Emirati Journal of Environment, Sustainability, and Climate Change
Vol 2 Issue 1 (2024)
Pages (12 –17)

Available at www.emiratesscholar.com

Innovative Algal-Based System for Nearly-free Sustainable Energy Generation and Air Purification

Khalil Chakra
chakrakhalil714@gmail.com
Engineering student, physicist and inventor - Morocco - Tiznit Province - Rakkada Community - Dar Ed Hajj

ARTICLE INFO

Published on 30th of December 2024
Doi:10.54878/rwzzat08

KEYWORDS

Bio-hydroelectric, Green Energy, Environmental Pollution Reduction, Bioenergy, Photosynthesis

HOW TO CITE

Innovative Algal-Based System for Nearly-free Sustainable Energy Generation and Air Purification. (2024). *Emirati Journal of Environment, Sustainability, and Climate Change*, *2*(1), 12-17.

ABSTRACT

In this world, living organisms such as plants, algae, and some other creatures play a crucial role in producing oxygen through the process of photosynthesis. This process relies on the unique ability of green plants and algae to use light energy to convert water, carbon dioxide, and minerals into oxygen and energy. By using the pigment chlorophyll, found within these organisms and giving them their green color, photosynthesis is carried out. During this process, these organisms absorb carbon dioxide, water, and sunlight, utilizing them to produce energy and oxygen. They retain the energy for their own use, while releasing oxygen into the environment for other living beings to consume. Algae, for instance, produce oxygen bubbles at the bottom of water bodies. These bubbles remain stationary until buoyant force, resulting from the weight of the liquid, causes them to rise. Once released, these bubbles ascend slightly to be collected and periodically or in batches released into cavities connected to a vertical belt located above the release base. This belt, connected to the cavities on one side, is pulled upward. This upward pull generates rotational mechanical movement, which is then used to produce electricity. In this way, we have successfully innovated an additional eco-friendly and free method for generating energy. This system is registered with the Portuguese Patent Office INPI under the number 119528 dated 15/06/2024.

Introduction

The increasing environmental challenges and concerns about the depletion of fossil fuel resources compel us to seek renewable and clean energy sources. This can only be achieved by innovating new methods for generating electricity that are environmentally friendly and cost-effective, to protect the wealth of future generations. I have developed a new energy generation system concept that represents a revolution in renewable energy technology. It offers significant environmental benefits by reducing pollution and improving air quality, in addition to providing a sustainable and nearly free energy source. This system utilizes algae, which not only produce oxygen but also yield by-products that can be used as natural fertilizers, promoting sustainable agriculture. Furthermore, this system can operate effectively in areas where other renewable energy systems, such as solar power, may not be efficient. Due to these advantages, this nearly-free oxygen-emitting electrical energy production system using green algae adds substantial value to the field of renewable energy, advancing available technology and efforts toward sustainable development and environmental protection.

Let's begin by discussing what is new about this invention.

This innovative technology for electricity production relies on a clean method that contributes to releasing large quantities of oxygen instead of greenhouse gases. This technology reduces the pollution caused by electricity generation using fossil fuels. Here, we will mention some of the main benefits and features of the innovation, which include:

- Reducing environmental pollution from electricity production.
- Obtaining sustainable and free (or nearly free) energy.
- Absorbing greenhouse gases from the atmosphere, thus repairing the damage caused by non-clean energy sources.
- Producing eco-friendly natural fertilizers from green algae waste.
- Functioning effectively in humid and cloudy regions, such as tropical areas, where direct sunlight is scarce, reducing the effectiveness of solar energy systems.

The Scientific Principle Behind This Technology

Algae are photosynthetic organisms responsible for the majority of oxygen renewal on Earth. They achieve this by converting light energy and carbon dioxide into organic matter, such as biomass, which can be transformed into rich natural fertilizers or other products. Similar to terrestrial forests, algae remove carbon dioxide from the Earth's atmosphere and produce oxygen, helping to regulate the climate. This process can be summarized by the following chemical equation: 〖6H〗_2 O+6〖CO〗_2+(Light energy)→C_6 H_12 O_6+6O_2 , The diagram below illustrates the biological process through which algae produce oxygen.

