

Biomanufacturing Kit Equipment List/Descriptions/Uses

- **Spectrophotometer**

An analytical instrument used to measure the amount of light absorbed (or transmitted) as it passes through a sample. Transmittance and absorbance are inversely related.

For measuring bacterial growth: A spectrophotometer can help us determine the concentration of a compound or particles in a solution or suspension. Light of a pre-selected wavelength is shone through a chamber that houses the sample. The sample particles, bacteria for example, will absorb some of the light. The more bacteria in the sample, the lower the transmission of light, and therefore the higher the absorbance of light. The higher the absorbance of light, the more bacteria are present.

For measuring protein concentration (Bradford assay): The Bradford protein assay is used to measure the concentration of total protein in a sample. The principle of this assay is that the binding of protein molecules to Coomassie dye under acidic conditions results in a color change from brown to blue. The absorbance of the solution containing the protein increases as the color changes from brown (no protein) to blue (presence of protein). The darker the blue color, the more protein is present, and the higher the absorbance readings on the spectrophotometer. There are many manufacturers that sell relatively robust, benchtop spectrophotometers.

For this kit, you will need a spectrophotometer that can measure Absorbance/Transmittance at the wavelengths of 590nm and 600nm.



- **Bacterial Incubator** (for bacterial culture on plates)

An apparatus with a chamber used to provide controlled environmental conditions especially for the cultivation of microorganisms or the care and protection of premature or sick babies.

The incubators used in this kit are used to grow bacteria (not to protect human babies). To incubate means: to maintain under controlled conditions. In the case of the bacteria growing on plates for this kit, controlled conditions requires keeping the temperature at 37 degrees Celsius. Benchmark Scientific makes reasonably priced portable small incubators.



- Shaker/Incubator (for liquid bacterial culture)

This is an incubator that has a platform that moves in an orbital (circular) path. This keeps liquid cultures of bacteria moving to ensure good gas exchange so that the bacterial can grow well. In the case of the bacteria growing in liquid media (broth) for this kit, controlled conditions means keeping the temperature at 37 degrees Celsius and shaking at 200-250 rpm (revolutions per minute).



The shaker/incubator shown in the photo above is the type we use for the kit. It is relatively portable. I purchased a platform that comes with attachments for twelve 125mL Erlenmeyer flasks. I remove 4 of the flask attachments and screw down a tube rack so that tubes and flasks can be shaken at the same time if needed (see photo below). Ordering information for the shaker/incubator and platform is shown below. We purchased them from Laboratory Supply Network.

Benchmark Scientific – Incu-Shaker Mini – SKU# BMS:H1001-M (approx. \$3,000)

Benchmark Scientific – Platform for Incu-Shaker Mini, 12 x 125mL Flasks – SKU# BMS:H1000-P-125 (approx. \$400)



- 125mL Glass Erlenmeyer Flasks plus lids

You can use baffled or non-baffled flasks. The baffles (dents in the glass at the bottom of the flask) help mix the bacterial culture with air, resulting in better bacterial growth. When growing a 50mL culture you don't need the baffles (I've done a direct comparison). See pics below of baffled (on the right) and non-baffled (on the left) 125mL Erlenmeyer Flasks.

These can be ordered from many manufacturers. We ordered from Thomas Scientific (\$250 for 12 flasks + lids).

https://www.thomassci.com/Laboratory-Supplies/Erlenmeyer-Flasks/_/DeLong-Neck-Erlenmeyer-Flask-with-Cap

Glass flasks and metal lids can be washed and re-sterilized (autoclaved). You can use plastic flasks but they are not re-useable.



- Heat Block

An apparatus used for incubating solutions or chemical reactions in small tubes.



- Mini Centrifuges

A centrifuge is used to separate particles suspended in a liquid according to particle size and density, viscosity of the medium, and rotor speed. Within a solution, gravitational force will cause particles of higher density than the liquid to sink, and those less dense than the liquid to float to the top. Mini centrifuges are just small centrifuges.



- Micropipette

A very fine pipette for measuring, transferring, or injecting very small quantities of liquid.

