

# TECHNOLOGY DEVELOPMENT

PILOT PLANTS FOR DEVELOPMENT AND SCALE UP OF SYNTHETIC ACTIVE PHARMACEUTICAL INGREDIENTS AND HERBAL PRODUCTS

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## Executive summary

NIPER, a national institution of excellence, caters to the diverse human resource, research and consultancy needs of the pharmaceutical industry be it small, medium or large. As a part of its mandate, it has set-up a state of the art Technology Development Center (TDC) where in experimental, pilot plant scale-up and validation, and infrastructural facilities have been made available to companies.



**NATIONAL INSTITUTE OF  
PHARMACEUTICAL EDUCATION AND  
RESEARCH (NIPER)**

(Ministry of Chemicals and Fertilizers)

# FACILITIES AVAILABLE

## Synthetic Section

Pilot plant for the production of synthetic APIs is well equipped with latest equipments and automatic control system for critical parameters. Synthetic section of pilot plant is designed so as to run according to international standards of cGMP. This section of pilot plant is provided with the following equipments:

Specifications of Equipments	Capacity	Accessories
MS Glass lined reactor	100 L	Glass column, Glass condenser, Subcooler & Glass Receiver (20 ltr.)
SS 316 reactor with mechanical seal	60 L & 100 L	SS column, Heat exchanger, Vent H.E & Reflux tank (30 ltr & 50 ltr.)
MS Glass lined reactor	250 L	Glass column, Glass condenser, Subcooler & Glass Receiver (20 ltr.)
SS 316 reactors with layer separation device at bottom	250 L & 200 L	SS column, Heat exchanger, Vent H.E & SS 316 Receiver (100 ltr.)
SS 316 high pressure reactor designed for a pressure of 20 kg/ cm <sup>2</sup> with double mechanical seal	100 L	Vent pipe with rupture disc, Safety valve and Flame arrestor.
SS 316 high temp. Reaction vessel with electrical oil heating system.	60 L	Thermo-syphon convective heating, SS column, SS H.E, Vent H.E & SS Receiver (50 ltr.)
SS 316 high vacuum distillation vessel	100 L	SS column, Heat exchanger, Vent H.E & Receiver tanks (30 ltr. & 60 ltr.)
SS 316 high temp. Hydrogenator reaction vessel designed for a pressure of 20 Kg/cm <sup>2</sup> with double mechanical seal	250 L	Vent Pipe with rapture disc, safety valve & flame arrestor
SS 316 long column still	250 L	SS column, Heat exchanger, Vent H.E & Receiver tanks (200 ltr. & 50 ltr.)
SS 316 Centrifuge 24" top discharge	24"	
SS 316 Nutsch filter		
MS rubber lined Scrubber (Portable)	100 L	PP Centrifugal pump with flame proof motor, PP valves & piping.
Water Ejector with venturi arrangement	700 kg/cm <sup>2</sup>	
SS 316 Sparkler Filter	14" Dia	All contacts parts of SS 316
Hoist	1 Ton	Limit switch
Agitated Nutch Filter	50 L	With Vacuum & Condenser system
High Vac. 0.01torr.	1000 m <sup>3</sup>	With vaccum& condenser system

# Herbal Section

Herbal section of pilot plant consists of advanced extraction units and downstream processing of the herbal extracts. Equipments present in the herbal section are enlisted below:

Specifications of Equipments	Capacity	Accessories
SS 316 Steam distillation unit	500 L	SS 316 vapor line, Heat exchanger & Phase separator tank (100 ltr)
SS 316 Solvent Extraction unit	500 L	SS 316 column, Heat exchanger, Percolation column & Solvent circulation pump.
MS glass lined reactor	250 L	Glass column, Condenser, Subcooler and Glass flask (20 ltr.)
SS 316 high vacuum still	100 L	SS 316 column, H.E, Vent H.E, Receiver tanks (50 ltr. & 30 ltr.)
SS 316 long column still	500 L	SS 316 column, H.E, Vent H.E & Receiver tanks (300 ltr. & 100ltr.) with two rotameters.
SS 316 Reactor	1000 L	SS 316 column, H.E, Vent H.E & Receiver tanks (300 ltr. & 100ltr)
MSGSL Reactor	500 L	Glass column,condenser, subcooler and Receiver with high vacuum system.
SS 316 long column still	60 L	SS 316 column, H.E, Vent H.E & Receiver tanks (100 ltr.)
SS 316 long column still	100 L	SS 316 column, H.E, Vent H.E & Receiver tanks (30 ltr.)
SS 316 Centrifuge 36" Four point suspension top discharge	36"	Separate enclosure as per GMP requirement.
Chromatographic column	Dia 12"	Safety precautions



