TECH OFFER

Bladeless Bioreactor for Cell Culture

KEY INFORMATION

TECHNOLOGY CATEGORY:
Foods - Processes
Life Sciences - Industrial Biotech Methods & Processes

TECHNOLOGY READINESS LEVEL (TRL): TRL5
COUNTRY: JAPAN
ID NUMBER: TO175417

OVERVIEW

Conventional stirred-tank bioreactors (STRs) often expose cells to high shear stress from impellers, which can damage sensitive cell types like mammalian or stem cells and reduce viability by up to 20–30%. Their complex internal structures with baffles, probes, and impellers also make cleaning and sterilisation challenging, with cleaning-related downtime reported to account for as much as 30–40% of overall operation time. Compared to traditional stirred-tank bioreactors used in large-scale cell culture, these systems present significant challenges in maintaining both efficiency and hygiene.

This technology offers a novel bladeless bioreactor that achieves homogeneous, gentle mixing without impellers, supported by a simple geometry that enhances cleanability. It enables the scalable and hygienic cultivation of sensitive cells, addressing critical bottlenecks in regenerative medicine and sustainable food production. The bioreactor design supports consistent performance and minimal contamination risk, making it ideal for both research and industrial cell culture applications.

TECHNOLOGY FEATURES & SPECIFICATIONS

This technology consists of a bladeless bioreactor (hardware) and a proprietary fluid simulator (software) used to optimize mixing conditions in advance. The innovative, blade-free system generates self-sustained vortices via the controlled rotation of a partially filled container, achieving homogeneous, low-shear mixing without internal mechanical parts. This unique design provides exceptionally low shear stress, protecting fragile cells, while the simple geometry ensures enhanced cleaning efficiency and reduced contamination risk.

POTENTIAL APPLICATIONS

- Regenerative Medicine: Enables the scalable, GMP-compliant production of therapeutic cells like pluripotent and mesenchymal stem cells under low-shear conditions, preserving viability and functionality for clinical therapies, drug discovery, and toxicity testing.

- Cellular Agriculture: Supports the large-scale, sanitary cultivation of muscle and fat cells for cultivated meat, ensuring safety, consistency, and sensory quality while reducing environmental impact and ethical concerns.

UNIQUE VALUE PROPOSITION

- Low shear stress: Minimizes damage to sensitive cells compared to conventional turbine-blade methods.

- High cleaning efficiency and contamination control: Simple internal structure reduces cleaning complexity and risk of contamination.

- Excellent scalability: Maintains consistent gentle mixing performance from 1L to 150L, enabling reliable scale-up from lab to industrial production.