

CONTINUOUS POLYMERIZATION MICROPLANT

Automated and computerized laboratory-pilot plant for the study of polymers production

The Polymerization Micro-Pilot Plant, developed by PID Eng&Tech, is designed for continuous polyolefins production at microscale.

PID Eng&Tech in co-operation with important Research and Technology Centres (ICP-CSIC and URJC) by means of different Collaboration Projects has developed this pilot plant that comprises two liters continuous stirred-tank reactors that operate in series.

This Micro-Pilot Plant is fully automatized and all of the process parameters, as the solvent, comonomer, operating pressure and temperature, residence time per reactor, etc., can be selected by user, or modified in a wide range.

PID Eng&Tech's computerized process control systems allow a direct control of temperature, level, pressure and gas composition in the reactors.

The devices for polymer slurry driving between the different reaction steps and for solid addition have been studied in depth. These developed mechanisms have been designed for performing the process in microscale and is patent pending.

The catalyst is continuously added into the first reactor. PID Eng&Tech has developed in collaboration with ICP (Catalyst and Petrochemical Institute of CSIC, Spain), a system, based in loops and actuated valves, patent pending that allows to load it continuously.

FEATURES:

Feed and conditioning of gas and liquid feed stocks

- Five gas lines: two independent ethylene feed streams (0-4 l/min), one for each reactor; one hydrogen stream (0-500 ml/min); one 1-butene stream (0-50 ml/min); and one nitrogen line for inertization purposes.
- Two solvent (heptane) lines; a common stream is divided in two, feeding at real time with a H.P. Dosapro Milon-Roy pump (5-10 ml/min), one for each reactor.
- A catalyst line; catalyst is added like a slurry in heptane into first reactor;
- A cocatalyst line; cocatalyst (e.g. TIBA) homogeneous solution in heptane is added to first reactor using a HPLC pump.

Reactors and flashes

- The plant comprises three SS316 stirred tanks (1 or 2 l) with high pressure closure system. The 1st reactor works at 8 bar @ 80°C, 1st flash, at P atm @ 40 °C and 2nd reactor, at 2.5 bar @ 80°C.
- Each one is provided with a magnetically coupled stirred head, a heating jacket, cooling coil, valves and accessories. Stirrer speed is controlled by Inverter.
- In addition to temperature and pressure control, the ethylene/hydrogen, or the ethylene/butane, composition relations are measure continuously, near-real time.
- In this way, the integrated control pressure/relation loop allows the user to work holding simultaneously a stable desired pressure and a stable desired hydrogen/ethylene (at the first reactor) and butene/ethylene (at the second reactor) relations during the reaction time.



Distributed control system

All the process variables are controlled by distributed PID controllers. The control system modules are linked with PC by means of a Process@ software for remote control by digital communications. The system can be controlled manually or automatically, locally or remotely.

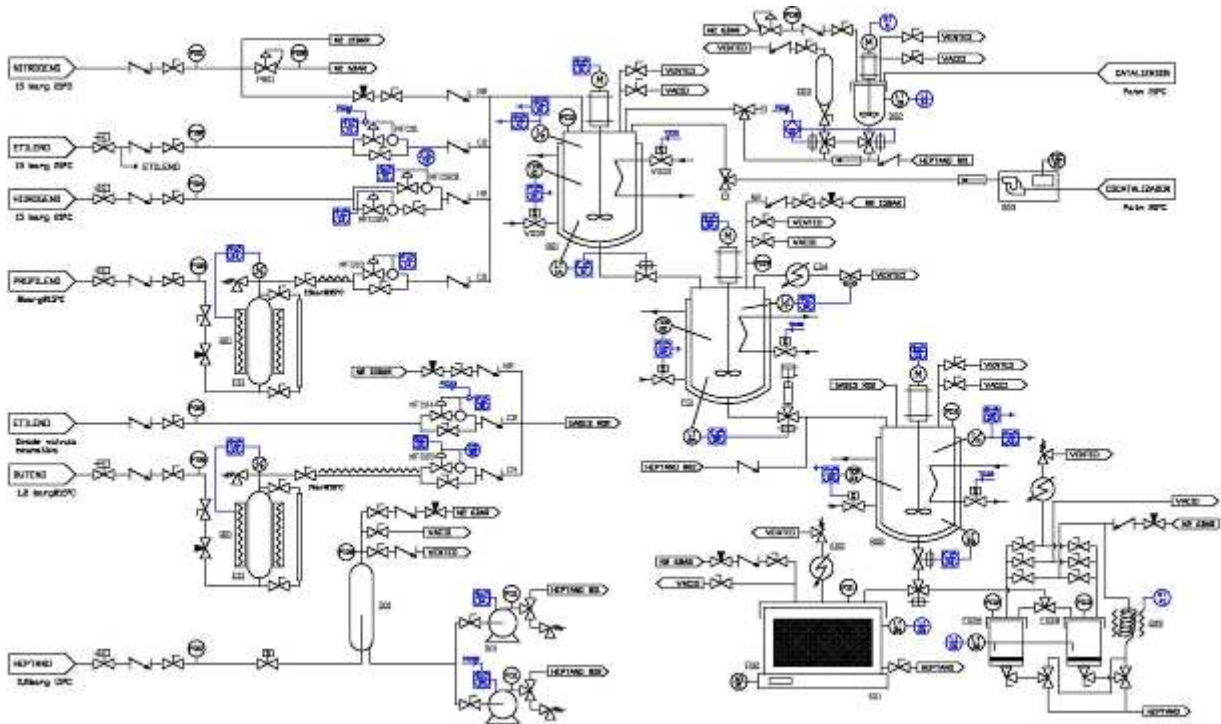
All the process and control variables and parameters are registered in only one software application. In addition, software allows the operator to design automatic procedures for design and automate the run.

Security system

Plant has several independent safety levels: automatic switch off in case of any problem, pressure, level and temperature security systems; all of that based on a Programmable logic controller (PLC) device independent of PC. PLC manages the alarm signals from controllers. In addition, actuated valves are configured according to good safety practices.

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POLYMERIZATION MICROPLANT PI DIAGRAM



PROCESS@ SOFTWARE