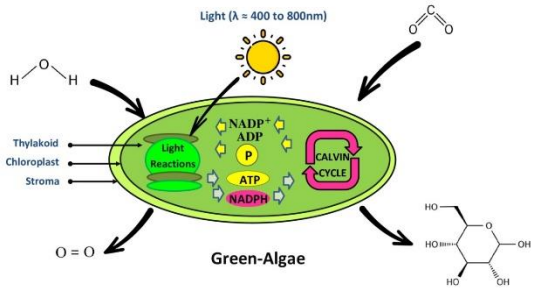

Fig. 1. Photosynthesis reaction 〖6H〗_2 O+6〖CO〗_2+(Light energy)→C_6 H_12 O_6+6O_2.

It is believed that various types of algae produce more than half of the oxygen on Earth. These algae are found in all aquatic environments and are an essential part of the life cycle in marine ecosystems, forming the first link in the food chain. As autotrophic organisms, algae range from unicellular forms (known as phytoplankton) which produce about 50% of the oxygen, to multicellular forms (such as seaweed) which produce about 30%.

By harnessing this natural process, the new technology not only generates electricity but also contributes significantly to oxygen production and the reduction of greenhouse gases, providing multiple environmental benefits [1,2].

Most algae perform photosynthesis, which uses solar energy (λ ≈ [400 to 800 nm]) to convert carbon dioxide and water into sugars and oxygen. This process is one of the most important biological processes on Earth. It is worth noting that some properties of algae differ from terrestrial plants, including the way chlorophyll aids in photosynthesis. There are two main categories of algae: "macroalgae," which are visible to the naked

eye, and "microalgae," which are small, single-celled organisms known as "phytoplankton." These microalgae are found in freshwater, saltwater, and moist soil and are a major food source for small animals in the aquatic environment. In this system, we will use microalgae fields to produce oxygen[3], as illustrated in the image.

2. Technical Design of the System.

2.1 The Platform Responsible for Oxygen Production.

The platform responsible for oxygen production consists of a large field planted with green oxygen-producing algae. These organisms absorb carbon dioxide, water, and sunlight, using the green pigment chlorophyll—a green substance found within these organisms—to carry out photosynthesis. During this process, the algae retain the energy for themselves but release oxygen into the environment for us all to breathe. Figure 2 illustrates the oxygen bubbles produced by an algae colony, which remain stationary in the field until the pressure exerted by the fluid's weight causes the bubbles to rise. These algae reside on the surface (illustrated in image number 8), which forms a field after planting algae in it. This surface is used when planting algae in deep water, but in areas such as swamps or adapted ponds, it is unnecessary since the pond or sea surface serves as a substitute.

Above this field is a bubble collection base (illustrated in image number 6) that captures any bubbles rising from the field. Directly above it is a curve filled with trapped oxygen that does not exit with the oxygen toward the release

in the curve (5) is mixed with the oxygen in the oxygen collection funnel, but the oxygen in the curve (5) does not escape since the oxygen transfer tube is in the oxygen collection funnel, thus remaining trapped as an air pocket. This step aims to deliver light rays to deep fields as effectively as possible. Above it are empty columns, closed from the bottom – Its structure resembles that of an optical fiber – allowing light to be transmitted to the depths to support the biological process (illustrated in image number 4). These columns also support the base as they connect the buoyancy device (illustrated in image, number 2) and the bubble collection base. The buoyancy device keeps the station afloat on the surface, allowing us to control the depth at which the algae are placed by adjusting the column length.

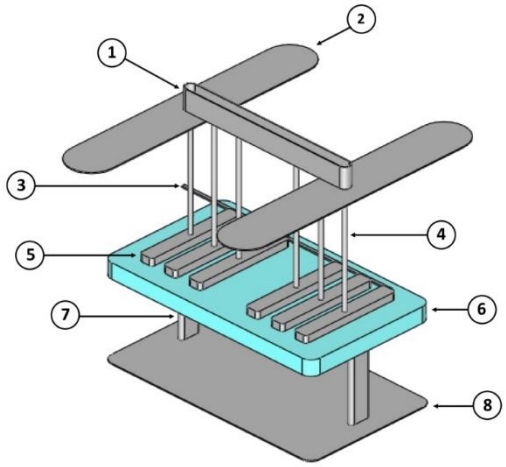

Fig. 3. Design of the Oxygen Production System

No	System Components Names
1.	Compartment to Prevent Seawater from Covering Light Inlets
2.	Buoyancy Device: Keeps the station afloat on the surface and the algae at a certain depth, used when planting algae in deep waters. In areas like swamps or adapted ponds, the buoyancy device is unnecessary.
3.	Tube to Transport Produced Gas to the Platform
4.	Empty Columns Closed from the Bottom: Allow light to be transmitted to the depths to support the biological process.
5.	Curve Filled with Trapped Oxygen and Light Distribution
6.	Oxygen Collection Funnel Produced by Algae
7.	Columns to Support the Field
8.	Algae Cultivation Area or Algae Field

