



LABPARK

Educational Environmental & Water Treatment Pilot Plants Catalog

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COMPANY PROFILE

>>> About Us

Labpark is a high-tech enterprise serving universities, research institutes, and enterprises in fields such as chemical engineering, biotechnology, and environmental science. Our main product lines are Educational Unit Operations Pilot Plants and Practical Training Unit Operations Pilot Plants, designed to support practical engineering education. Supported by our own R&D platforms and 209 technical patents, we operate a production facility with a planned area of 49,000 square meters, dedicated to helping institutions enhance laboratory infrastructure and practical training capabilities.



Photocatalytic Membrane Separation And Degradation Unit Operations Pilot Plant

Item Number: LPK-CMBS



Introduction

Bench-scale pilot plant integrating photocatalytic degradation with membrane separation for engineering education. Study advanced oxidation, microfiltration, and hybrid processes using industrial sensors. Features safety light-blocking curtain, low-noise compressor, and durable stainless-steel construction.

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System Component / Experimental Module	Technical Parameters / Operational Capabilities	Core Concepts & Academic Alignment
Xenon Light Source Assembly	300 W Xenon lamp simulating solar spectrum, complete with adjustable intensity and a protective light-shielding curtain.	Photo-activation energy, reaction kinetics, and catalyst absorption characteristics.
Feed and Product Management	Corrosion-resistant 304 stainless steel tanks with high-accuracy gas (0-160 mL/min) and liquid (0-10 L/h) rotameters.	Material balances, volumetric flow rates, and residence time distribution (RTD).
Pressurized Membrane System	Pressure-regulating pump operating up to 16 bar, supported by shock-resistant mechanical pressure gauges.	Transmembrane pressure (TMP), membrane permeability, and hydraulic resistance.
Photocatalytic Degradation Module	Batch or continuous degradation of organic model compounds using suspended or immobilized catalysts.	Heterogeneous catalysis, reaction rate constants, and mass transfer limitations.
Membrane Separation Module	Filtration and concentration of treated effluents with active monitoring of flux decline.	Membrane fouling, concentration polarization, and solute rejection coefficients.

Constant Pressure Filtration Educational Unit Operations Pilot Plant

Item Number: LPK-BFLP



Introduction

Hands-on educational pilot plant for constant pressure filtration. Classic plate and frame filter press allows students to study kinetics, determine specific cake resistance, perform cake washing and evaluate washing rates. Ideal for chemical engineering curriculum. Mobile, customizable, safety-compliant design.

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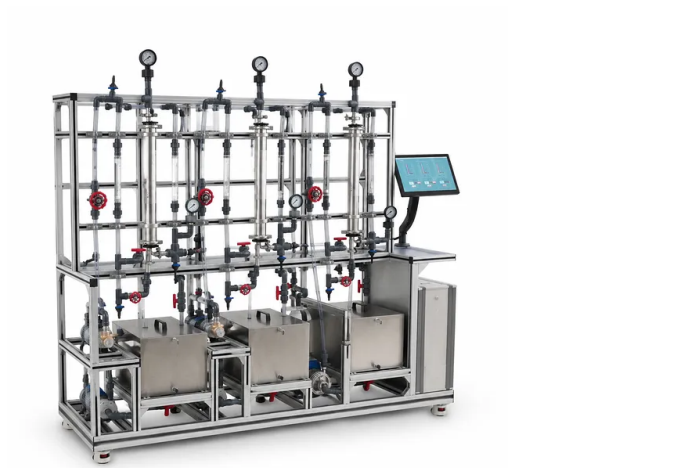
Parameter	Specifications & Components
Physical Dimensions	≤ 2200 mm × 580 mm × 1400 mm (Length × Width × Height)
Frame Material	High-strength anodized aluminum alloy profile with heavy-duty casters
Filter Equipment	Industrial-type dismountable plate and frame filter press, washable blind-flow design
Feed System	Pressurized feed vessel with integrated pneumatic agitation disc and pressure-regulating valve
Material Vessels	Stainless steel slurry preparation tank, pressurized feed tank, and filtrate receiver
Safety Features	Overpressure relief valve, pressure gauges, and secure pipe routing
Slurry Aggregation	Bottom-entry compressed air pneumatic dosing and suspension system

