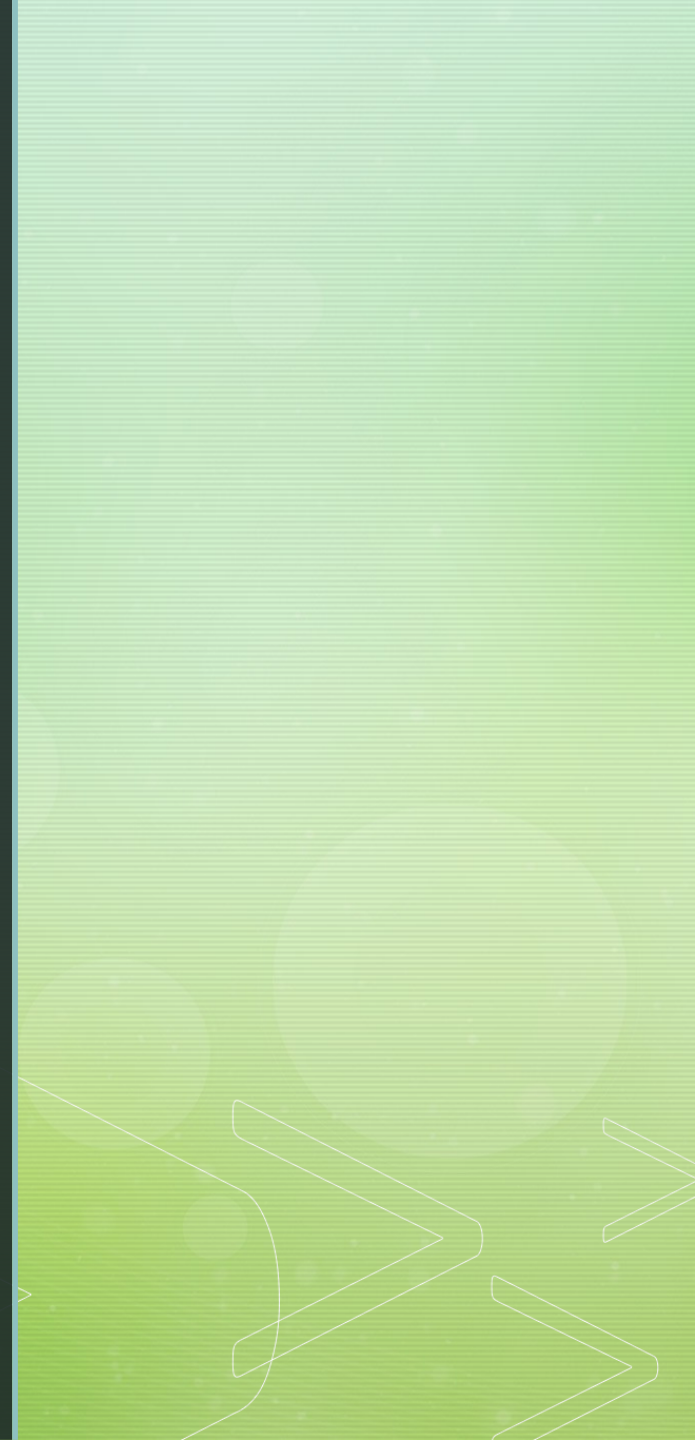
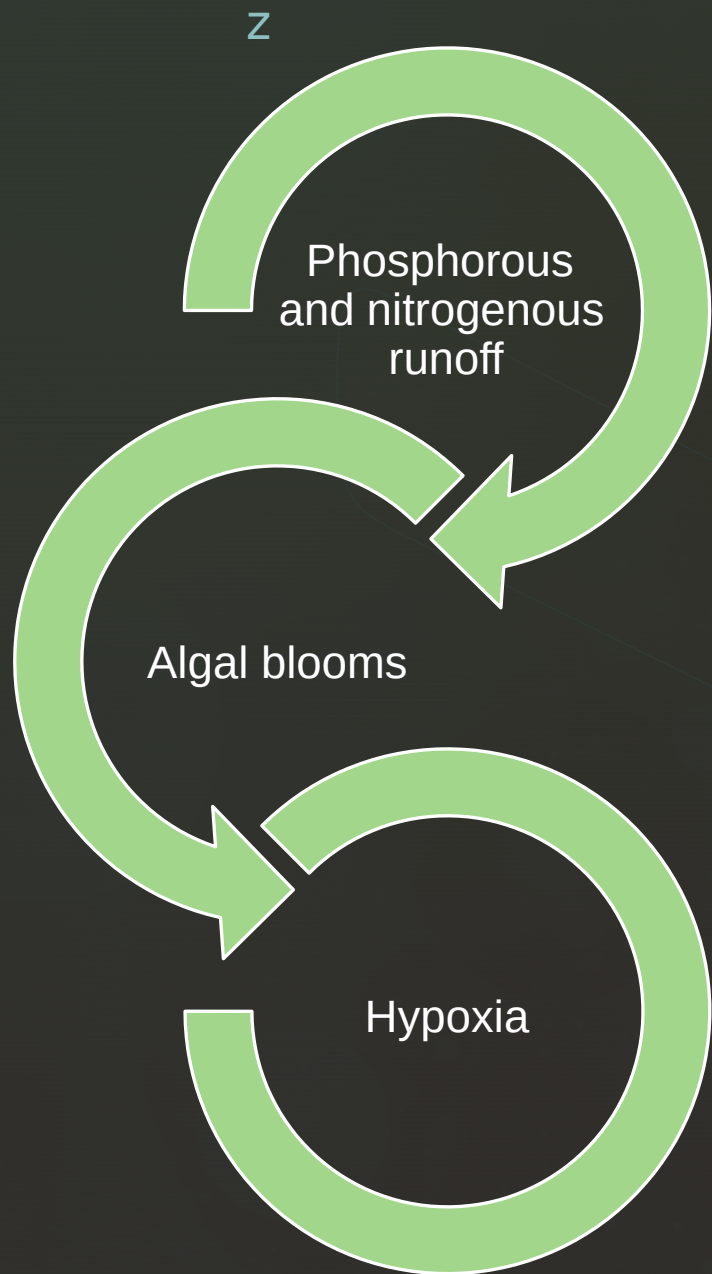