3.1 The Main Platform for Converting Oxygen to Electrical Energy

After the gas is produced, it is transferred to a base via a tube (illustrated in image 3, number 3). The base periodically releases the gas to fill the cavities on the conveyor belt (illustrated in image 4, number 5). Once these cavities are filled with gas, they exert a force, as

any gas-filled body submerged in water at a certain depth would. In other words, once these cavities are filled with air, they have a lower density compared to the surrounding water. This density difference creates a force known as buoyant force, which lifts relatively light objects in fluids. Archimedes' principle explains this phenomenon, stating that the buoyant force acting on a submerged object is equal to the weight of the fluid displaced by the object. In the case of air cavities (illustrated in image 4, number 4), the air-filled cavities are lighter than the surrounding water, thus they are lifted upward by the buoyant force.

Since these cavities are attached to the rotating belt (illustrated in image 4, number 5), the generated lifting force is transferred to the belt, causing it to move upward and rotate continuously. This rotational mechanical movement is the basis for electricity production.

3.2 Components and Design for Converting Oxygen to Electrical Energy

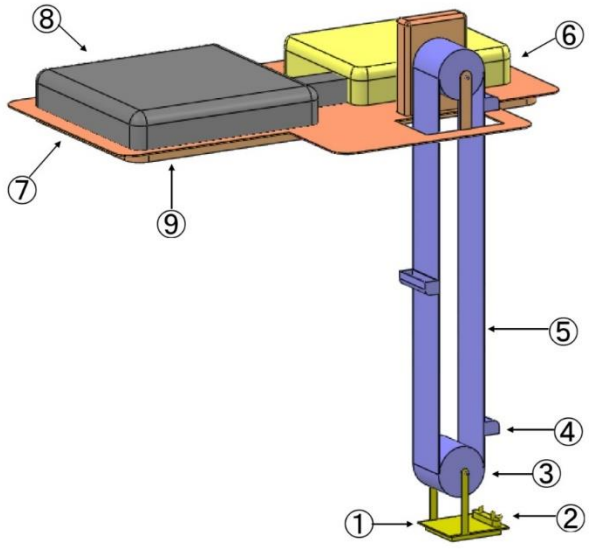

Fig. 4. Converting Oxygen to Electrical Energy

No.	System Components Names
1.	Lower Base
2.	Oxygen Release Outlet
3.	Lower Pulley Connected to the Lower Base
4.	Cavity Filled with Oxygen: This causes the cavity to be pushed upward due to the buoyant force generated by the volume of oxygen inside the cavity.
5.	Conveyor Belt
6.	Rotation Multiplication Area: For converting rotational movement into electrical energy.
7.	Platform Surface Supporting System Components
8.	Generator Area: Where mechanical movement is converted into electrical energy.
9.	Under the Base: An air-filled space to ensure the base remains buoyant.

4. Explanation of the entire system

The system for producing free electrical energy and oxygen using green algae is a novel solution designed to generate clean and renewable energy while simultaneously producing oxygen. This system leverages the natural photosynthesis process of green algae to convert carbon dioxide, light, and water into oxygen and organic matter. The oxygen is then used to generate electricity in an environmentally friendly manner. Additionally, this system offers a new method for producing electricity in humid and cloudy regions where direct sunlight is limited. The technical design of the system comprises two main components: the oxygen production platform and the main platform for converting oxygen into electrical energy.

The oxygen production platform consists of a large field cultivated with green algae that produce oxygen bubbles. These bubbles are collected by a bubble collection base positioned above the algae field. Above the collection base, light distribution

mechanisms ensure that all algae receive sufficient light for photosynthesis. The distance between the field and the collection base is designed to allow water currents to flow, ensuring the continuous supply of vital nutrients such as nitrates, potassium, phosphorus, and carbon to the field. When these conditions are met, the microalgae multiply rapidly, resulting in what is known as an "algal bloom."

The main platform for converting oxygen into electrical energy periodically releases the collected oxygen bubbles into cavities on a conveyor belt. These oxygen-filled cavities are lifted by buoyant force due to the density difference between the air-filled cavities and the surrounding water. The buoyant force drives the conveyor belt, creating rotational mechanical motion. This mechanical motion is transferred and amplified through a series of gears, increasing the rotations. The amplified rotational motion is then converted into electrical energy using generators.