Textbook	Core Unit Operation / Concept	Corresponding Lab Exercise with Pilot Plant
<i>Unit Operations of Chemical Engineering</i>	Cake filtration theory, constant pressure filtration equations, specific cake resistance, filter medium resistance.	Determination of filtration constants (\$K\$ and \$s_s\$) and calculation of specific cake resistance under varying pressures.
<i>Transport Processes and Unit Operations</i>	Fluid-particle mechanics, porous media flow, cake washing dynamics, washing rate estimations.	Operation of the cake washing cycle to measure solute displacement rates and analyze washing kinetics.
<i>Chemical Engineering Design</i>	Equipment selection, scale-up of filtration systems, process safety in pressurized systems.	Evaluating pilot-scale experimental data to estimate the filtration area required for industrial-scale batch operations.

Multi-Functional Membrane Separation Educational Pilot Plant

For Unit Operations Lab

Item Number: LPK-SUNR



Introduction

The Multi-functional Membrane Separation Educational Unit Operations Pilot Plant is an integrated bench-scale laboratory system designed for teaching undergraduate engineering education. It features Ultrafiltration, Nanofiltration, and Reverse Osmosis modules in a compact, mobile unit for practical hands-on learning.

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System Parameters & Modules	Technical Specifications & Components	Targeted Experimental Applications	Academic Concepts & Textbook Alignment
Physical Dimensions	Max 2200mm × 580mm × 1995mm (L × W × H)	Structural footprint and spatial planning	Process layout and laboratory design standards
Frame & Support	Anodized aluminum alloy frame with lockable casters	Mobile structural support and safety stability	Structural integrity and materials selection
Ultrafiltration (UF) Module	Industrial-grade UF membrane module, feed tanks, pressure gauges, flow meters	Macromolecular protein separation, concentration, and membrane fouling studies	Concentrating macromolecular solutes, gel layer formation, and fouling resistance
Nanofiltration (NF) Module	Selective NF membrane module, high-pressure pump, safety valves	Softening processes, removal of divalent ions (calcium, magnesium), and small organics	Solute transport mechanisms, electrostatic interaction in membranes, and water softening
Reverse Osmosis (RO) Module	High-rejection RO membrane module, system pressure regulators, feed pumps	Desalination, purification of water, and removal of monovalent salts	Osmotic pressure limits, concentration polarization, and solvent permeation models

Electrochemical Water Treatment Educational Unit Operations Pilot Plant

Item Number: LPK-CEWT



Introduction

Enhance engineering education with this pilot-scale electrochemical water treatment plant. Designed for hands-on learning of efficient salt removal, electrolytic reactions, and real-time data acquisition. Features multi-mode control, corrosion-resistant PVC, low-voltage safety, and wireless connectivity for modern teaching labs.

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Experimental Module	Key Technical Parameters	Academic & Textbook Integration
Electrochemical Separation & Salt Removal	- Multiple power modes (Constant V, Constant I, Reverse Polarity) - High-salinity resistance	Textbook: <i>Unit Operations of Chemical Engineering</i> Core Concepts: Electrochemical separation processes, mass transfer in electrolyte solutions, and polarization curves.
Electrolytic Reactor Characterization	- Optimized electrolytic cell design - Real-time voltage & current monitoring	Textbook: <i>Chemical Engineering Design</i> Core Concepts: Reactor sizing, materials selection for corrosive environments, process safety, and instrumentation diagrams.
Fluid Flow and Ion Transport	- Controlled fluid delivery - Integrated 24V electric ball valves	Textbook: <i>Transport Processes and Unit Operations</i> Core Concepts: Fluid dynamics in closed conduits, ion transport under electrical fields, and convective mass transfer.