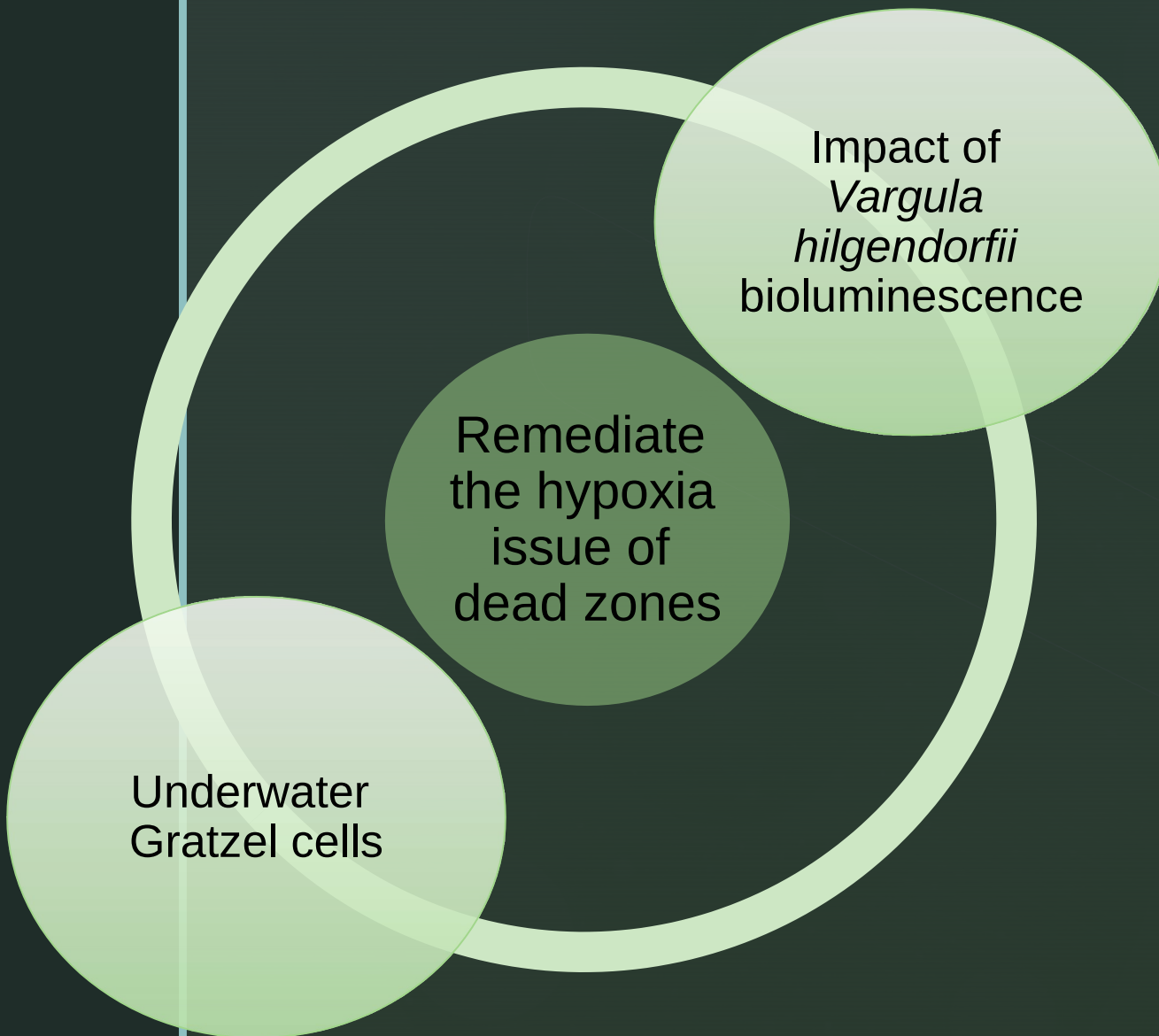
Remediating the Issue of
Dead Zones through the
Utilization of *Vargula*
hilgendorfii Bioluminescence
in Sync with Underwater
^z Grätzel Cells to Induce
Visible-Light Water
Electrolysis



Dead Zones?



Primary Goals



Secondary Goals

Environmentally Friendly

Cost-Efficient

Noninvasive

Previous Methods

z



- Ultrasonic irradiation



- Algaecides



- Drum Filters



- Disc Filters

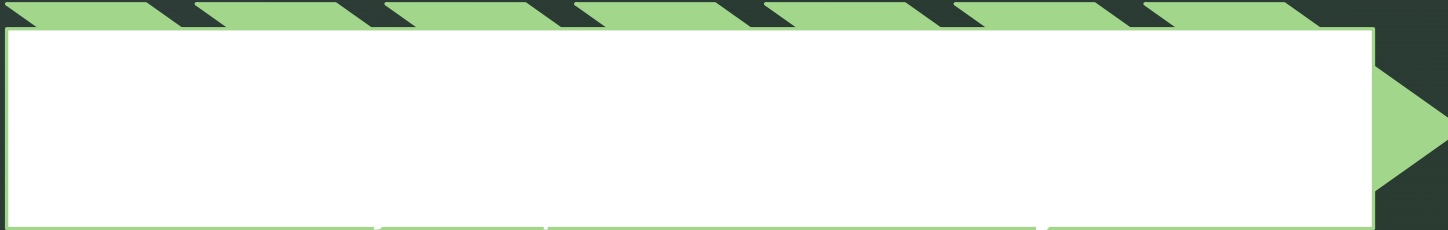
Two questions:

1. What is the cost range?
2. Can it be placed in the ocean?

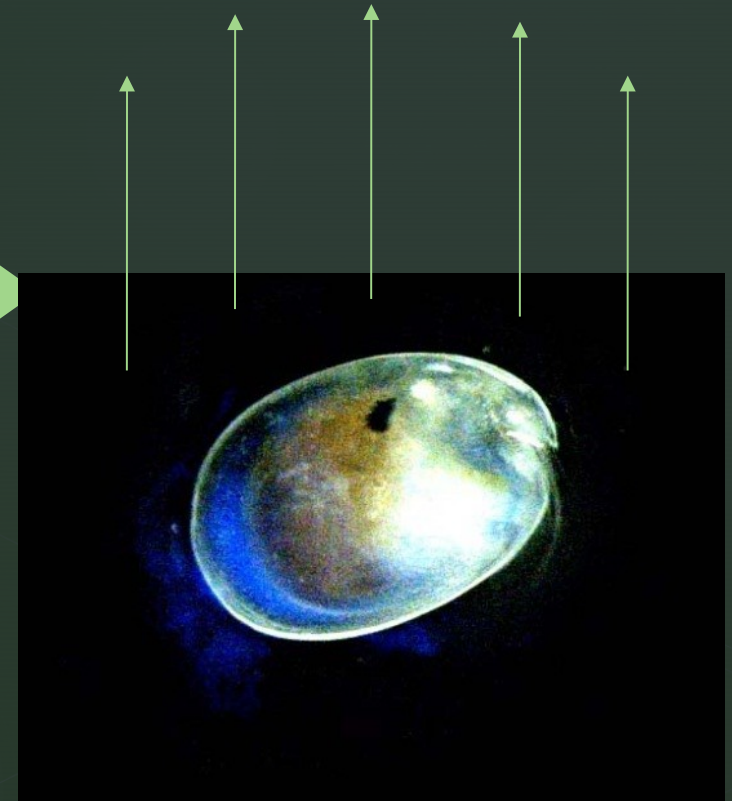
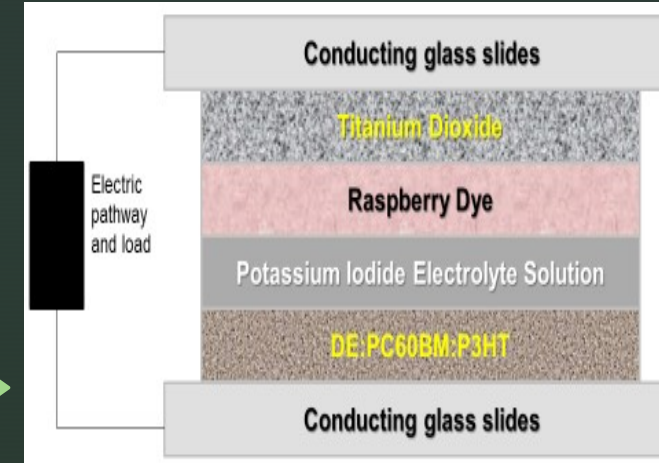
Hypotheses

