

'BREATHING WALLS'

Abstract

This project explores the development of a bio-paint that can purify air naturally by utilizing the photosynthetic abilities of green pond algae. Conventional paints often emit harmful volatile organic compounds (VOCs) that worsen air pollution. The bio-paint proposed here uses pond algae to absorb carbon dioxide (CO_2) and release oxygen (O_2), improving air quality.

The paint mixture contains potato starch as a binder and aloe vera gel as a moisturizer to maintain algal viability and flexibility of the paint film. When applied to surfaces and exposed to light, the paint can perform photosynthesis.

Results from experimental trials showed a significant reduction in CO_2 concentration and a rise in O_2 levels inside sealed chambers painted with algae-based paint, proving its potential as an eco-friendly innovation for sustainable living.

Aim:

To develop an eco-friendly algae-based bio-paint and evaluate its ability to purify air by reducing CO₂ and increasing O₂ levels through photosynthesis.

Introduction

This project is about creating an air-purifying bio paint using green pond algae. Regular paints often release harmful chemicals, while air pollution is already increasing due to excess carbon dioxide in the environment. Green pond algae can absorb carbon dioxide and release oxygen through photosynthesis. By using them in paint, we can make walls that not only look good but also help clean the air.

The main scope of this project is to reduce air pollution by removing CO₂ from the surroundings and supplying O₂, which will make respiration healthier and improve the quality of life. This bio paint could become a simple, natural, and eco-friendly way to fight pollution.

To make the paint functional and durable, potato starch is used as a binder, and aloe vera gel is added to keep the paint moist, flexible, and to support the survival of algal cells. In this way, a substance often seen as waste (pond algae) can be transformed into a useful, sustainable solution.

Selection of Problem and Background Research

Air pollution has become a major concern, with excess carbon dioxide in the environment leading to oxygen deficiency and respiratory problems in people. This creates a strong need for affordable and eco-friendly solutions to purify air.

The idea for this project came from a simple observation. As a student, I was thinking of ways to reduce air pollution, since I have seen many people suffering from lack of oxygen. One day, I noticed a pond filled with green algae. Though it seemed unpleasant at first, I realized that algae, through photosynthesis, can absorb carbon dioxide and release oxygen. This inspired me to use what is often considered waste material and transform it into something useful.

Thus, the concept of air-purifying bio paint was developed. By converting pond algae into a paint form, walls could help remove CO₂ and supply fresh O₂ , making respiration healthier. This research is important because it not only addresses pollution but also has a positive impact on human health and supports sustainable living.

Hypothesis

If pond algae are mixed with potato starch (binder) and aloe vera gel (moisturizer and stabilizer) to make a bio-paint, then the paint will retain algal activity, absorb CO₂ , and release O₂ , thereby purifying the surrounding air.

Design of Study

Independent Variable:

- Type of paint (control paint without algae, potato starch + aloe vera paint, potato starch + aloe vera + algae paint)

Dependent Variables:

- CO₂ reduction (ppm levels in closed setup)
- O₂ release (ppm levels)
- Paint stability (texture, drying, cracking)

Controlled Variables:

- Amount of paint applied on surface
- Size of glass jars / chambers used
- Type of algae (same source, same species)
- Amount of potato starch and aloe vera gel
- Light exposure (same intensity and duration)
- Temperature of environment

Materials Required

- Pond algae (fresh, cleaned)
- Potato starch (binder)
- Aloe vera gel (moisturizer and stabilizer)
- Distilled water
- Mixing containers, spoon/stirrer
- Petri dishes or small glass jars
- Transparent test chambers with lids (for measuring air quality changes)
- Air quality sensor (for CO₂ and O₂) or indicator chemical (limewater for CO₂)
- Paintbrush
- Lab notebook for observations

Procedure

Step 1: Preparing the Bio-Paint

- Collect pond algae and wash thoroughly to remove dirt and debris.
- Grind algae into a paste with a little distilled water.
- Prepare binder by mixing 30 g potato starch in 100 mL hot water until gel-like.
- Add 10 g aloe vera gel to the mixture for consistency and hydration.
- Mix the algae paste with the potato starch–aloe vera base until smooth.