Carbon Dioxide Absorption And Desorption Educational Pilot Plant For Carbon Capture Studies

Item Number: LPK-TBJJX



Introduction

Explore carbon dioxide absorption and desorption with this educational pilot plant. Transparent columns visualize mass transfer; electric heating simulates industrial solvent regeneration; touchscreen interface enables data monitoring. Ideal for chemical engineering, bridging theory and practice.

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Parameter / Component	Specification Details
System Dimensions	≤ 2200 mm × 580 mm × 2500 mm (Length × Width × Height)
Structure Frame	High-strength aluminum alloy with lockable, adjustable casters
Absorption Column	Transparent borosilicate glass, packed column configuration
Desorption Column	Transparent borosilicate glass, packed column with integrated reboiler
Desorption Heating	High-temperature electric heating jacket, operational up to 400°C
Control Interface	15.6-inch industrial touchscreen terminal
Data Transmission	Supports wireless data export and real-time remote monitoring
Instrumentation	Integrated gas mass flow meters, peristaltic liquid pumps, and temperature sensors

Experimental Module	Core Unit Operation & Knowledge Points	Associated Textbook & Concepts
Packed Tower Hydrodynamics	Pressure drop determination, loading point, flooding velocity, and gas-liquid flow regimes.	<i>Unit Operations of Chemical Engineering</i> - Flow of fluids through packed beds - Packed column design and flooding correlations
Carbon Dioxide Absorption	Gas-liquid mass transfer, solvent selection, two-film theory, and calculation of the height of a transfer unit (HTU).	<i>Transport Processes and Unit Operations</i> - Absorption of dilute gases in packed towers - Mass transfer theories and coefficients
Solvent Desorption & Regeneration	Thermal stripping, energy balance, solvent recovery, and reboiler duty calculation.	<i>Chemical Engineering Design</i> - Stripping column design - Energy integration and heat exchange in separation systems
System Efficiency Analysis	Overall mass transfer coefficient calculation ($K_G a$), influence of gas/liquid flow rates on absorption efficiency.	<i>Unit Operations of Chemical Engineering / Transport Processes and Unit Operations</i> - Gas-liquid equilibrium - Rate-based mass transfer in columns

Gas-Solid Heterogeneous Separation Demonstration Educational Unit Operations Pilot Plant

Item Number: LPK-BHS



Introduction

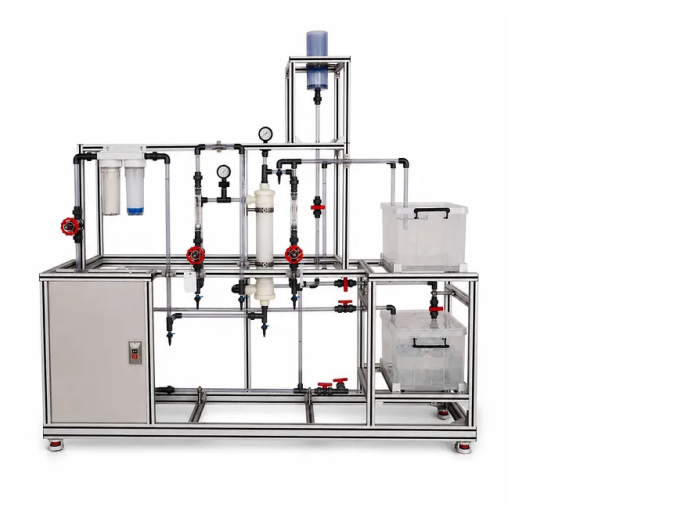
Comprehensive visual transparent gas-solid separation pilot plant for chemical engineering labs. Demonstrates gravity settling inertial settling cyclone and bag filter technologies. Enables real-time analysis of fluid-particle mechanics pressure drop and collection efficiency. Ideal for undergraduate unit operations courses.

