unitel technologies

Your Partner in the Pursuit of Process Innovations

POLYOLEFINS: PILOT PLANTS & DEMO UNITS .....

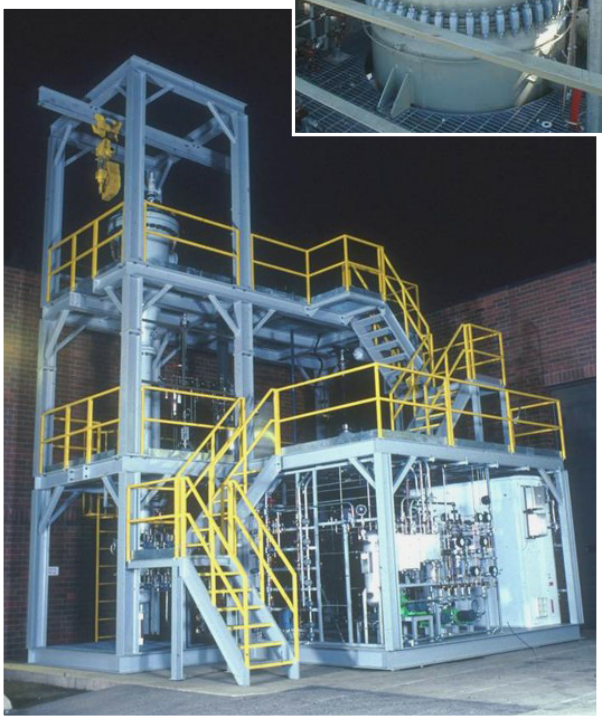
For developing new polymers (substances composed of macromolecules, commonly known as plastics), developing/testing catalysts, modifying physical and chemical properties and creating more cost-effective processes.

Polymerization is a process in which reactive monomer molecules are combined to form chains or three dimensional networks. Methods deployed to produce high-molecular-weight products enable the control of initiation, propagation and termination rates. Due to the fact that all polymerization reactions are exothermic, design efforts have to be focused on heat removal.

Oftentimes more than 100 monomer molecules have to be combined to make a polymer with unique physical properties such as elasticity, high tensile strength and the ability to form fibers.

Multipurpose Polypropylene Demonstration Plant: 50 kg/day

APPLICATIONS



Gas Phase Polymerization Catalyst Screening Unit

Catalyst Screening

To compare kinetics, product properties and activity of individual catalysts from a large pool of candidates. These small plants must enable rapid start up, data collection and shutdown.

Catalyst-Product Evaluation

To simulate commercial operations with a focus on key performance indicators.

Process Development

To generate data such as heat and mass balance information for commercial plant design and operation.

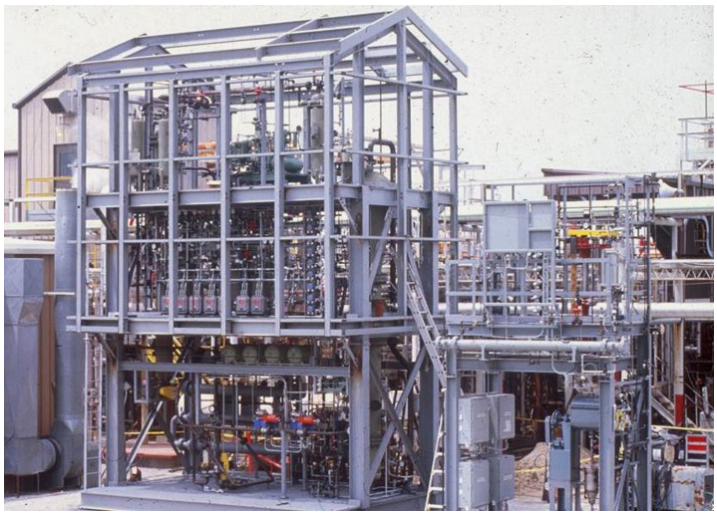
Product Development

To produce sample quantities of product for in-house testing and client evaluation and for verifying new catalysts prior to commercial application.