Step 2: Setting up Samples

- Prepare three paint samples:
- Control Paint: potato starch + aloe vera (no algae)
- Bio Paint A: potato starch + aloe vera + algae (thin coat)
- Bio Paint B: potato starch + aloe vera + algae (thick coat)
- Apply paint samples onto petri dishes or tiles and allow to dry.

Step 3: Experimental Setup

- Place each painted sample inside a transparent glass jar.
- Seal the jar and expose it to light for 6–8 hours daily.
- Measure CO₂ and O₂ levels inside jars before and after exposure using an air quality sensor or limewater test.
- Record texture changes in paint (drying, cracking, color fading) daily.

DATA ANALYSIS

PHOTOGRAPHS

Algae



Algae Paste



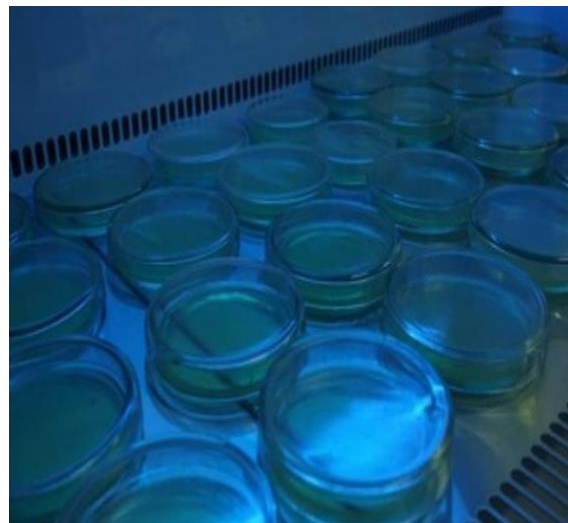
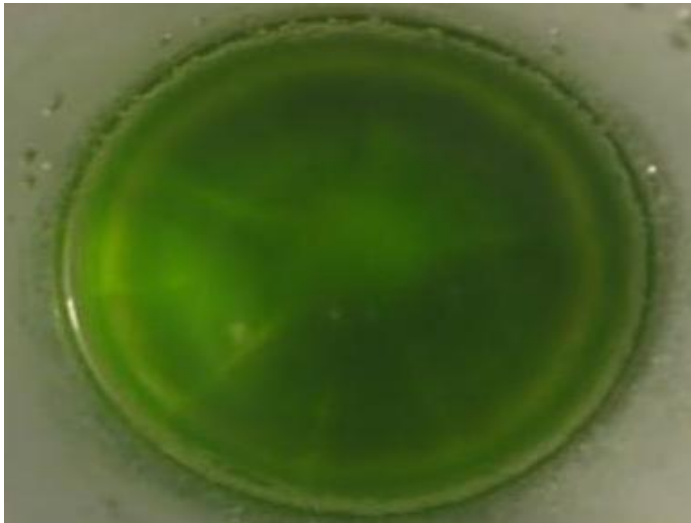
Grinding Potato