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Organism



Phenomenon



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Diatomaceous Earth

- siliceous sedimentary rock made of aquatic diatoms

$$C = \frac{\epsilon A}{d}$$

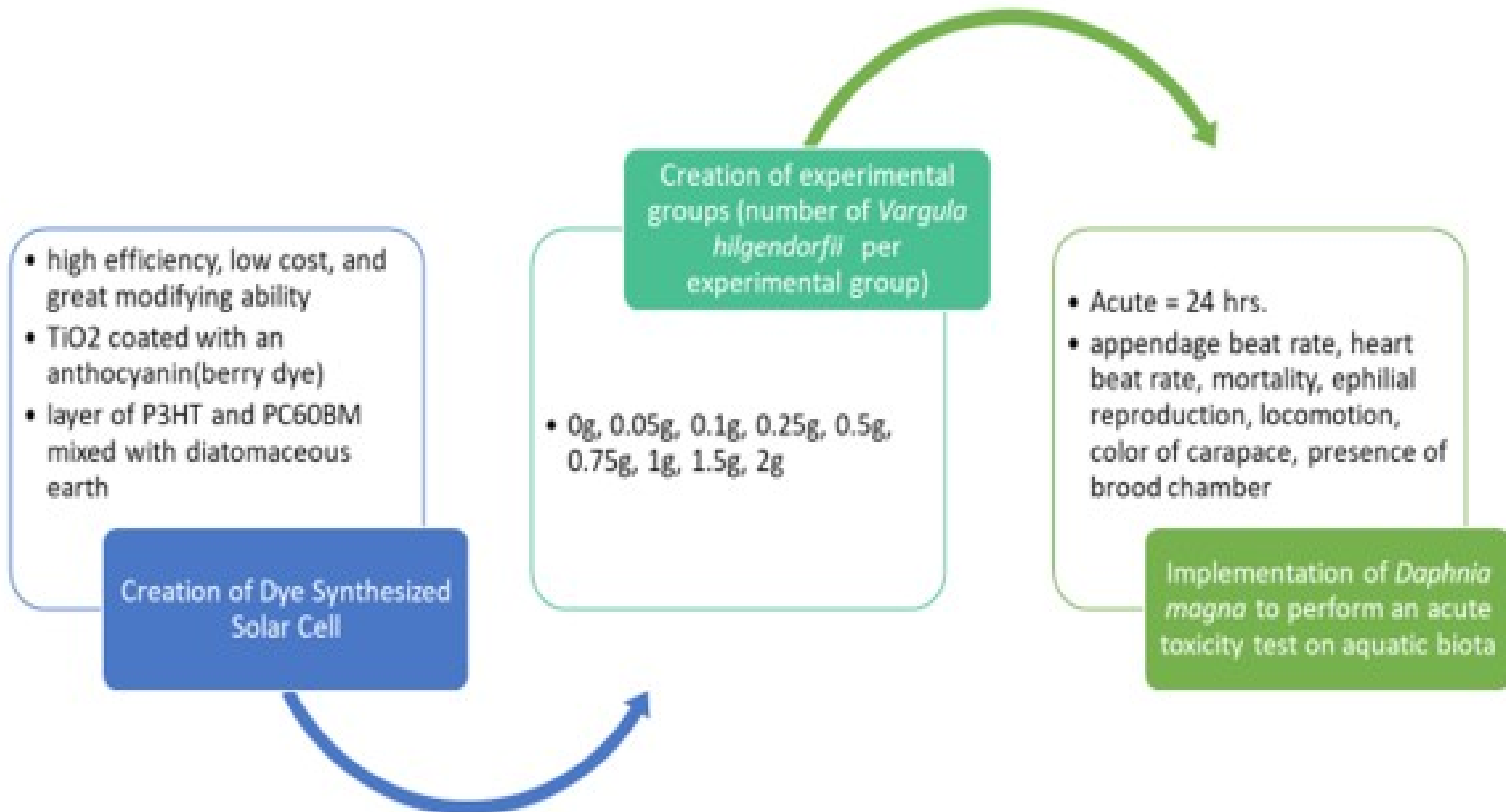
Where,

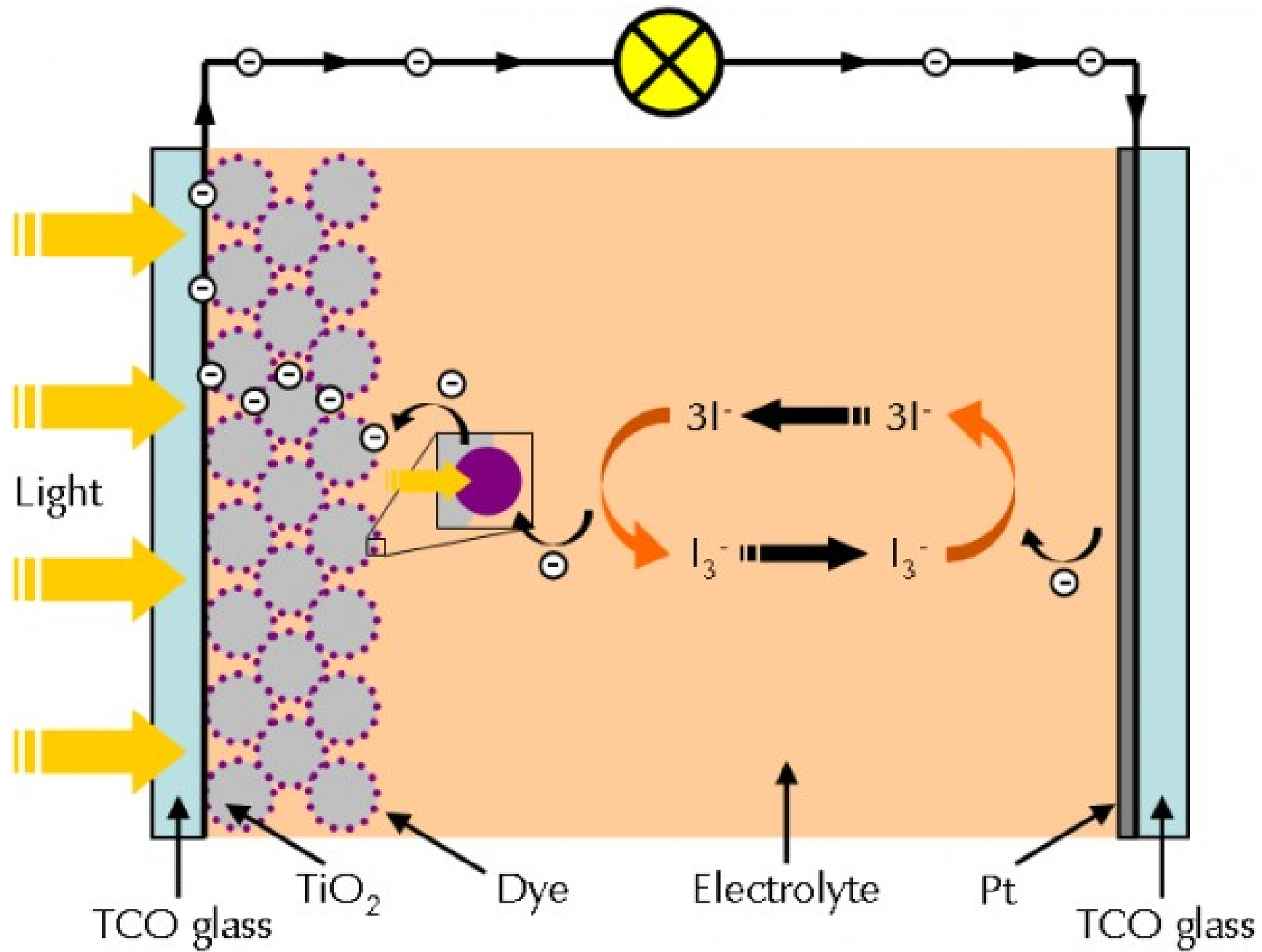
C = Capacitance in Farads

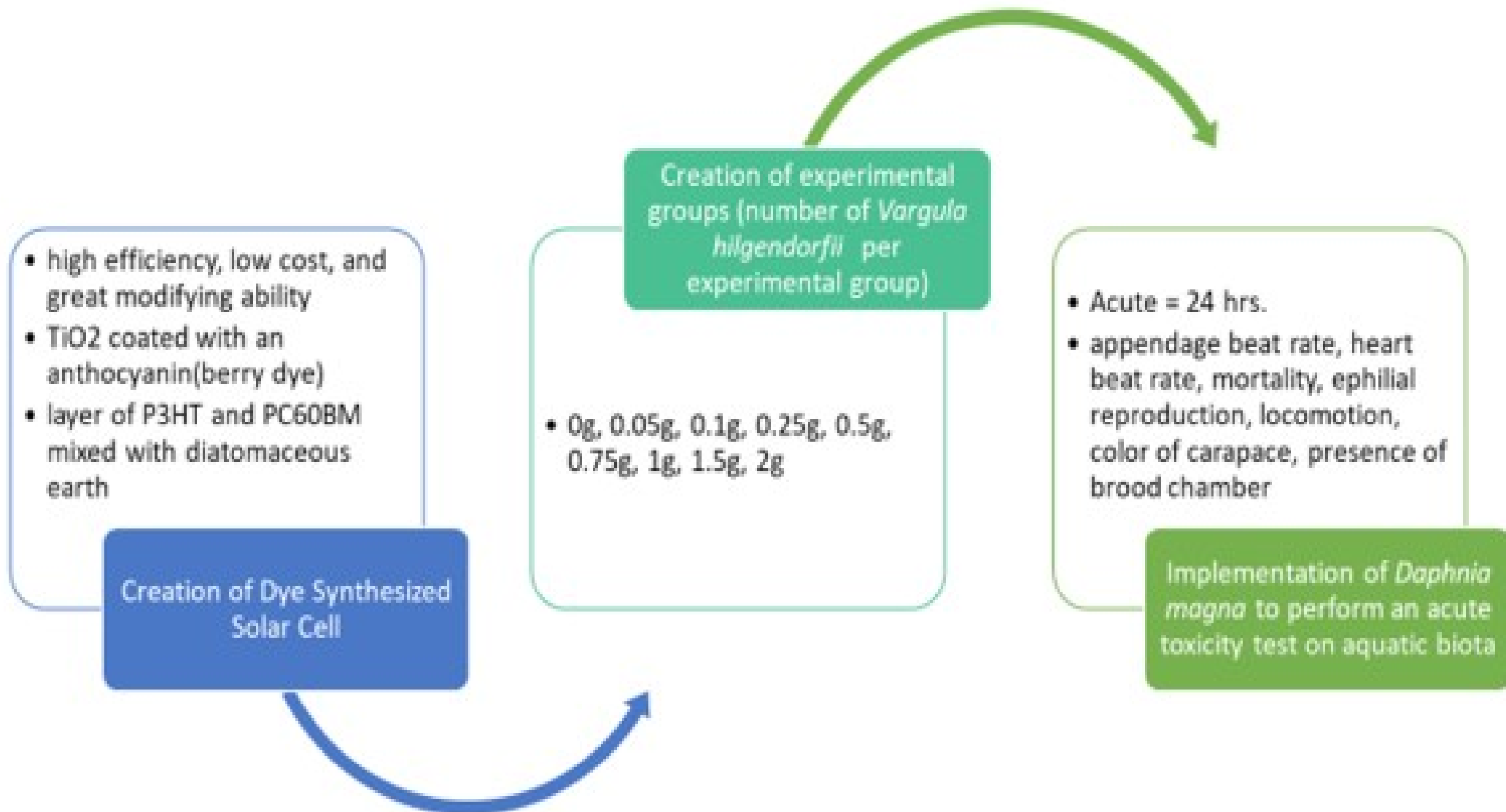
ϵ = Permittivity of dielectric (absolute, not relative)