In conclusion, the system for producing free electrical energy and oxygen using green algae represents a significant advancement in renewable energy technology. By leveraging the natural photosynthesis process of algae, the system generates clean electricity while simultaneously producing oxygen and reducing atmospheric carbon dioxide levels. This innovation not only addresses sustainability in the energy sector but also positively contributes to environmental health, making it a valuable addition to the field of green energy solutions.

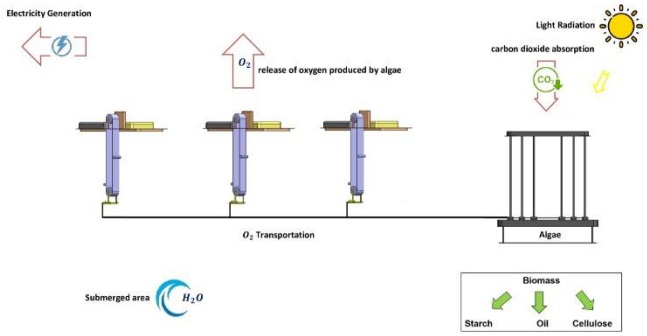

Fig. 5. The figure illustrates how the entire system works.

6. KHALIL's Free Energy Diagram

This diagram briefly describes how mechanical power (Pw) can be obtained by using the buoyant force (Archimedes' principle) generated by collecting oxygen bubbles produced by algae as a byproduct of photosynthesis.

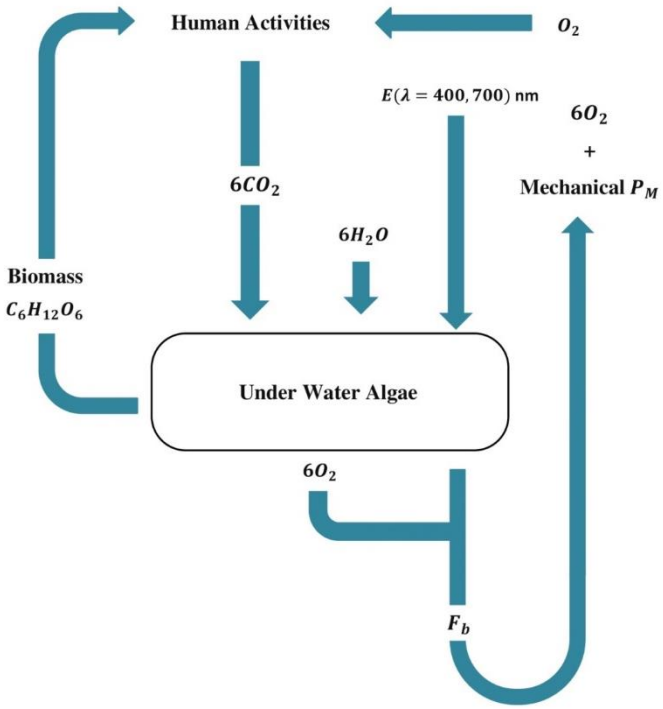

Fig. 6. KHALIL's Free Energy Diagram.

Conclusion

The system for generating free electrical energy while emitting oxygen using green algae represents a significant and essential step towards achieving a sustainable and environmentally friendly future. Initial experiments I conducted have shown that this system can operate effectively in various environments, including humid and cloudy areas such as tropical regions, making it an affordable and suitable solution for a wide range of climatic and geographical conditions. In addition to generating electrical energy, the system contributes to improving air quality by producing oxygen and absorbing carbon dioxide. In conclusion, it can be said that the development and adoption of such innovative technologies are the only way forward towards a more sustainable and cleaner future, where we can meet our energy needs in ways that respect the environment and ensure resource sustainability for future generations.

Acknowledgment

I would like to thank everyone who contributed to bringing this research to fruition, especially the publishing journal. I also want to express my full readiness to collaborate with any party to develop this system and make it available to everyone, particularly in underdeveloped regions.

References:

1. Björn LO. Photosynthetic production of molecular oxygen by water oxidation. Oxygen. 2022;2(3):337-47. Available from: https://doi.org/10.3390/oxygen2030024

2. Oxford Academic. Molecular aspects of photosynthesis in algae: converting light and CO2 into oxygen and biomass. The Plant Cell. 2023. Available from: https://doi.org/10.1093/plcell/koae143

3. Smore Science. Where does oxygen come from?. May 2022. Available from: https://www.smorescience.com/where-does-oxygen-come-from