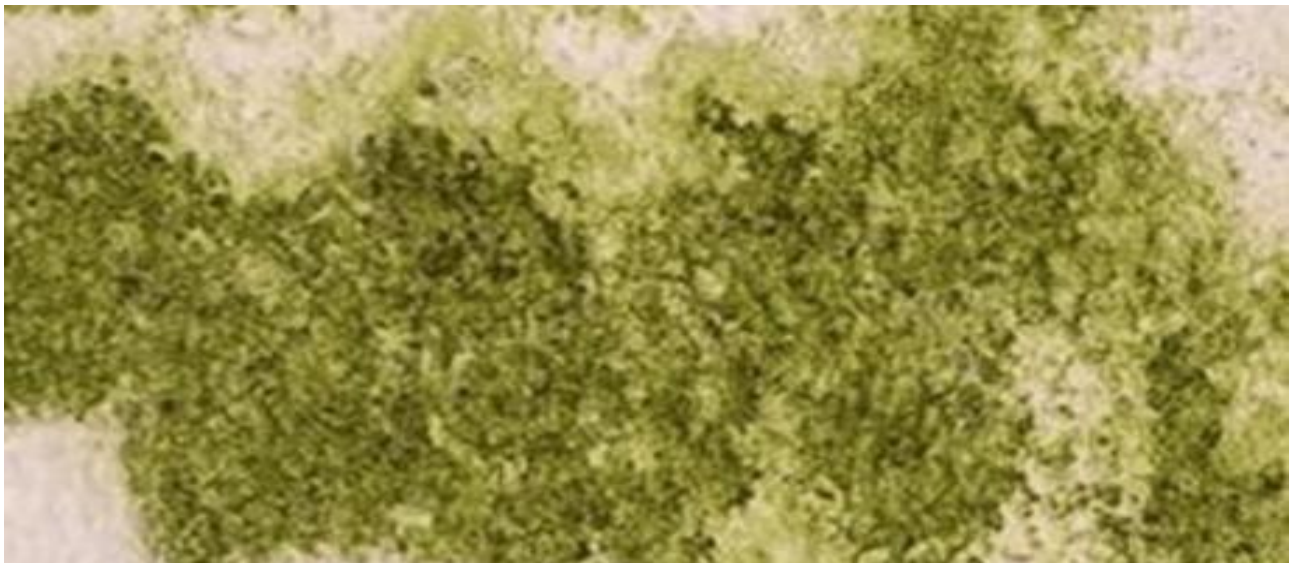
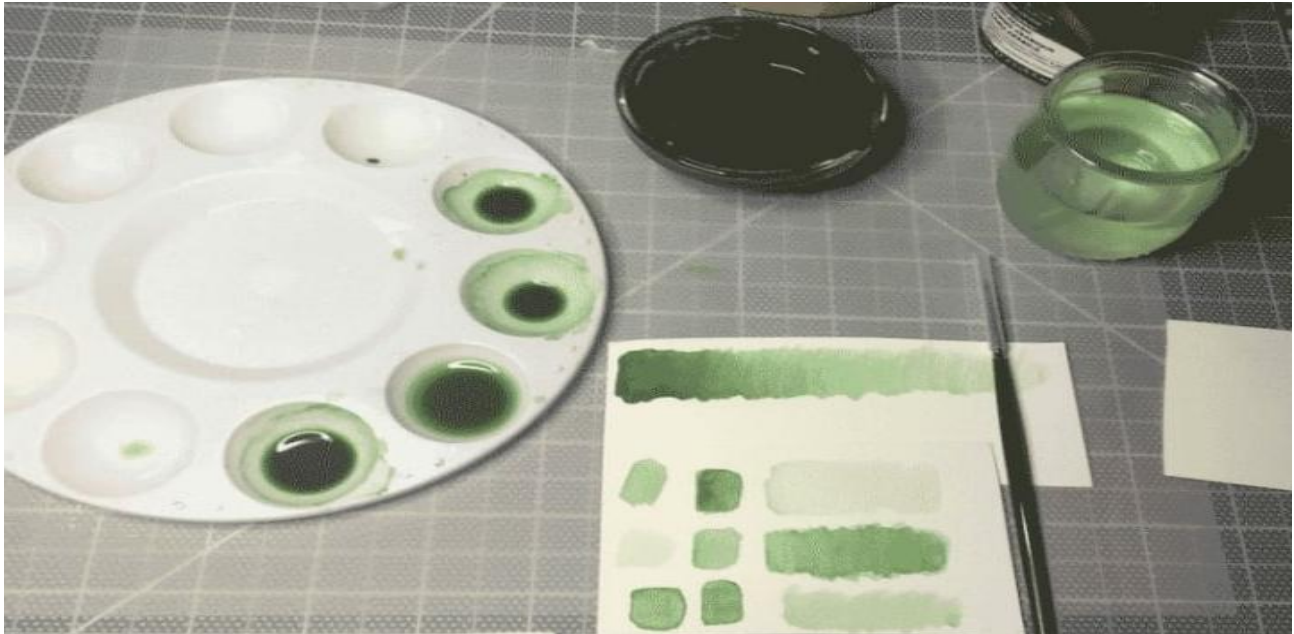
Potato Starch