Technical Service

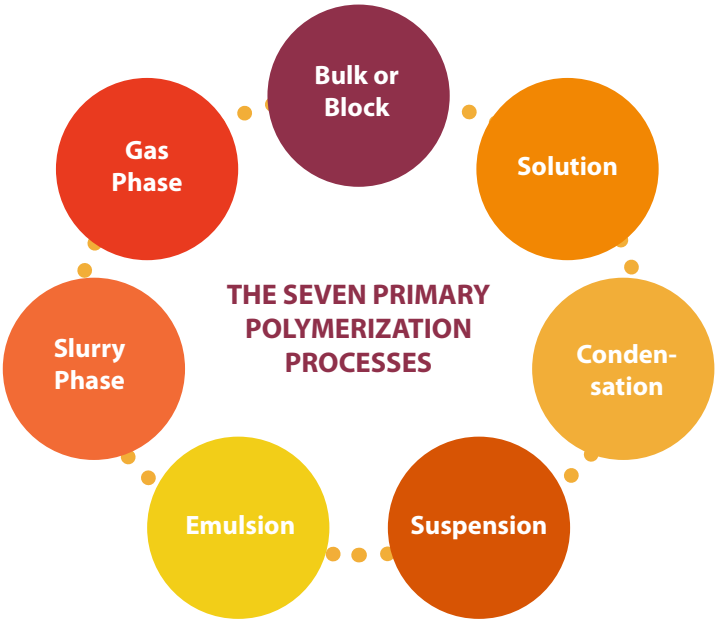
To troubleshoot operating problems in a commercial facility. Debottlenecking strategies can also be evaluated prior to full-scale implementation.

Olefin Feeds Purification System



Gas Phase Polymerization System

SEVEN PRIMARY POLYMERIZATION PROCESSES



Bulk or Block Polymerization

This simplest of all the processes is carried out in the absence of any solvent or dispersant. A monomer, polymer & initiator are the only components. Applications include most step-growth and many chain-growth polymers. *Polystyrene, poly methyl methylacrylate, nylons, polyethylene, polypropylene*

Solution Polymerization

Liquid monomer in the presence of a solvent and catalyst. The solvent absorbs the heat of polymerization by a rise in temperature or vaporization. The monomer, solvent, initiator and polymer can exist in a soluble or insoluble phase. *LLDPE, polyacryonitrile*

Condensation Polymerization

A process in which water or some other substance separates from two or more of the polymer molecules as a result of their combination. *Polyphenyleneoxide, polyphenylenesulfide, polysufone*

Suspension Polymerization

If the monomer is insoluble in water, bulk polymerization can be carried out in suspended droplets. The water phase serves as the heat transfer medium. In the continuous phase, conversion does not affect viscosity thus enabling efficient heat transfer to the reactor walls. The polymer precipitates in the droplets (10 to 1000 µm dia.) and rapid reaction rates can be tolerated without boiling the monomer. *Polyvinyl alcohol, polyvinyl acetate, PVC*

Emulsion Polymerization

Droplets of monomer are emulsified in a continuous phase with water using a surface active agent (surfactant). Free-radical initiators migrate into the stabilized monomer droplets (known as micelles) to initiate polymerization. Emulsions are usually comprised of small particles (0.05 to 5 µm dia.) and the end product is typically a stable latex – an emulsion of polymer in water. *Paints, latexes, styrene-butadiene rubber*

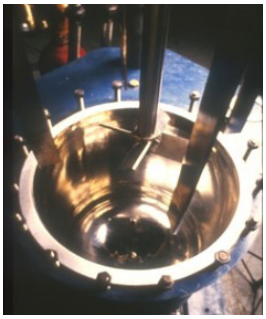
Slurry Phase Polymerization

A process in which an olefin monomer and optional co-monomer are polymerized in the presence of a catalyst. The solid polymer product is suspended and transported in this slurry. *Polyacetyl resins, polyoxymethylene (Deldrin), PE and PP, miscellaneous Z-N based polymers*

Gas Phase Polymerization

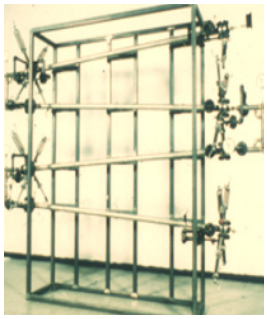
This method is used with gaseous monomers such as ethylene, propylene, and butylenes. The monomer is introduced under pressure into a reaction vessel containing a polymerization initiator. Once polymerization begins, monomer molecules diffuse into the growing polymer chains. The resulting polymer is obtained as a granular solid. Heat of polymerization is removed as the gas is circulated through external coolers. Molecular weight can be decreased by using hydrogen as a chain transfer agent. *Propylene polyethylenes, polypropylenes, impact copolymers*