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Parameters & Modules	Technical Specifications & Details	Academic Relevance & Textbook Alignment
Physical Dimensions	Maximum dimensions: 1480 mm x 580 mm x 1800 mm (Length x Width x Height). Mounted on a durable aluminum alloy frame with industrial casters.	Associated Disciplines: - Chemical Engineering - Environmental Engineering - Process / Food Engineering
Separation Technologies	• Gravity Settling Chamber • Inertial Settling Chamber • Cyclone Separator • Bag Filter	Core Textbook Connections: - <i>Unit Operations of Chemical Engineering</i> - <i>Transport Processes and Unit Operations</i> - <i>Chemical Engineering Design</i>
Fluid Measurement & Control	• Variable Speed Air Blower • Transparent Orifice Plate Flowmeter • Transparent Star Feeder for particle introduction	Relevant Unit Operations & Topics: - Fluid-Particle Mechanics & Sedimentation - Terminal Settling Velocity & Stokes' Law - Centrifugal Separation & Cyclone Collection Efficiency - Gas Cleaning, Dust Removal, & Air Pollution Control
Diagnostic Capabilities	• Differential Pressure Measurement (for cyclone pressure drop) • Variable velocity adjustment for performance evaluation	Key Conceptual Application: Evaluation of pressure drop vs. collection efficiency; understanding industrial scale-up and design parameters for particulate collection systems.

Ultrafiltration Membrane Separation Educational Pilot Plant

Item Number: LPK-CLMFL



Introduction

This ultrafiltration membrane separation educational pilot plant enables undergraduate students to process PVA solutions, study hollow fiber membrane dynamics, and perform quantitative analysis with spectrophotometry for hands-on learning of unit operations and industrial maintenance and membrane cleaning protocols.

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Module / Component	Technical Description	Aligned Academic Concept
Membrane Module	Hollow fiber ultrafiltration membrane module	Membrane geometry, pore size distribution, and hollow fiber bundle mechanics.
Feed System	Polyvinyl Alcohol (PVA) feed preparation tank with corrosion-resistant circulation pump	Feed solution preparation, fluid transport, and system flow control.
Instrumentation	Precision flow meters, pressure gauges, and temperature indicators	Process monitoring, sensor calibration, and data acquisition.
Analytical Unit	Integrated UV-Vis Spectrophotometer compatibility for concentration measurement	Spectrophotometric analysis, calibration curves, and concentration determination.
Cleaning System	Backwash and chemical cleaning circuit with dedicated storage	Membrane fouling, cake layer formation, and chemical cleaning protocols.
Experimental Utility	Continuous operation mode with recycling capabilities	Steady-state operation, mass balance, and process optimization.

Carbon Dioxide Capture And Utilization Educational Pilot Plant For Unit Operations

Item Number: LPK-TBJQM



Introduction

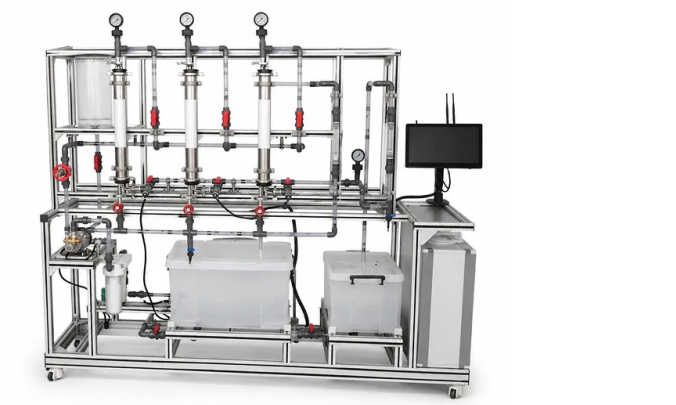
Educational pilot plant for carbon dioxide capture and utilization featuring four-tower adsorption, high-temperature regeneration, precise CO₂ analysis, modern touchscreen control, real-time data, and robust construction for hands-on unit operations training in university labs with curriculum alignment and safe operation.