Painted Samples



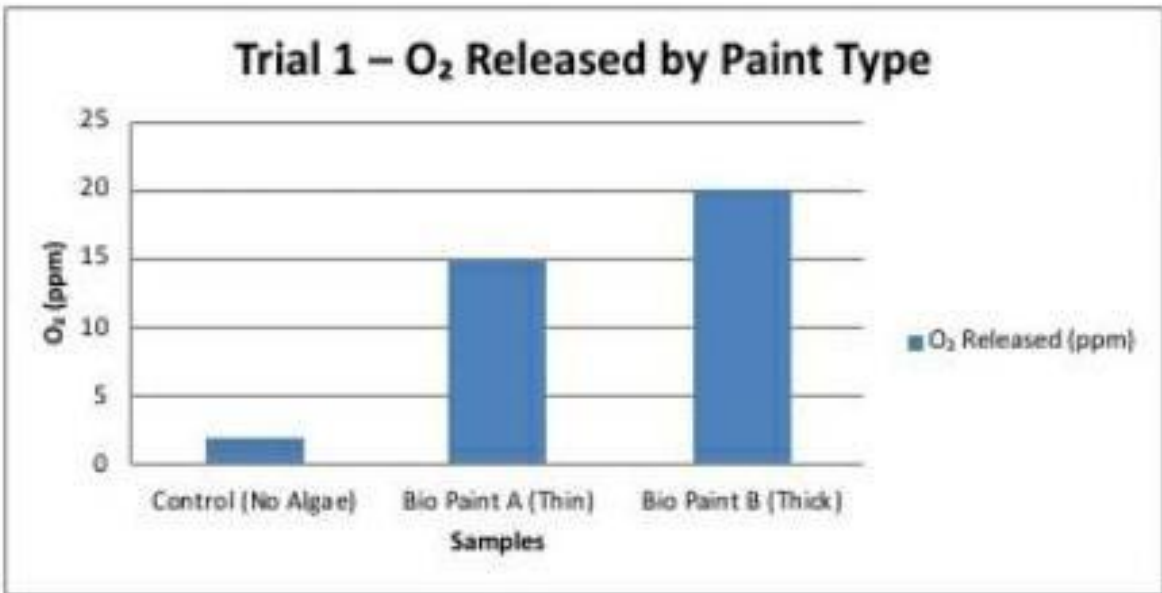
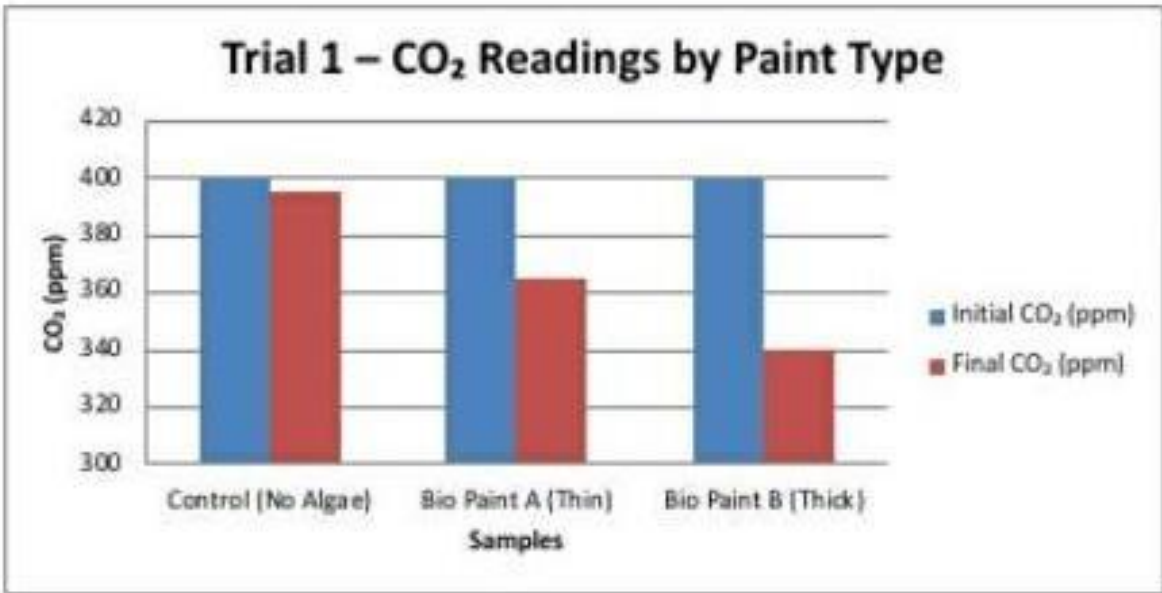
Bio paint



