The Seed Train

Propagating Micro-Algae for Research and Development

Introduction

In the field of research and development, micro-algae have gained significant attention due to their potential applications in various industries, such as biofuels, pharmaceuticals, food supplements, and wastewater treatment. Cultivating micro-algae in large-scale production requires a well-designed seed train, or inoculation train, which serves as a crucial component in ensuring optimal growth and production in photobioreactors (PBRs). This article explores the importance of the seed train in micro-algae research and development, its design considerations, and its impact on productivity and scalability.

The Role of the Seed Train in Micro-Algae Research and Development

The seed train, essentially a propagation system, provides a continuous supply of starting cultures for micro-algae cultivation in PBRs. Its primary purpose is to ensure the availability of high-quality inoculum, which is critical for achieving optimal growth and productivity.

The seed train acts as a bridge between small-scale laboratory cultures and large-scale production, allowing for controlled scaling and maintaining the desired characteristics of the micro-algae strains.

Designing the Seed Train

The design of the seed train is a crucial aspect of planning a micro-algae factory or research facility. Several factors need to be considered to ensure its efficiency and effectiveness. These factors include the size and type of PBRs, growth protocols, labor requirements, and production goals.

One important consideration is the biomass density of the starting culture. It is recommended to have a minimum biomass density of 3 grams of dry weight per liter (3 gDW/L) before moving the culture to the next step in the seed train. This ensures a robust and healthy inoculum for subsequent stages, leading to improved growth and productivity.

The seed train typically consists of successive steps with increasing culture volumes. Each step serves as a stage for

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gradual scaling, allowing for the transfer of cultures from smaller vessels to larger ones. For example, a 200 mL flask culture can be used to start a 2L flask culture, which can then be used to initiate a larger PBR, such as the Lgem Lab-25 PBR. This sequential approach facilitates controlled growth and minimizes the risk of contamination, ensuring the quality of the micro-algae cultures.

The duration of each step in the seed train depends on the growth characteristics of the micro-algae strain and the desired biomass density. On average, it takes about one week for the culture to reach the target biomass density before it can be transferred to the next step. This timeline allows for proper acclimation and growth of the micro-algae, ensuring a healthy and vigorous inoculum for subsequent stages.

Implementing the Seed Train

There are two primary ways to run a seed train: batch mode and repeated batch mode. In batch mode, the entire culture from a particular step is transferred to the next step, ensuring a fresh and uncontaminated inoculum.

This approach requires cleaning the PBR after each transfer to maintain a sterile environment

On the other hand, repeated batch mode involves maintaining a continuous growth process within the seed train. Every other week, the PBR is filled with the inoculum from the previous step, while the cultures in the subsequent steps are moved forward. This mode allows for a more frequent supply of starting material, with one seed train producing approximately 26 seed cultures per year. It also ensures that any failures or contamination can be traced back to the original stock, enhancing quality control.

Benefits of a Well-Designed Seed Train

1. Consistent and Reliable Growth: The seed train ensures that each step receives a high-quality inoculum, resulting in consistent growth and improved productivity in the PBRs. It minimizes the risk of contamination and maintains the desired characteristics of the micro-algae strains.

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2. Scalability: The sequential nature of the seed train allows for controlled scaling, starting from small laboratory cultures and gradually increasing the culture volumes. This scalability is crucial when transitioning from research-scale to large-scale production.

3. Quality Control: By maintaining a continuous flow of new seed material, the seed train enables easy traceability and identification of any issues or failures in the production process. It enhances quality control measures and facilitates troubleshooting when necessary.

4. Increased Productivity: A well-functioning seed train ensures a steady supply of high-quality starting cultures, leading to increased productivity in PBRs. The controlled scaling process and optimized growth conditions result in higher yields and improved production efficiency.

Conclusion

The seed train plays a pivotal role in micro-algae research and development, providing a continuous supply of high-quality starting cultures for large-scale production in PBRs. Its design considerations, such as biomass density, sequential scaling, and choice of operational mode, significantly impact the efficiency and productivity of the cultivation process.

By implementing a well-designed seed train, researchers and scientists can ensure consistent growth, optimize productivity, and streamline the development of micro-algae-based products and applications. The seed train acts as a bridge between laboratory-scale research and large-scale production, facilitating controlled scaling, and maintaining the desired characteristics of micro-algae strains. With its critical role in ensuring high-quality inoculum, the seed train serves as a fundamental component of successful micro-algae research and development endeavors.

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