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Parameter / Module	Technical Details	Relevant Textbook Unit Operations & Concepts
Separation Process	Four-tower adsorption/desorption system; operating pressure range: -0.1 to 1 MPa.	Gas absorption, adsorption isotherms, packed-bed hydraulics, and multi-stage separation.
Thermal System	304 stainless steel towers with electric heating jackets (up to 400°C); supports vacuum operation.	Heat transfer in packed beds, thermal regeneration of adsorbents, and vacuum desorption.
Control & Interface	15.6-inch touchscreen terminal; modular 24-signal monitoring; wireless data transmission capability.	Process dynamics, automated control loops, and digital data acquisition.
Analytical Instruments	Inline CO ₂ analyzer ($\pm 3\%$ accuracy); multi-range flow monitoring.	Material balances, species transport, and continuous concentration profile analysis.
Structural Frame	Industrial-grade aluminum alloy frame with casters; dimensions: $\leq 2200 \times 580 \times 2000$ mm.	Pilot plant design, scale-up principles, and process safety layout.

Multifunctional Membrane Separation Educational Pilot Plant With Ultrafiltration, Nanofiltration, Reverse Osmosis

Item Number: LPK-MFL



Introduction

An integrated laboratory bench-scale membrane separation system for higher education engineering labs combining Ultrafiltration, Nanofiltration, and Reverse Osmosis processes. Features industrial PLC control with touch-screen HMI, transparent piping, and academic assessment software. Ideal for chemical and environmental engineering curricula.

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System Module / Component	Technical Specifications & Parameters	Educational Unit Operation / Core Concepts
Ultrafiltration (UF) Module	Industrial-grade hollow fiber or tubular membrane; low pressure operation	Macromolecular concentration, gel-layer formation, membrane fouling
Nanofiltration (NF) Module	Spiral-wound composite membrane; medium pressure operation	Divalent ion rejection, water softening, organic molecule separation
Reverse Osmosis (RO) Module	High-rejection polyamide thin-film composite membrane; high pressure operation	Desalination, osmotic pressure overcoming, solvent permeation
Monitoring & Instrumentation	Digital pressure transducers, electromagnetic/rotameter flow meters, conductivity meters	Mass balance, flux determination, concentration polarization
Control System	Industrial panel PC with PLC workstation, real-time data logging	Process control, automation, data acquisition systems
Wetted Materials	Corrosion-resistant stainless steel and high-durability transparent polymers	Fluid transport, corrosion resistance in process design

Standard Textbook	Referenced Unit Operation / Academic Concept	Practical Application on the Pilot Plant
Unit Operations of Chemical Engineering	Membrane separation processes, osmotic pressure, concentration polarization, and membrane fouling.	Students measure flux decline over time to analyze concentration polarization and determine membrane resistance.
Transport Processes and Unit Operations	Mass transfer across semi-permeable barriers, rate equations for dialysis and membrane separations, and flux calculations.	Students collect permeate and retentate samples to calculate solute rejection rates and total mass transport coefficients.
Chemical Engineering Design	Process piping and instrumentation diagrams (P&ID), equipment scaling, material selection, and system safety interlocks.	Students study the physical layout of the pilot plant to understand industrial safety valves, sensor placement, and system design limitations.

Solid Waste Pyrolysis And Refining Educational Pilot Plant For Unit Operations

Item Number: LPK-ISOP



Introduction

This pilot plant for solid waste pyrolysis and refining integrates pyrolysis, separation, distillation, and catalytic hydrogenation into one educational unit. It provides visual process observation, smart data logging, and industrial safety for hands-on learning of engineering unit operations.

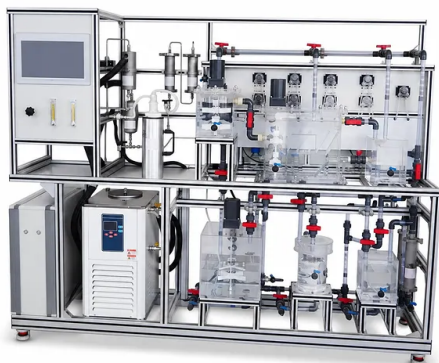
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Component / System	Technical Specifications & Material Details
Primary Structural Material	High-grade 304 and 316 stainless steel for chemical resistance and high-temperature durability
Pyrolysis Heating System	Ceramic fiber electric heating furnace with integrated PID temperature controllers
Refining Subsystem	Distillation column, catalytic hydrogenation desulfurization, and denitrification reactors
Safety Mechanisms	High-temperature cut-offs, real-time pressure gauges/transmitters, explosion-proof motors
Control Interface	15.6-inch industrial touchscreen with remote cloud data monitoring (5G/Bluetooth)
Observation Elements	Borosilicate glass gas-liquid separators and column sections for flow process visualization