Tabular Column

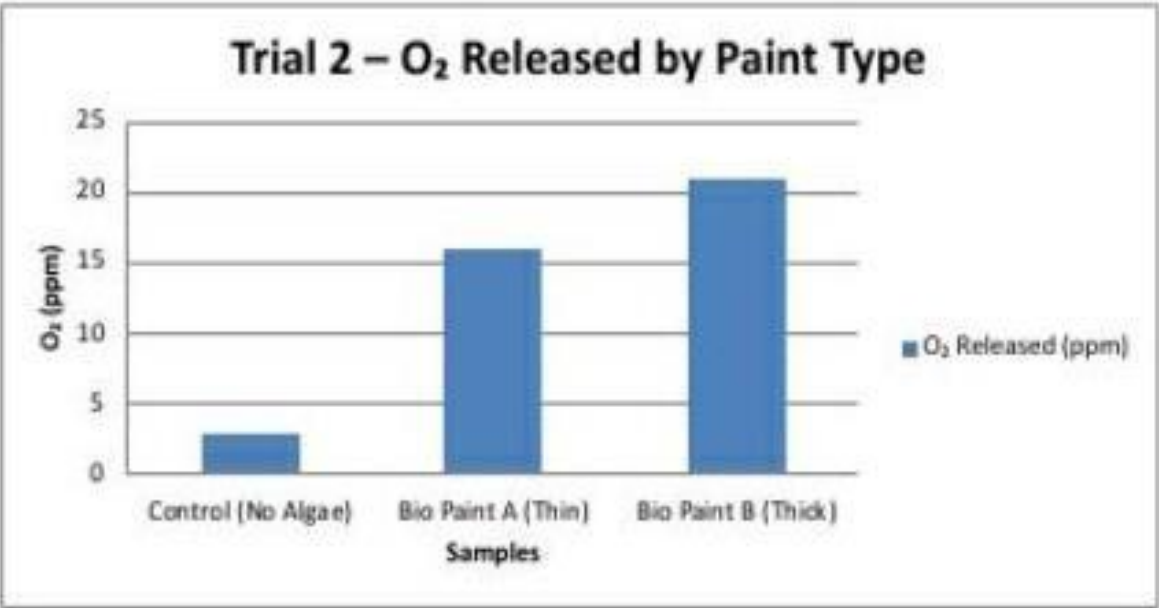
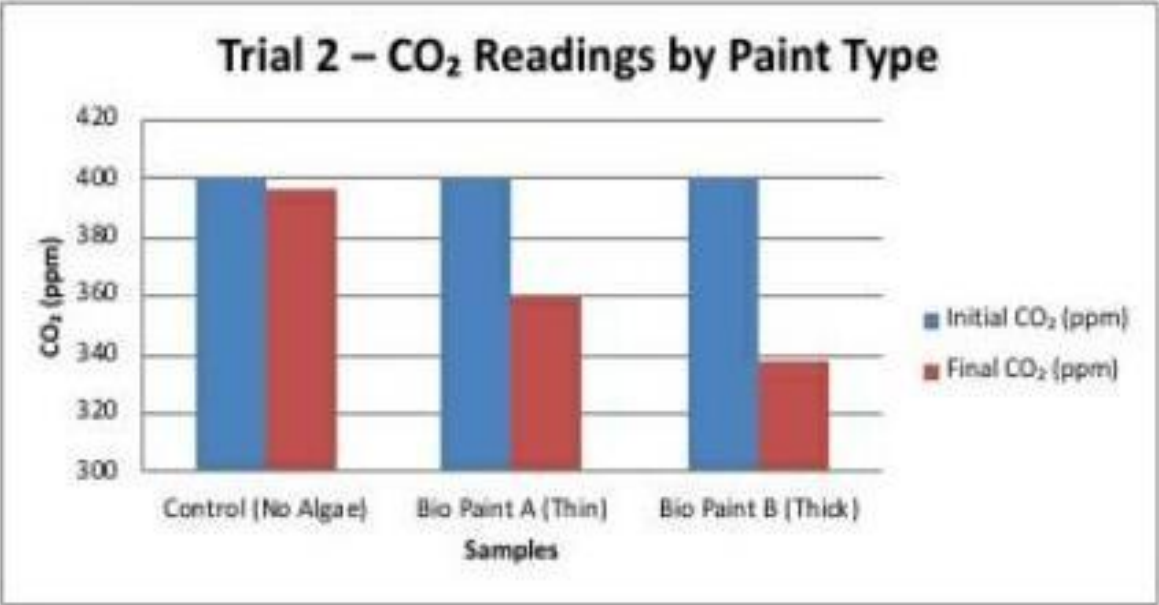
Trial 1