A = Area of plate overlap in square meters

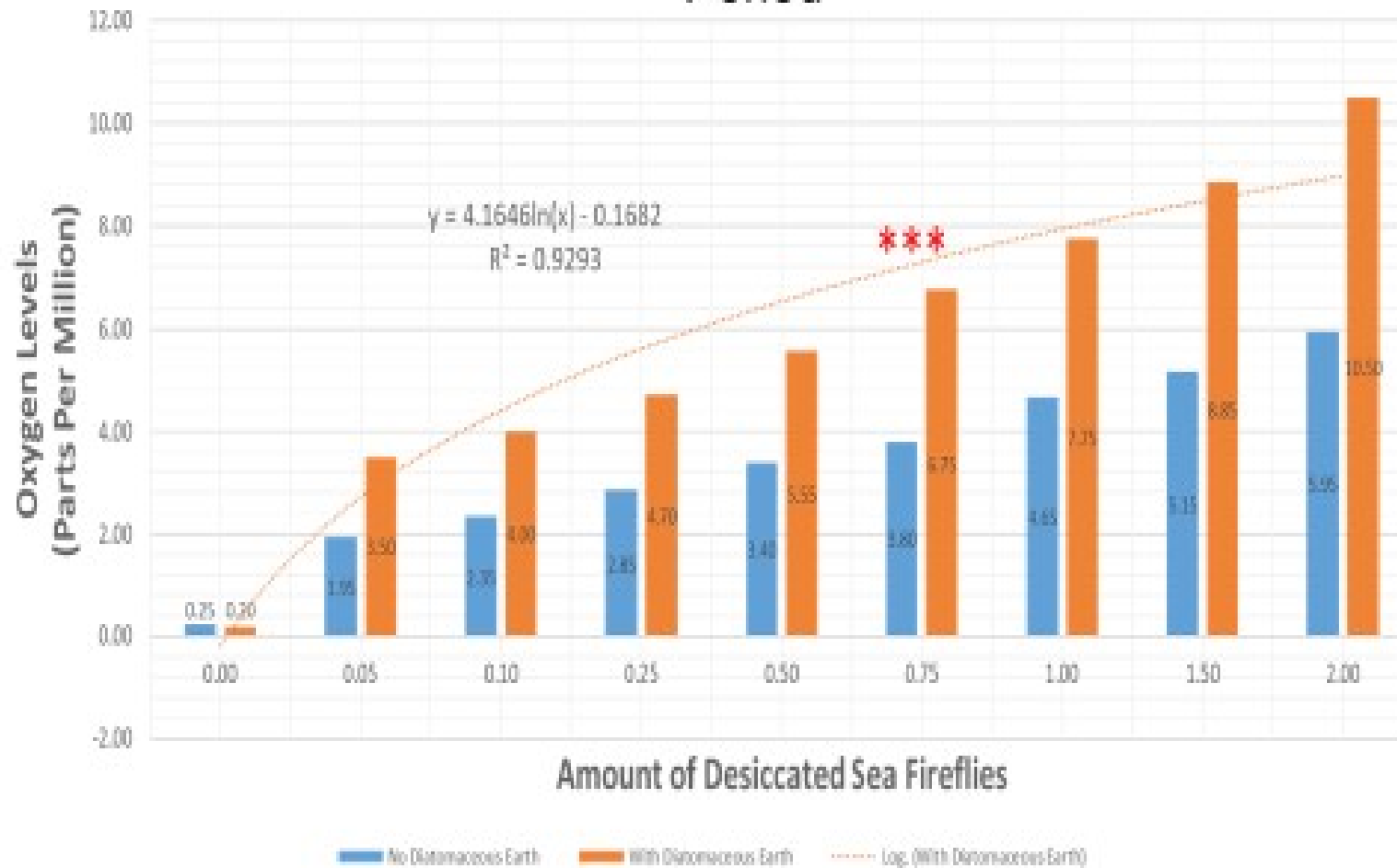
d = Distance between plates in meters





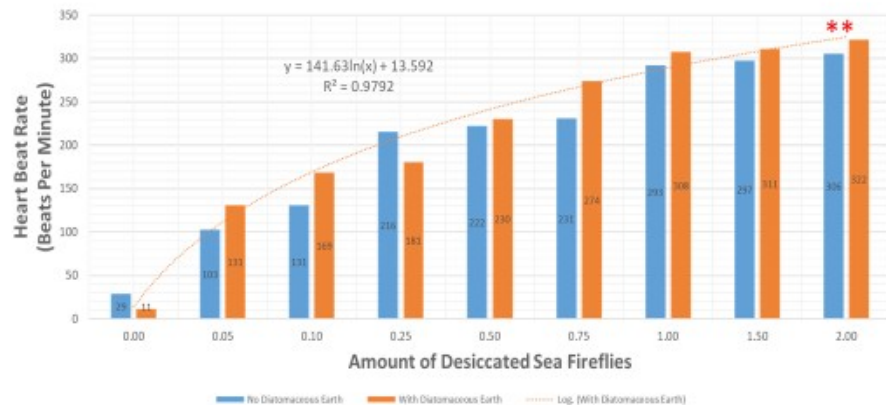


The Dissolved Oxygen Levels Logarithmically Increased by the 20 Hour Period



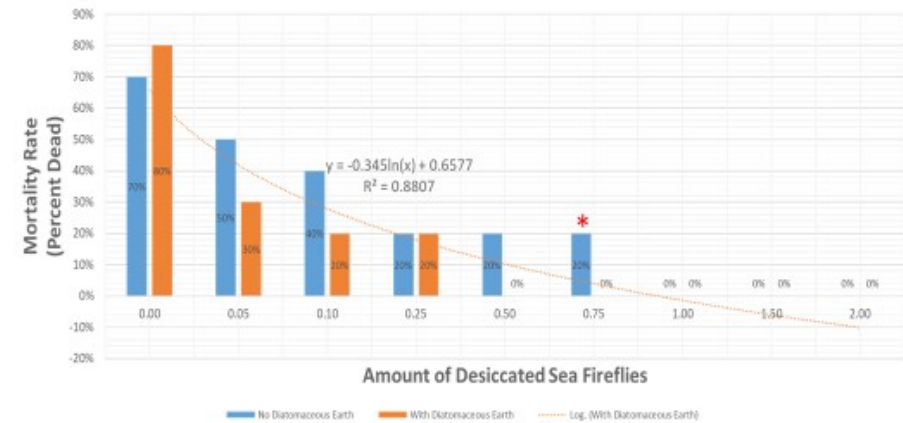
p test: *(p value) < 0.05 **(p value) < 0.01 *** (p value) < 0.005

The Heart Beat Rate Increased Logarithmically by the 20 Hour Period



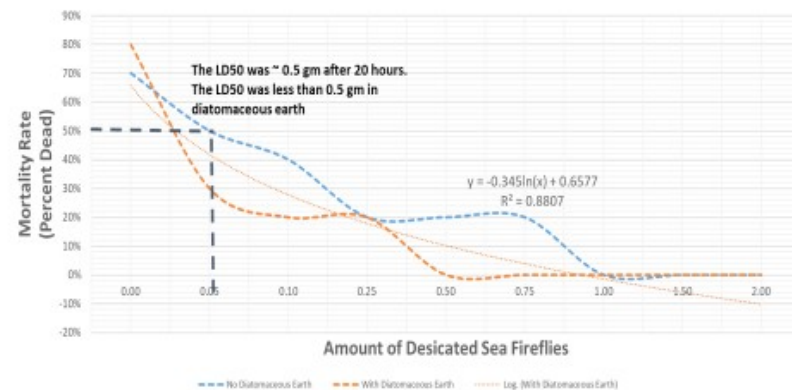
p test: *(p value) < 0.05 **(p value) < 0.01 ***(p value) < 0.005

