DarbyTech
Training Equipment Inc.

Bioethanol Process Trainer with PLC Control

Model Series: BioET - 900

Description:

The Bioethanol Process Trainer is a pilot-scale plant that demonstrates batch fermentation and continuous distillation of a suitable feedstock into fuel-grade ethanol (in this case white sugar). The produced ethanol is denatured by a process that renders it unsuitable for human consumption as per any local regulations regarding Completely Denatured Alcohol.

The process trainer has PLC based instrumentation to provide for the control of operating flows, temperatures and levels. This trainer provides the student the opportunity to gain real operating experience focusing on ethanol fermentation, distillation, dehydration, denaturing and preparation for use as a fuel as well as process control technology.
This trainer is available as a basic model for the chemical conversion using a refined sugar feedstock solution and ethanol separation by integrated binary distillation system. While industry uses a variety of feedstocks, often starch based, the processing of these into fermentable sugars varies. Due to the complexity of preparation from other non-sugar feed-stocks, we do not recommend these for student use at this time.

Function:

Non-cellulosic ethanol production today relies on a fermentation process which uses microorganisms to convert simple sugars into ethanol and carbon dioxide. This reaction takes place at modest temperatures and pressures. The rate of reaction is influenced by several factors including temperature, degree of mixing, and the microorganism chosen for the process. This process trainer includes a number of student-friendly visualization components that allow the students to visually monitor the entire bioethanol fuel production process.

"the plant is no place to practice!"

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The Process Trainer utilizes batch fermentation in its initial stage, with a refined white sugar solution as the feedstock. This batch fermentation process takes several days to reach completion (typically 5 days). The standard unit has a SS primary fermenter and a PE secondary fermenter and can process 2 batches every week. Optionally, multiple secondary fermentation vessels may be added to allow for several student groups to ferment in sequence and then distill at a subsequent session several days later.

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- The product separation, dehydration and denaturing is run as a continuous process, designed for an approximate three hour lab session.
- The trainer is equipped with process measurement and control devices including:
  - o Controllable metering feed pump
  - o PID controlled temperature control (reboiler power)
  - o Cooling water PID control on the reflux condenser
  - o Level activated product pumps
  - o Automatic ethanol denaturing system controlled by the PLC
- The trainer will be controlled from a programmable logic controller (PLC) computer mounted on the process skid. Operator station is a second computer with custom configured control logic and HMI interface.

Equipment Specification Highlights:

- Approximately 5 litres of produced ethanol per 50 litres batch fermentation (using refined sugar feedstock)
- Two visual inspection ports in the SS primary fermentation vessel with electric heat for fermentation temperature control
- Clean in place (CIP) of fermentation vessels
- 3" Diameter glass distillation column (with SS random packing)
- Translucent storage vessels
- Electric process heaters and distillation reboiler
- Molecular sieve dehydration models the process but does not actually make fuel grade product. (sieve regeneration not included)
- Interlocked alcohol denaturing system - Denaturing process to be confirmed at time of order to comply with applicable laws and regulations in addition to the intended end-use of the produced Ethanol
- Complete unit mounted on a stainless steel frame / support structure with integral spill catchment
- Approximate overall dimensions 762 x 2845 x 2845 mm high (30" x 112" x 112" high)
- Optional number of secondary fermentation vessels
- Available in all world voltages / frequencies (customer to specify electrical power available on-site)

Utilities Required:

- Single or 3-phase power (voltages to be confirmed by customer)
- Compressed air
- Hot and cold potable water

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