<i>Paint Sample</i>	Initial CO₂ (ppm)	Final CO₂ (ppm)	O₂ Release (ppm)	Paint Stability (Observation)	% Reduction in CO₂
<i>Control (No Algae)</i>	400	395	2	Stable, no change	1.25%
<i>Bio Paint A (Thin)</i>	400	365	15	Slight drying	8.75%
<i>Bio Paint B (Thick)</i>	400	340	20	Moist, stable	15.0%



Trial 2

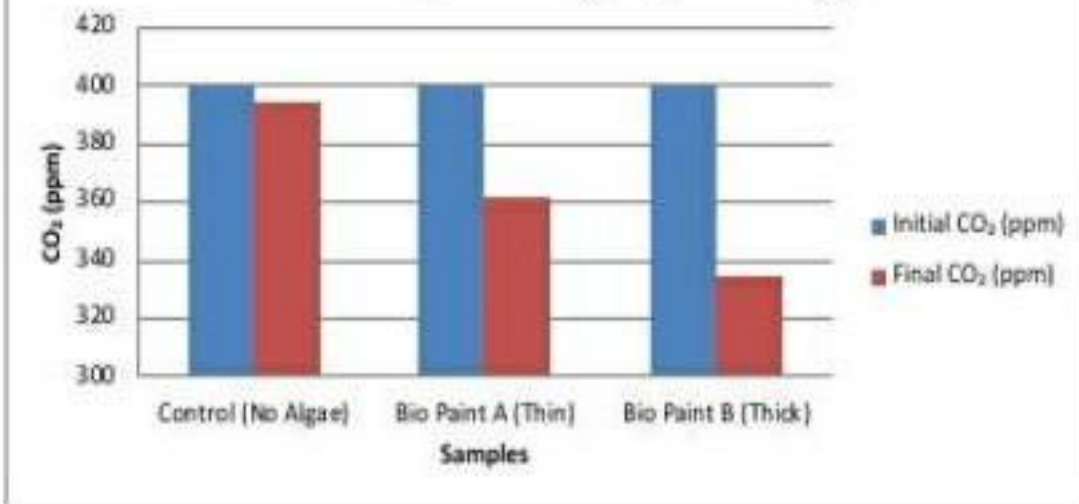
<i>Paint Sample</i>	Initial CO₂ (ppm)	Final CO₂ (ppm)	O₂ Release (ppm)	Paint Stability (Observation)	% Reduction in CO₂
<i>Control (No Algae)</i>	400	396	3	Stable	1.0%
<i>Bio Paint A (Thin)</i>	400	360	16	Slightly cracked	10.0%
<i>Bio Paint B (Thick)</i>	400	338	21	Stable, good moisture	15.5%



