



EnerGaia

Spirulina Production System

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INTENDED USAGE

The supplied materials, consisting of hundreds of components including, but not limited to PVC-Pipes, PP-Tanks, air blowers, harvesting equipment, airline components and processing equipment, are intended by EnerGaia Co., Ltd. to be solely used for the purpose of production and semi-continuous cultivation of *Spirulina* biomass.

If all instructions and recommended quality-control measures are followed, then the produced *Spirulina* will be safe for human consumption. After proper processing, the *Spirulina* can be consumed directly fresh, or dried to further extend its shelf life to up to 4 years. The EnerGaia cultivation system enables producing *Spirulina* paste with the longest refrigerated shelf-life of 4 to 6 weeks, with a mild taste and creamy texture that sets it apart from conventional *Spirulina* products.

CLOSED CIRCUIT SPIRULINA PRODUCTION SYSTEM

Unlike other commercial *Spirulina* producers who cultivate algae in open ponds, EnerGaia provides a closed system that presents numerous advantages including:

- limited contamination risk
- better quality control
- limited evaporation loss and substantially less water usage
- precise monitoring
- increased production per area of land
- air-filtration that removes airborne contaminants



The intended Life Expectancy of the spirulina production system is a minimum of 5-years. Some components will last longer than this while will have a shorter life span and are intended to be replaced as part of the routine system maintenance when necessary. Additionally, because our design relies on the injection of forced air for aeration and mixing, we are able to utilize CO2 emissions from industrial sites as an option, reducing the carbon footprint of our customers.

EnerGaia is continuously working on further refinements to the system with the goal of being able to compete with meat for protein on a price per kilogram basis.

WHAT IS SPIRULINA ?

Spirulina is a microscopic cyanobacteria, or blue-green algae that has been consumed by humans and animals for centuries. While Spirulina is typically consumed in a dried form as a nutritional supplement, fresh Spirulina offers many benefits over dried including ease of use, superior flavor, and the absence of nutritional degradation due to the drying process. Spirulina is rapidly gaining recognition around the world as an exceptional food source for nutrition and protein and EnerGaia is one of the first producers in the world to offer fresh Spirulina products.

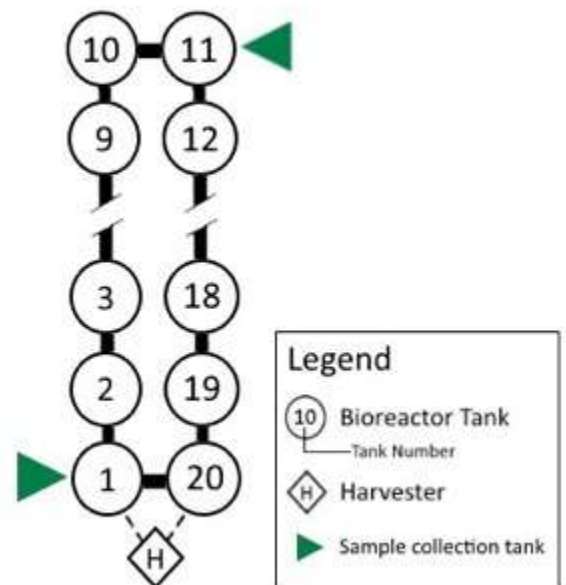


SYSTEM OVERVIEW

As a microorganism, Spirulina cells are cultivated within a liquid growth media, contained in our enclosed photobioreactors. These photobioreactors, or tanks, are white PP-tanks with a maximum volume of 80 gallons. A large number of these tanks, typically 10 to 40, are linked to one another with PVC pipes, forming a circle, called a system. All systems on a production site are supplied with air by an air blower, connected via air lines.

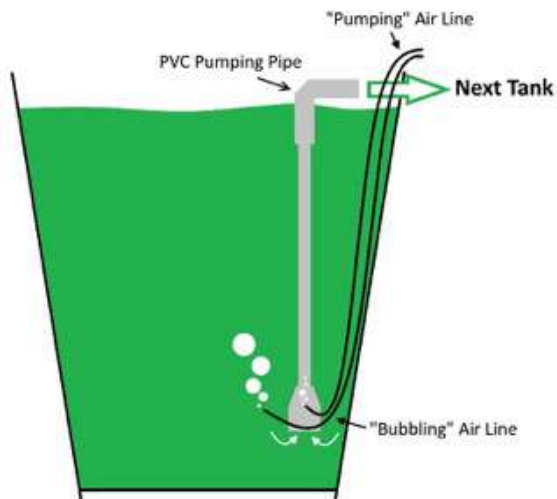
The liquid medium is pumped occasionally through all of the reactors within a system, ensuring a good mixing of the medium itself and homogenization of the culture. If not in “pumping” mode, the culture inside a single reactor is mixed while in the “bubbling” mode.

The harvesting can be done in a separate harvesting container installed as a by-pass in the system, or implemented into one of the bioreactor tanks.



AIR LIFT PUMP TECHNOLOGY

The pumping of the culture medium is achieved by airlift technology. By making use of capillary forces, the system is automatically kept in a homogenized state while using a minimal amount of energy.



With this mixing method, a stable liquid flow can be achieved, with the additional benefit of providing gas to liquid exchange between medium and air, to prevent the commonly faced problem of oxygen oversaturation in traditional bioreactors.

AUTOMATIC HARVESTING TECHNOLOGY

The automated harvested system allows Spirulina to be removed from the system with minimal labor. The harvester consists of a strainer, acting as a filter, and a micron mesh bag for separating the Spirulina cells from the medium.

The pumping brings Spirulina cells from the previous tank into the harvest compartment. The cells are filtered out, while the remaining medium flows into the next reactor.

The circular flow of the system ensures that the incoming media has a high concentration of Spirulina cells, allowing for long harvesting cycles of the system with minimal human intervention.

