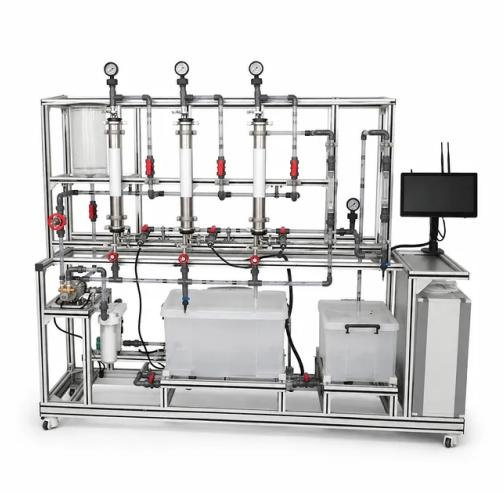
Multifunctional Membrane Separation Educational Pilot Plant With Ultrafiltration, Nanofiltration, Reverse Osmosis

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.