Experimental Module	Core Unit Operation / Knowledge Point	Textbook Alignment Reference
Solid Waste Pyrolysis	Thermochemical conversion, solid-state kinetics, conductive heat transfer in packed beds	<i>Transport Processes and Unit Operations</i> <i>Chemical Engineering Design</i>
Multiphase Separation	Gas-solid separation (gravitational/inertial settling), gas-liquid separation, phase equilibrium	<i>Unit Operations of Chemical Engineering</i> <i>Transport Processes and Unit Operations</i>
Pyrolysis Oil Distillation	Continuous and batch distillation, vapor-liquid equilibrium (VLE), reflux ratio, column hydrodynamics	<i>Unit Operations of Chemical Engineering</i> <i>Chemical Engineering Design</i>
Catalytic Hydrogenation (Desulfurization & Denitrification)	Heterogeneous catalysis, chemical reaction kinetics, mass transfer in multiphase reactors	<i>Chemical Engineering Design</i>

Thermal Desorption Exhaust Gas And Tail Water Treatment Educational Pilot Plant

Item Number: LPK-CRTF



Introduction

Bench-scale educational pilot plant for treating thermal desorption exhaust gas and tail water integrates condensation, Fenton oxidation, precipitation, filtration, and carbon adsorption. Ideal for chemical engineering and environmental labs, teaching unit operations, process control, and real-time data analysis.

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System Module / Component	Technical Details & Features	Associated Unit Operations & Textbook Mapping
Exhaust Gas Condensation & Recovery	Multi-stage condensation loop featuring standard cooling and deep cryogenic condensation, paired with a high-efficiency gas-liquid separator.	Condensation, Gas-Liquid Equilibrium, Heat Transfer Operations (<i>Unit Operations of Chemical Engineering</i>)
Fenton Advanced Oxidation Reactor	Transparent reaction vessel equipped with an adjustable speed agitator, chemical dosing ports, and real-time pH and temperature monitoring.	Chemical Reaction Kinetics, Reactor Design, Advanced Oxidation Processes (<i>Chemical Engineering Design</i>)
Precipitation & Solid-Liquid Separation	Gravity-based sedimentation clarifier designed to facilitate flock formation, settling, and sludge separation.	Gravity Settling, Sedimentation, Fluid-Particle Mechanics (<i>Transport Processes and Unit Operations</i>)
Deep Filtration & Adsorption Column	Dual-column system featuring sand/media filtration and multi-stage activated carbon adsorption beds.	Fixed-Bed Adsorption, Deep Bed Filtration, Mass Transfer Operations (<i>Unit Operations of Chemical Engineering</i>)
Control & Instrumentation Suite	Integrated PLC system with a touchscreen interface, digital flow sensors, pH transmitters, and temperature controllers.	Process Dynamics and Control, Data Acquisition & Instrumentation (<i>Chemical Engineering Design</i>)

Bench Scale Carbon Dioxide Capture Educational Unit

Operations Pilot Plant

Item Number: LPK-CEBJ



Introduction

This bench-scale educational pilot plant simulates industrial CO₂ separation using a multi-tower adsorption system for hands-on engineering training. Students achieve ≥90% CO₂ purity while studying pressure swing adsorption, desorption kinetics, and process control in gas purification experiments.