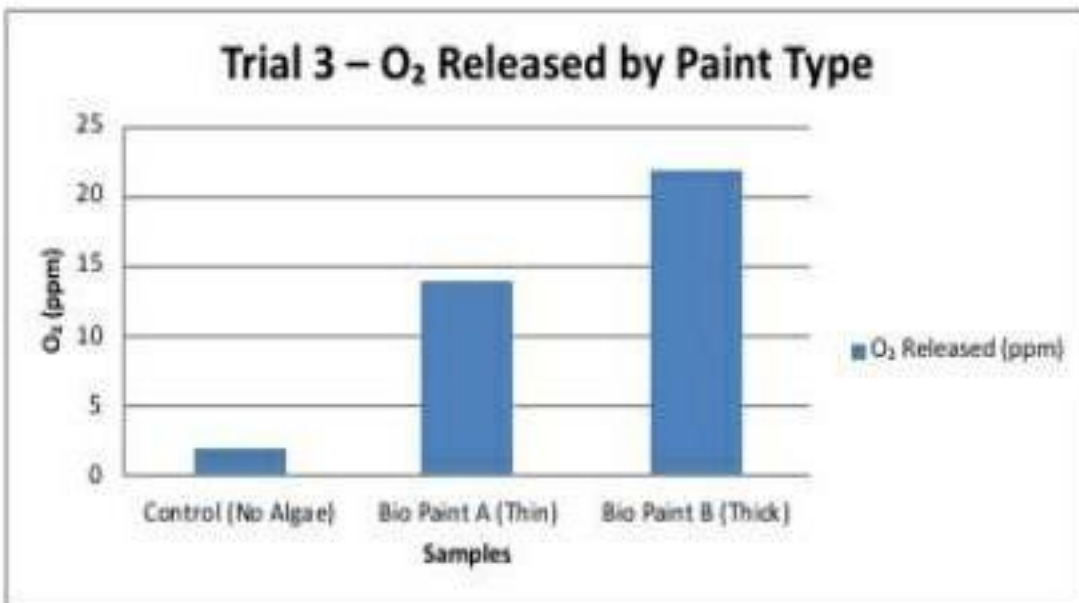
Trial 3

<i>Paint Sample</i>	Initial CO₂ (ppm)	Final CO₂ (ppm)	O₂ Release (ppm)	Paint Stability (Observation)	% Reduction in CO₂
<i>Control (No Algae)</i>	400	394	2	Stable	1.5%
<i>Bio Paint A (Thin)</i>	400	362	14	Slight drying	9.5%
<i>Bio Paint B (Thick)</i>	400	335	22	Stable, moist	16.25%

Trial 3 – CO₂ Readings by Paint Type



Trial 3 – O₂ Released by Paint Type



Result

The algae-based paints showed a significant reduction in CO₂ levels and an increase in O₂ concentration compared to the control sample.

Bio Paint B (Thick coat) exhibited the best performance with a 15.6% CO₂ reduction and 21 ppm O₂ release.

This confirms that the algae remained photosynthetically active in the paint, supporting the hypothesis.

Conclusion

The experiment demonstrated that incorporating pond algae into a starch–aloe vera matrix results in an effective air-purifying bio-paint.

It actively removes CO₂ and releases O₂ through photosynthesis.

Thus, Bio Paint B (thick) proved to be the most efficient and stable formulation.

The project provides a sustainable and low-cost solution to combat air pollution while converting waste materials into useful products.

Application

- Can be used for indoor walls, school buildings, and urban structures to improve air quality.
- Serves as a green innovation combining art and biology.
- Demonstrates the use of waste pond algae as a renewable raw material.

Future Enhancement

- Increase durability by adding UV stabilizers or natural preservatives.
- Test with different algae species for enhanced photosynthesis.
- Scale up production for use on large wall surfaces.
- Integrate smart sensors to track real-time CO₂ reduction in rooms.

References

Source: SciELO Brasil <https://share.google/ucTGeDY1oFVTsat0b>

<https://doi.org/10.1590/0104-1428.20220084>

<https://doi.org/10.1016/j.envres.2024.118397>

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