## Powder Handling Section

This section of pilot plant is laid out according to the GMP requirements. The equipments available are listed below

Specifications of Equipments	Capacity	Accessories
Tray dryer	12 trays	SS 316 trays (12 No.) PP trays (12 No.)
Vacuum tray dryer	12 trays	SS 316 trays (12 No.) with water ring vacuum pump.
Vacuum tray dryer	12 trays	SS 316 trays (12 No.) with high vacuum arrangement.
Fluidized bed dryer	10 Kg.	Equipped with Explosion door.
Multi- mill GMP model		SS 316 contact parts with 0.5 mm sieve
Sifter	20" dia	Screens of # 20,40,60,100
Drum blenders GMP model	200 L	GMP Model
Tray Dryer	24 Trays	Vent & Steam Heating
Nauta Dryer	100 L	With Vacuum & Condenser system
Super Decanter		GMP Model



## Glass Assemblies

Provision is made for the scale-up operations of all laboratory processes in synthetic drugs and Herbals in glass assemblies. Following equipments are provided in this section.

Specifications of Equipments	Capacity	Accessories
Round bottom flask	20 L	Gals column,. Glass condenser, Subcooler & Glass receivers (10 L. & 5 L)
Round bottom flask	10 L	Gals column,. Glass condenser, Subcooler & Glass receivers (5 L & 3 L)
Round bottom flask	2 L	Glass column,. Glass condenser,
Round bottom flask	50 L.	Glass column,. Glass condenser,
Heidolph 20lit Rotavapour	20 L	Automatic operation

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## Utility Services

- Boiler capacity 500 Kg/hr. at a pressure of 10 kg/ cm<sup>2</sup> with pressure reducing station; Non IBR.
- Refrigeration, Chilled water plant of 20 ton capacity at +5 °C, Chilled brine plant of 6 ton capacity at - 20°C with storage tanks of 2 m<sup>3</sup> capacity each for brine & chilled water.
- Cooling tower of 100 TR capacity operating at 35°C max.
- Vacuum service at 2- 100 torr.
- Cryogenic temperature with liquid nitrogen or dry ice.
- High temperature system at 250 °C max.
- Compressed air provision for automatic controls.
- PSA unit for on line nitrogen
- Cooled filtered air
- AHU in powder handling area
- Dedicated fire hydrant system with appropriate Fire Extinguishers for safety.

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## Instrumentation

Pilot plant of NIPER is equipped with automatic data logging system and control system for monitoring and control of critical parameters such as temperature, pressure, pH etc. Agitator RPM control is done by Variable frequency drives provided at each reactor.

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## Auto logging of Data

- Relevant parameters such as temperature, pressure, pH, humidity, fluid flows (steam, CHW, CHB) during the reaction get logged during reaction at predefined intervals in a PC.
- All the reactors, columns, heat exchangers, subcoolers and the process lines are provided with RTD's and further connected to centrally placed PCs.
- All measured variables could be logged at predetermined time intervals in a centrally placed PC for plotting and analysis.
- Further processing leads to insights into reaction and generation of thermodynamic data.

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## Effluent Treatment plant

- Equalization tank, neutralizing tank and a solar pond for aqueous effluent.
- Isolated process water system.
- Incinerator for waste solvents and combustible solids.

## Control Plan

- Provide all reaction vessels with appropriate sensors.
- Connectivity of equipments to scanner & PC, which are centralized, located.
- Temperature and pressure control at appropriate equipments.
- PLC based, multipurpose console for hooking up with a specific instrument configuration with provision for:
  - Temperature control
  - Pressure control
  - pH control

## Process Control Laboratory

The following equipments are available for the process control parameters analysis:

- HPLC system, 2 Systems
- GLC system, 2 systems
- UV
- Auto titrator
- TLC
- Melting point apparatus
- Rotatory Evaporator
- Analytical Balance
- Ultrasonic bath
- High vacuum pump
- BOD/ COD testing instruments
- R & D laboratory

## Trained Manpower

The institute has recruited Engineer, Science graduates and post graduates to carry out pilot plant trials. The entire operating staff works under the supervision of the faculty member incharge of Technology development centre. Other experienced faculty members can also be consulted as and when desired. The details of educational and research background of faculty members is available on NIPER website.

## CONTACT

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