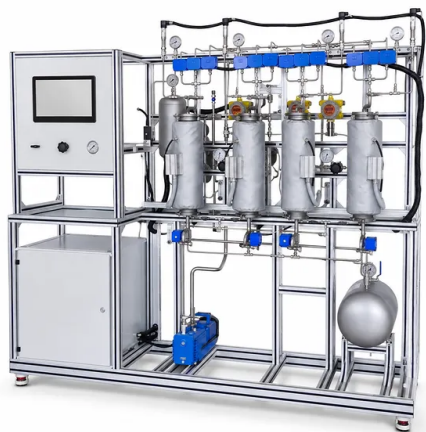
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Parameter	Description / Capability
Feed Gas Composition	Nitrogen and Carbon Dioxide mixture (typically 15:85 ratio or customizable)
CO ₂ Product Concentration	≥ 90% after separation
Regeneration Temperature Range	100°C to 300°C via electric heating jacket control
Regeneration Methods	Vacuum desorption and thermal inert gas purging
Control Interface	Modular PLC with 32-channel signal monitoring and open-source programming capacity
Sensors and Analytical Tools	Inline thermal mass flowmeters, electronic pressure transmitters, and dual-gas (N ₂ /CO ₂) analyzers
Structural Materials	Corrosion-resistant stainless steel (SUS304/316) piping and an aluminum alloy mounting frame

Experimental Module	Student Learning Outcomes	Relevant Textbook Terminology
Adsorption Kinetics & Breakthrough Analysis	Measuring concentration profiles over time; determining breakthrough capacity and mass transfer zones within packed beds.	Gas Adsorption, Breakthrough Curves, Mass Transfer Coefficient
Desorption & Adsorbent Regeneration	Comparing vacuum thermal regeneration with inert gas purge; calculating energy efficiency and desorption rates.	Sorbent Regeneration, Thermal Desorption, Vacuum Swing Adsorption
Cyclic Process Design & Control	Configuring valve-switching sequences to establish continuous separation cycles; adjusting cycle times to optimize recovery.	Cyclic Process Design, Pressure Swing Adsorption (PSA), Process Control
Mass Balance & Yield Evaluation	Performing overall material balances; determining gas separation recovery rates and purity factors.	Material Balances, Gas Separation Unit Operations, Separation Factors

Carbon Dioxide Adsorption And Capture Educational Unit Operations Pilot Plant

Item Number: LPK-TBJC



Introduction

Advanced laboratory pilot plant for teaching carbon dioxide adsorption and capture unit operations. Features four-tower adsorption system with 400°C heating jackets, high-precision CO₂ and O₂ sensors, and 15.6-inch touchscreen with wireless data logging. Ideal for chemical engineering education.

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Equipment Component / Module	Technical Specification	Associated Unit Operations & Academic Concepts
Four-Tower Adsorption System	SUS304 stainless steel towers; heating jackets rated up to 400°C; pressure range: -0.1 to 1 MPa.	Gas-solid adsorption kinetics, fixed-bed mass transfer zones, thermal swing regeneration, pressure swing adsorption.
Gas Mixing & Feed Section	Configured for Nitrogen/CO ₂ mixtures (standard 15:85 ratio); integrated gas mixing manifold.	Gas-phase diffusion, convective mass transfer, preparation of industrial flue gas simulants.
Analytical Instrumentation	Integrated high-precision CO ₂ sensor, O ₂ sensor, multi-range mass flow meters, multi-point temperature sensors.	Mass balance equations, dynamic breakthrough curve analysis, sensor calibration, and instrumentation.
Control & Data Acquisition	15.6-inch touchscreen PLC terminal; wireless data logging; real-time visualization of P&ID.	Process dynamics and control, automated safety interlocks, data acquisition system (DAS) operation.
Frame & Enclosure	Aluminum alloy structural profile; adjustable caster wheels; dimensions ≤2200×580×2000mm.	Pilot plant scale-up, system layout design, laboratory safety standards.

Bench Scale Dual Column Gas Separation And Capture Educational Pilot Plant

Item Number: LPK-CQBJ



Introduction

This dual-column educational pilot plant provides hands-on teaching of gas adsorption, separation, and capture processes. It features stainless steel columns, regeneration up to 400°C, and a 15.6-inch touchscreen PLC for TSA and PSA studies in chemical engineering curricula, process simulation.