The Mortality Decreased Logarithmically by the 20 Hour Period

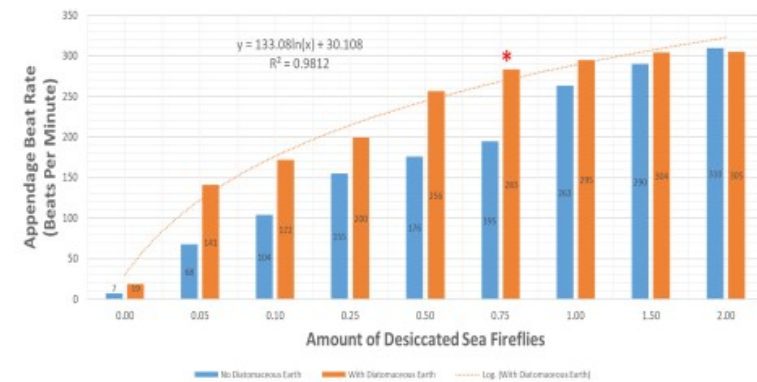


p test: *(p value) < 0.05 **(p value) < 0.01 ***(p value) < 0.005

The LD50 Significantly Decreased after the Inclusion of Diatomaceous Earth Solar Cells

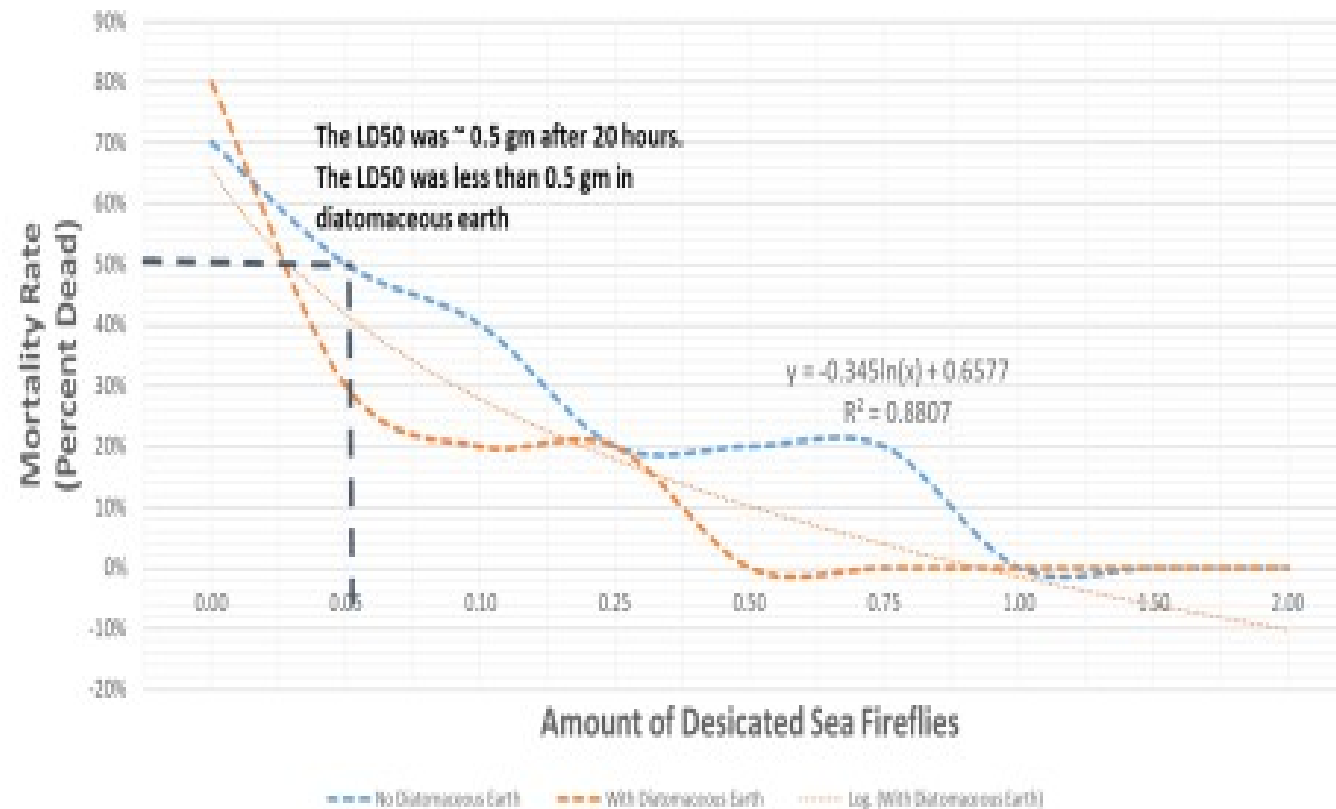


The Appendage Beat Rate Increased Logarithmically by the 20 Hour Period



p test: *(p value) < 0.05 **(p value) < 0.01 ***(p value) < 0.005

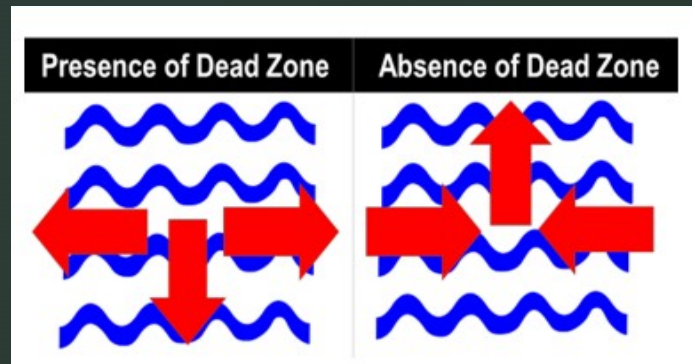
The LD50 Significantly Decreased after the Inclusion of Diatomaceous Earth Solar Cells