Various types of polyethylenes, polypropylenes and ethylene-propylene rubbers

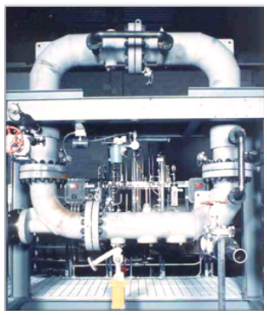


Batch Reactor

Continuous Stirred Tank Reactor



Plug Flow Tubular Reactor



Loop Reactor

Gas Phase Fluidized Bed Reactor

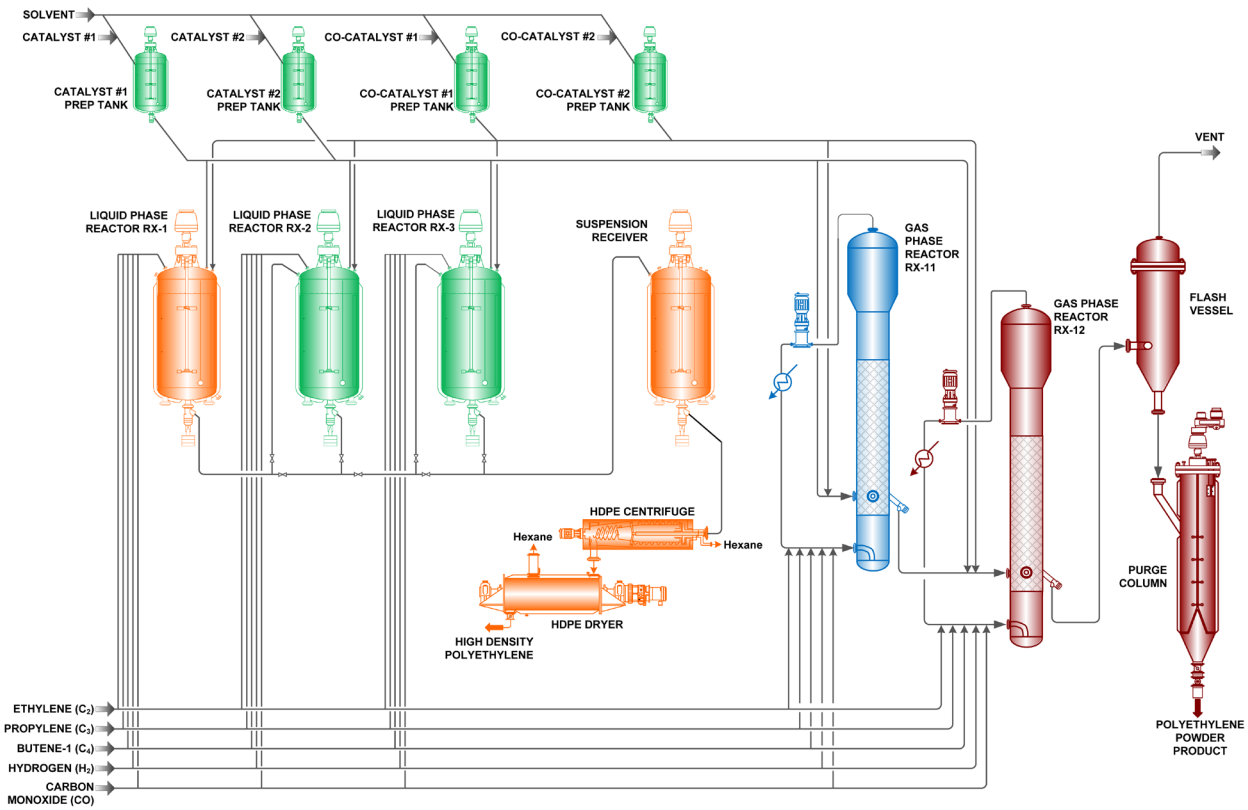
Typical Multipurpose Polyolefin Production Process

The orange colored units relate to a configuration for the production of High Density Polyethylene (HDPE)

The red colored units relate to a configuration for the production of Polypropylene and also Linear Low Density Polyethylene (LLDPE)

The blue colored units relate to a configuration for the production of Polypropylene (PP)

The green colored units are common to all configurations



If you are interested in learning more about **Multipurpose Polyolefin Pilot Plants & Demo Plants**, please contact Unitel Technologies:

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