

**Introduction:-**

- The Anaerobic Digester is designed as a benchtop training facility and as a means of providing operational process data for plant design purposes.
- Anaerobic treatment processes involve bacteria that function only in the absence of air.
- These processes are becoming more popular in the water-treatment industry as they have considerable advantages over aerobic processes, including low sludge production, tolerance of stop/start operation, production of a useful fuel (methane) and relatively high throughput
- The anaerobic digester comprises two five-litre upward-flow packed bed reactors with feed rate and temperature control facilities. This allows steady, continuous operation at up to seven litres per day over periods of several days.
- The reactors may be operated in series or parallel. A buffer vessel between the reactors permits discharge of excess flow from the first reactor when the second reactor is operated in series but at a lower flow rate. The flow rates to the vessels are set and controlled by calibrated peristaltic pumps.
- The temperature of each reactor is controlled by an electric heating mat wrapped around the external wall. The temperature distribution within each reactor is maintained to $\pm 0.5^{\circ}\text{C}$. Reactor temperatures may be separately set at any desired value in the range ambient to 55°C .
- The gas off-take from each reactor is taken to a volumetrically calibrated collector vessel operating by water displacement. A constant head, liquid seal device ensures the gas pressure in the reactor is maintained at a constant value throughout the test run.
- The collected gas can be exhausted from the vessel and the volume refilled with water during a run without breaking the liquid seal. Liquid and gas sampling points are located at all strategic points around the reactors. Non-return valves and liquid seal syphon breaks are included in the process pipework to ensure each reactor operates at a constant volume without the ingress of air or the danger of accidental syphonic action.
- The equipment is mounted on a vacuum-formed plastic base with an integral drain channel to cope with spillages and wash down.

Note: Specifications are subject to change, Photos shown above are Indicative, Actual Product can Vary.



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IT-2013, Ramchandrapura Industrial Area,
Sitapura Extension, Jaipur-302022, India.



info@tesca.in
www.tescaglobal.com

Features:

- Small Scales bench mounted design
- A major feature of the digester is that results obtained from tests can be scaled up precisely to industrial throughputs.
- Includes PID control
- Series and Parallel operation

Scope of learning :

- Effluent treatability studies, including solids, carbon and biogas balances to determine purification (COD/BOD)
- Determining optimum operating temperatures, feed rates and ratios
- Observing effect of pH and influent nutrient concentration
- Process stability studies
- Determination of controlling kinetics
- 100% scale-up to industrial requiremen
- Preparation, warming and acclimation of an anaerobic reactor
- Demonstration of the multistage nature of anaerobic digestion
- Undertaking carbon balances
- Studying effects on purification performance of:
 - Hydraulic loading
 - Feed ratios
 - Temperature
 - Nutrient deficiency
 - Influent strength

Software:

- Our own customized software enables the operator to select the appropriate stage of the process and a mimic diagram with measured variables is displayed. The speed of the pump can be varied to meet the required flow rate.
- Results are saved in a log, which can be viewed and manipulated with the ArmBUS results viewer. Results can be printed or exported in a spreadsheet format, which can be opened in a wide range of packages for further analysis

Technical Specifications :

- Reactors Two identical reactors Nominal capacity 5L Packed volume 4L 150mm dia x 250mm high
- Reactor packing 25mm diameter Bio-balls
- Temperature control For each reactor 200W heating jacket with PID control from a temperature sensor positioned inside the reactor, set point within range ambient to 55°C, the jacket is thermostatically protected by a cut-out set at 85°C

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- Feed pumps Two identical peristaltic pumps variable speed using 10 turn potentiometer to 4rpm supplied with three tube diameters, 1.6, 3.2 and 4.0mm, flow rates from 0.2 to 5.8 l/day
- Gas collection vessels Two identical linear-scale 0-5L Capacity
- Reactor vessel : 2 x 5L (4.3L packed section)
- Gas collecting vessel : 2 x 5L
- Heat jacket : 2
- Temperature sensor : 2
- Pump : 2 x 0-40mL, supplied with 4.0, 3.2 and 1.6mm tube

Utility Required :

- Electrical supply : 220-240V / 1 ph / 50Hz
- Plastic feed and product tanks typically 30-50L, floor standing (not supplied)
- pH meter (not supplied)
- Synthetic waste water (not supplied)
- Analytical equipment as exists in most water quality laboratories for measurement of pH, BOD, COD, alkalinity, total volatile acids and suspended solids. (not supplied)

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