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Qualitative Observations

Locomotion



Brood Chamber



Color of the Carapace



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Conclusion

Sea fireflies
increase,
dissolved
oxygen levels
increase

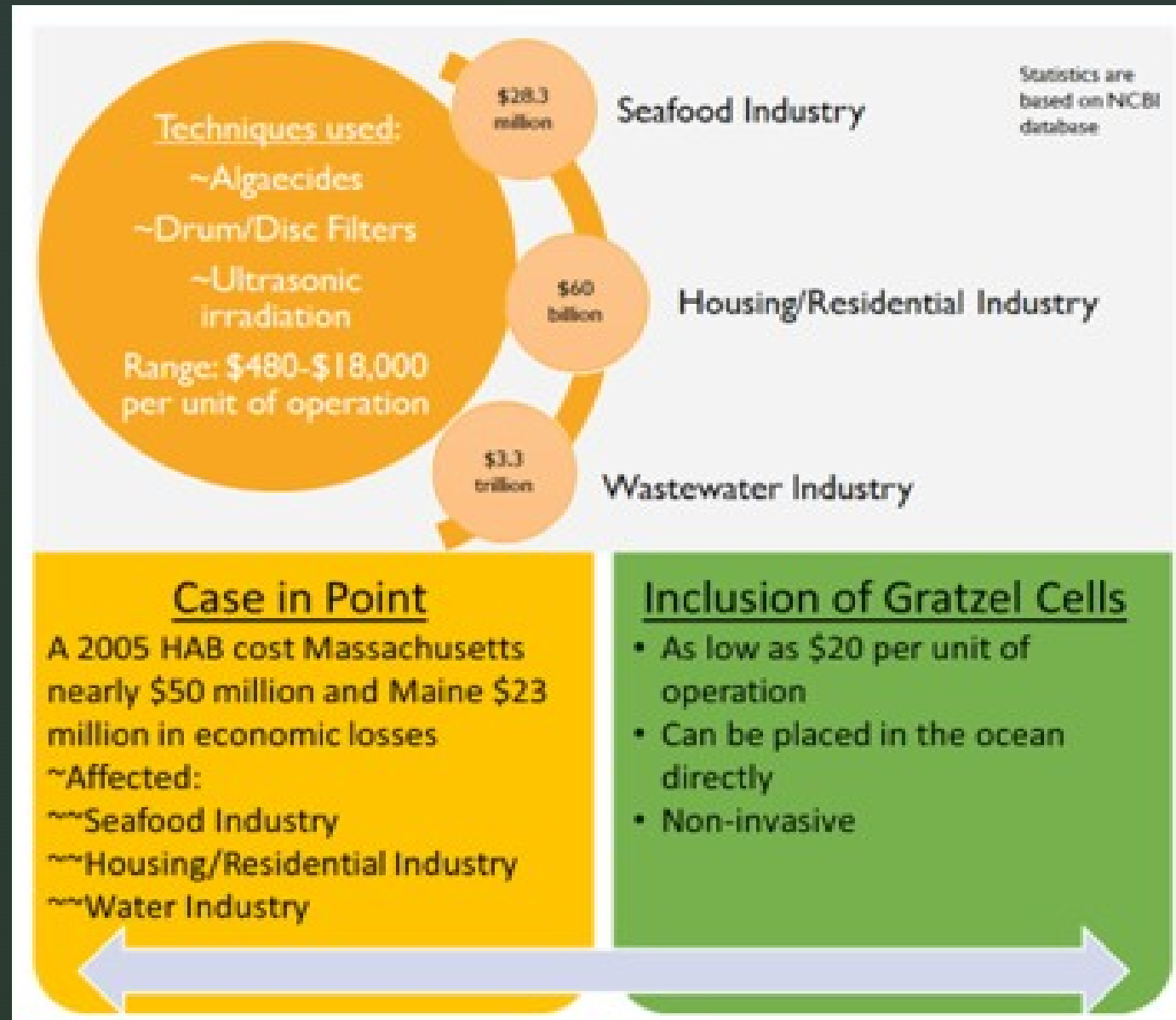
Gratzel cells with
diatomaceous
earth require **less**
amount of light to
produce the
same amount of
dissolved oxygen
levels

Presence of cells
remediates heart
beat, appendage
beat rate, and
reproduction

Gratzel cells
show a
remediated
carapace,
phototactic taxis,
and **sight of**
brood chamber
was
distinguishable

Cost Analysis

Z



z

Future Applications and Research

Creation of a biodegradable solar cell

- The solar cell will be more self-sustaining and can decompose in the body of water without harming other aquatic organisms.
- Can be made of citrus peels that can create a pectin border around aquatic organisms for protection of waste

Utilization of other Sources of Bioluminescence

- GFP protein in moon and crystal jellyfish, bioluminescence of dinoflagellates, bioluminescent octopod, lanternfish, midwater squid, and scaly dragonfish

Collaboration of an IOT device with an ELISA Assay

- The IOT solar device would signal the assay to release the bioluminescence carriers in the detected low oxygen and polluted environment and work in sync with it to induce electrolysis based on the wavelength of light