

Carbon Dioxide Hydrogenation Methanol Synthesis Educational Unit Operations Pilot Plant

Item Number: LPK-TBJ



Introduction

Pilot-scale educational system for carbon dioxide hydrogenation to methanol. Designed for unit operations teaching, it features a fixed-bed reactor, three-stage heating, dual mass flow controllers, and a 15.6-inch touchscreen with data acquisition. Perfect for chemical engineering and sustainable energy courses.

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Feature / Component	Specification
Reactor Type	Fixed-bed tubular reactor, 316L stainless steel
Catalyst Compatibility	Copper-based catalyst (pre-loaded, customizable upon request)
Maximum Operating Pressure	3.0 MPa
Maximum Operating Temperature	500°C
Heating System	Three-stage electric furnace with a hinged, split-outer shell
Flow Control	Dual high-precision mass flow meters for reactant gases
Human-Machine Interface	15.6-inch touchscreen terminal with real-time data acquisition
Frame & Mobility	Corrosion-resistant aluminum alloy frame with locking casters
Dimensions	1480 mm × 580 mm × 1800 mm

Experimental Module	Key Pedagogical Focus	Textbook Association & Core Concepts
Catalyst Evaluation & Kinetics	Study of conversion rate, selectivity, and space velocity during carbon dioxide hydrogenation.	<i>Unit Operations of Chemical Engineering</i> - Heterogeneous reaction kinetics - Catalytic fixed-bed reactors
Reactant Flow Dynamics	Investigating the pressure drop across packed catalyst beds under different gas velocities.	<i>Transport Processes and Unit Operations</i> - Flow of fluids through packed beds - Pressure drop calculations
Thermal Profile Tuning	Analyzing heat transfer coefficients and heat management using three-stage control.	<i>Transport Processes and Unit Operations</i> - Heat transfer in reactively heated tubes - Thermal conductivity of packed solids
Process Control & Automation	Setting up closed-loop feedback systems for temperature, pressure, and flow rates.	<i>Chemical Engineering Design</i> - Piping and Instrumentation Diagrams (P&ID) - Process safety and pressure relief loops