SERBIA

Elementary School
“IV kraljevački bataljon”
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CLIMATE BOX

3rd International Schoolchildren's Festival

BIOREACTOR

REDUCING CO_2, RECYCLING, AND CREATING USEFUL BIOMASS

Introduction:

This project addresses global environmental challenges such as climate change, urban pollution, and plastic waste through a sustainable, low-cost solution. Its main goal is to reduce atmospheric CO_2 using algae capable of photosynthesis, which absorb CO_2 and release oxygen, mimicking the natural role of trees. By constructing the bioreactor from recycled plastic bottles and reused materials, the project promotes recycling and reduces environmental waste. Additionally, it improves air quality by filtering aerosols and harmful particles, which is especially useful in indoor spaces such as classrooms and laboratories. The system is designed to operate autonomously with solar-powered energy, demonstrating the potential of renewable sources. Beyond CO_2 capture, the resulting algal biomass can be reused as compost or plant fertilizer, supporting a circular ecological process. Overall, the project combines biological innovation and environmental awareness to provide a sustainable method for improving air quality and mitigating climate change.

Greenhouse Gases and CO_2 Reduction

The main greenhouse gases are nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2). Among them, CO_2 plays the greatest role in global warming, as it traps the Earth’s infrared radiation. Reducing CO_2 levels decreases this effect and helps lower global temperatures.

Photosynthetic organisms, such as plants, algae, and some bacteria, naturally remove CO_2 from the atmosphere, converting it into sugars while releasing oxygen. Artificial CO_2 sequestration — capturing and storing atmospheric carbon — can further help mitigate climate change.

Algae as CO_2 Reducers

This project uses algae collected from a lake in Kraljevo due to their adaptability to local conditions. Common types include cyanobacteria, chlorophytes, and bacillariophytes, which efficiently absorb CO_2 thanks to their high chlorophyll content. Under proper conditions of light, pH, and air supply, these algae perform photosynthesis and reduce CO_2 levels. Commercial systems like Belgrade’s LIQUID3 demonstrate this principle on a larger scale, with one unit equaling the effect of a mature tree.

Plastic Recycling

Recycled materials were used to build the bioreactor casing, including water bottles and air hoses from an old compressor. An aquarium pump provides airflow and CO_2 to the culture. The project aims to replace the battery-powered pump with solar panels, creating an autonomous, sustainable system powered by renewable energy.

Air Filtration

Another goal is to reduce harmful aerosols that affect human health. Research confirms that bio-air purifiers using algae can improve indoor air quality and support respiratory health. The bioreactor was designed for a chemistry classroom, where clean air is essential. In urban “heat islands,” such systems could cool the environment, filter air, and produce algae biomass usable as compost or fertilizer — further enhancing sustainability.

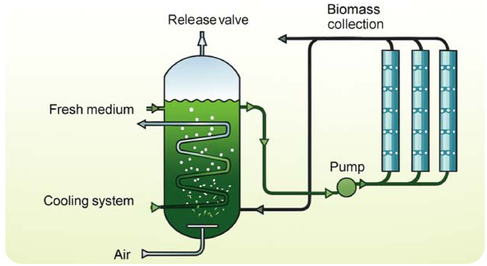
Main information:

1. Collecting an algae culture from a lake in Kraljevo, in which algae develop thanks to the constant decomposition of organic matter originating from the fish and other animals that live in it, as well as due to good aeration and lighting.

2. A system of connected containers in which air is pumped into the first bottle, then diffuses throughout the entire volume, and finally the oxygen produced during photosynthesis is released through an opening in the cap of the last bottle.

3. A new quantity of algae is added to the reactor every week. In this way, we ensure that the bioreactor efficiently binds CO_2 and aerosol particles, both of which are present in higher concentrations in urban air.

4. An example of a small air pump connected to a solar panel making it self-sustaining unit that requires little to no external input of energy.



5. Future endevour - a schematic representation of the system for producing and collecting algal biomass in the bioreactor. The image shows that successful algal cultivation requires several components through which the algae pass to be easily collected.

6. Excess of the biomass of algae created can be used as a natural fertilizer. The water is rich in minerals, nutrients and the microorganisms in the soil can decompose the leftover algae.

Key points:

- Algae are inexpensive, relatively easy to grow, and have multiple uses when confined to a plastic container.
- The project is easy to replicate and, except for the solar panel, requires minor initial investment.
- It is a self-sustaining unit that requires little to no external energy input.

Call for action:

Join our algae bioreactor project! Absorb CO_2, clean air, recycle materials, and create sustainable resources. Students, teachers, and environmental enthusiasts — help grow a greener, healthier future together!

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