

# MULTI-VESSEL BIOREACTOR FOR CELL MULTIPLICATION IN OIL PALM TISSUE CULTURE SYSTEM

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**S**hake-flask cultivation is a very effective method for growing cells on a laboratory-scale; however, its usefulness is restricted by inter-flask variation and lack of control over the culture environment. In comparison, bioreactors confer many advantages for the growth of plant cell and organ cultures. Most bioreactors have either mechanical or gas agitation for proper mixing to maintain a nearly homogeneous culture, while the chemical and physical environment can be controlled for optimum growth.

Bioreactors have two advantages over flasks for culturing plant cells. The first is in providing better control of the system (*e.g.*, the pH, temperature and dissolved gas concentration can be controlled); secondly, bioreactors can be reproduced on a larger scale.

## MAIN OBJECTIVE

To multiply cells under the controlled environment of a multi-vessel bioreactor.

## DESCRIPTION OF THE MULTI-VESSEL BIOREACTOR

The multi-vessel bioreactor (*Figure 1*) in oil palm tissue culture system has been used in MPOB since 2002. The apparatus comprises:

- six round-bottom 500-ml single-walled borosilicate glass vessels;
- stainless steel top-plate with two standard port fittings (2 x 12 mm) and two electrode-type port fittings (2 x 13.5 mm);
- four 10-mm ports for a sparger, a PT-100 sensor, an anti-foam probe and a harvest pipe; and
- four 4-mm fixed ports for reagent feed.

**Temperature control** for each vessel is by a support collar containing both a heating element and a channel for counter-cooling with a liquid. The temperature is maintained by a PT-100 temperature sensor working with a proportional integral derivative (PID) controller to provide reliable and accurate temperature control.

**Agitation** is provided by a magnetically coupled impeller shaft mounted above the bottom of the round-bottom vessel.

**Stirring speed** is maintained using a high-torque stirring shaft. The speed may be user-defined or controlled by an autoclavable oxygen probe.

**Aeration** to each fermenter is supplied by individual rotameters and spargers.

A **master control unit (MCU)** is located above the base unit, away from the liquid bath. It has

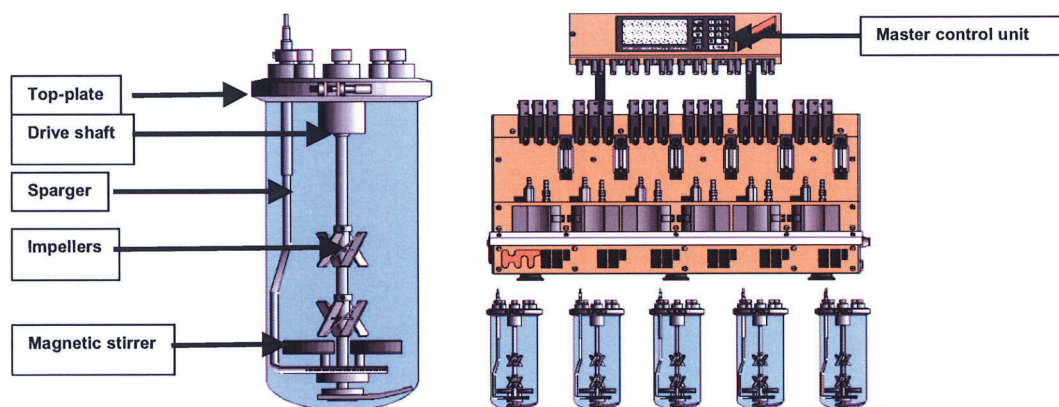


Figure 1. Schematic diagram of the multi-vessel bioreactor.

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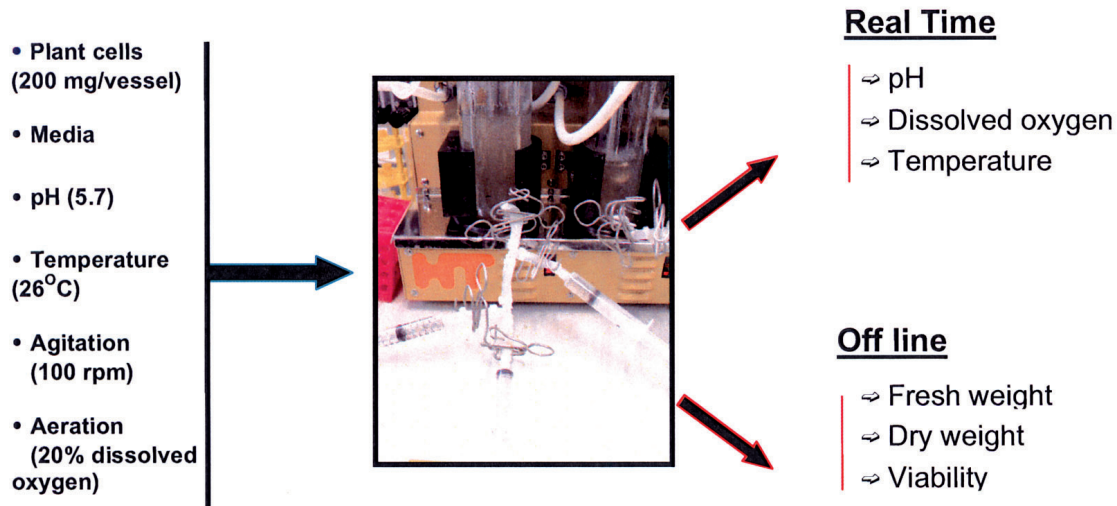


Figure 2. Cell analyses that can be measured during the process.

a splash-proof membrane keypad and a backlit liquid crystal display (LCD) showing the running values for each fermenter.

A **microprocessor controller** allows for a wide range of options in changing the set points, calibration and PID control for each vessel. The digital measurement and control system work on the direct digital control (DDC) principle with menu-driven operation. The easy-to-read display allows monitoring of both the actual and set values of speed, temperature, pH, dissolved oxygen (DO) and anti-foam.

### ADVANTAGES OF THE MULTI-VESSEL BIOREACTOR

- Multiplies cell biomass under a controlled environment.
- Operates under real time conditions, e.g. pH, oxygen, temperature and impeller speed for cells.
- Can be run simultaneously for individual or different clones.
- Can be applied to any plant culture system.

### SAMPLE ANALYSES

- Fresh and dry weights.
- Viability test using fluorescein diacetate (FDA), triphenyl tetrazolium chloride (TTC) and Evan Blues in haemocytometer.

### SERVICE OFFERED

The service of plant cell multiplication is offered at a minimal charge, depending on the raw materials

provided by the client. A basic analysis of the cells (Figure 2) will be produced as part of the service. In addition, the supernatant or cells produced during the analysis can be stored in liquid nitrogen for protein, molecular and metabolite analyses.

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