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Technical Parameter	Specification / Range	Associated Educational Module	Corresponding Academic Concept
Separation Columns	Dual-column configuration, stainless steel, easy disassembly	Gas separation efficiency; breakthrough curve analysis	Mass transfer zones, adsorption equilibrium, and selectivity
Regeneration Temp.	Adjustable up to 400°C with integrated heating jackets	Thermal Swing Adsorption (TSA) studies	Desorption kinetics and thermal regeneration energetics
Pressure Control	Multi-range digital pressure sensors with safety valves	Pressure Swing Adsorption (PSA) simulation	Adsorption isotherms and system pressure dynamics
Flow Management	High-precision mass flow controllers	Flow rate influence on separation breakthrough	Superficial velocity, residence time, and mass transfer resistance
Control System	15.6-inch touchscreen PLC, wireless transmission	Automated process control and data acquisition	Process dynamics, loop control, and digital data logging

Fixed-Bed Chemical Reaction And Gas Dust Tar Removal Unit Operations Pilot Plant

Item Number: LPK-CDTR



Introduction

Integrated educational pilot plant for studying catalytic gas-solid reactions and downstream gas purification. Features dual fixed-bed reactor, three-stage heating, and touchscreen control for hands-on engineering training. Ideal for chemical and environmental engineering curricula.

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Component / Subsystem	Technical Specifications	Primary Educational Concept & Module
Reactor Assembly	Dual fixed-bed tubular reactors; constructed from high-grade stainless steel (310S/316L); internal thermocouple sleeves.	Heterogeneous Catalysis, Reaction Kinetics, and Reactor Design.
Thermal System	Three-stage independent electric heating furnace; high-precision temperature control loops; real-time digital display.	Heat Transfer in Packed Beds, Thermal Profiles, and Process Control.
Gas Conditioning	Stainless steel preheaters and water-cooled condensers; high-efficiency particulate and tar filtration units.	Gas-Liquid Separation, Condensation Unit Operations, and Gas Purification.
Instrumentation & Control	15.6-inch industrial-grade touchscreen; integrated 5G/Bluetooth connectivity; data logging and trend plotting.	Process Automation, Instrumentation, and Data Acquisition.
Piping & Frame	Heavy-duty aluminum profile mobile frame; corrosion-resistant quick-disconnect ferrule fittings.	Pilot Plant Design, Fluid Piping Layouts, and Structural Engineering.

Low Concentration Carbon Dioxide Capture Pressure Swing Adsorption Educational Pilot Plant

Item Number: LPK-CKEF



Introduction

Low-concentration CO2 capture pilot plant using Pressure Swing Adsorption for engineering education. Students gain practical experience in breakthrough curve measurement, adsorption dynamics, and variable analysis in a hands-on lab setting. Ideal for unit operations, mass transfer, and chemical engineering labs.

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Component / Technical Specification	Experimental Module / Practical Task	Textbook Concept & Unit Operation Link
Adsorption Columns: Dual-column configuration (Adsorbent Column A & B) with thermal insulation jackets.	PSA Cycle Demonstration: Operation of continuous, semi-continuous, or batch PSA gas separation processes.	<i>Adsorption Kinetics & Dynamics</i> (Gas-solid separation, mass transfer zones, and breakthrough behaviors)
Gas Feed System: Mass flow controllers for carbon dioxide and nitrogen blending to simulate flue gas.	Breakthrough Curve Determination: Measuring effluent concentration over time to determine adsorption bed capacity.	<i>Mass Transfer Operations</i> (Fixed-bed adsorption, concentration profiles, and mass transfer coefficients)
Regeneration Unit: Vacuum pump and integrated heating elements for thermal or vacuum desorption.	Adsorbent Regeneration: Comparative study of thermal regeneration (temperature swing) vs. vacuum regeneration.	<i>Desorption & Adsorbent Activation</i> (Thermal swing adsorption, pressure swing dynamics, and regeneration efficiency)
Control & Instrumentation: Touchscreen PLC control panel, digital flowmeters, and pressure transmitters.	Process Variable Analysis: Evaluating the effects of feed concentration, pressure, and flow rate on separation efficiency.	<i>Process Control & Design</i> (System variables, sensor calibration, and instrumentation in unit operations)



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