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PDEU PANDIT DEENDAYAL ENERGY UNIVERSITY

Formerly Pandit Deendayal Petroleum University (PDPU)

CENTRE OF EXCELLENCE STATUS BY GOVT. OF GUJARAT

SCHOOL OF ENERGY TECHNOLOGY

Department of Chemical Engineering

Name of Laboratory : Center for Sustainable Technologies

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NAME OF EQUIPMENT :
Gas Permeation Setup

TECHNICAL SPECIFICATIONS :

- Pure and Mixed Gas Permeation Measurements
- **Mass Flow Controller Range**: 5-500ml/min (CO_2, CH_4) , 5-50 (Helium) (accuracy ±1% of full scale)
- **Membrane Module**: Flat Sheet .
- **Gas Chromatograph** – Nucon- 2700 series, Equipped with Thermal Conductivity Detector (TCD)Suitable for permanent gases (CO_2, CH_4, He)
- **Feed Configuration**: Single gas and binary gas mixture capability (CO_2/CH_4)
- **Maximum Operating Pressure:** Up to 10 bar
- **Gases Used**: Carbon dioxide (CO_2)Methane (CH_4)Helium (He) (used as sweep gas / carrier / calibration gas)
- **Accuracy:** ±1% of full scale
- Gas Chromatograph (GC):Equipped with Thermal Conductivity Detector (TCD)Suitable for permanent gases (CO_2, CH_4, He)
- Carrier Gas: Helium

NAME OF EQUIPMENT :
Parallel Synthesizer Autoclave

TECHNICAL SPECIFICATIONS :

- High Pressure High Temperature Measurements/ Reaction Conditions
- **Reactor capacity**- 100ml
- **Temperature** - up to 300°C
- **Pressure** -70 bar
- Multiple reactors operated simultaneously
- Independent control of temperature, pressure & agitation
- High-grade stainless-steel construction for durability and corrosion resistance
- Catalyst testing and optimization
- CO_2 conversion and hydrogenation reactions
- Hydrothermal and batch reactions
- High-pressure chemical process development

NAME OF EQUIPMENT :
Homogenizer

TECHNICAL SPECIFICATIONS :

- High RPM Mixings
- **Speed** : 8,000 to 25,000 rpm
- **Motor Power**: High-torque motor for demanding applications
- **Volume Range**: Approx. 1–2,000 mL
- **Digital Control**: Accurate speed adjustment and digital display
- **Dispersing Tools**: Interchangeable stainless-steel shafts (S25 range)
- **Mixing Mechanism:** Rotor–stator high-shear system
- Safety Features**:** Overload protection, secure shaft coupling

NAME OF EQUIPMENT :
Packed Bed Reactor

TECHNICAL SPECIFICATIONS :

- Continuous Flow Reactor
- **Operating temperature**: up to 300°C
- **Operating pressure**: up to 70 bar
- Stainless-steel tubular reactor packed with catalyst
- Continuous gas feed system (CO_2 + H_2)
- Digital control panel for automatic temperature, pressure, and flow regulation
- High-precision mass flow controllers (MFCs) / pressure regulators (if included)
- Integrated heating jacket/furnace for uniform temperature distribution
- Safety interlocks and emergency cut-off options
- Suitable for long-duration and steady-state kinetic studies

NAME OF EQUIPMENT :
Nucon Gas Chromatograph

TECHNICAL SPECIFICATIONS :

- Liquid Injection Port
- Designed for precise gas analysis and hydrocarbon detection
- Compatible with and FID (Flame Ionization Detector)
- Stable oven temp. control for accurate retention times
- Multiple packed column options for hydrocarbon analysis
- Reliable sample injection system for gas-phase testing
- Digital control panel with adjustable temperature zones (column, detector, injector)

NAME OF EQUIPMENT :
Autoclave

TECHNICAL SPECIFICATIONS :

- High Temperature and High Pressure
- **Type**: Batch high-pressure autoclave reactor
- **Application**: Catalytic and non-catalytic conversion reactions
- **Total volume**: 250 mL
- **Reactor body**: Stainless Steel
- Maximum temperature: 200°C
- **Temperature control:** PID controller with heating mantle/jacket
- Temperature accuracy: ±1°
- **Maximum operating pressure**: 70 bar
- **Speed range**: 0–1000 rpm (variable)

NAME OF EQUIPMENT :
Orbital Shaker

TECHNICAL SPECIFICATIONS :

- High-Capacity Orbital Shaker
- Adjustable speed control
- Platform for flasks, beakers, culture tubes
- Continuous or timed shaking
- Culturing microorganisms
- Extraction and sample homogenization
- Provides uniform mixing of liquid samples through circular orbital motion

NAME OF EQUIPMENT :
Microwave Pyrolizer

TECHNICAL SPECIFICATIONS :

- Microwave-assisted pyrolysis system for thermal decomposition of biomass, polymers, and waste materials under inert atmosphere
- **Capacity** -1000W quartz reactor
- **Reactor type**: batch
- **Reactor capacity**: 100–1000 mL
- **Microwave frequency**: 2.45 GHz
- **Microwave power**: 0–1000 W,
- **Mode of operation**: continuous or pulsed microwave heating
- **Temperature**: 600–1000°C
- Product collection: water-cooled condenser for liquid products (bio-oil), gas outlet for non-condensable gases, solid residue (biochar) retained in reactor

NAME OF EQUIPMENT :
Programmable – Tube furnace

TECHNICAL SPECIFICATIONS :

- Orbital Shaker
- Orbital shaker used for uniform mixing, agitation, and incubation of liquid samples in flasks, bottles, or tubes
- **Platform type**: orbital motion with circular shaking
- **Speed range**: 50–300 rpm
- **Speed control**: digital
- **Orbit diameter**: 10–25 mm
- **Load capacity**: 2–10 kg

NAME OF EQUIPMENT :
Centrifuge

TECHNICAL SPECIFICATIONS :

- High RPM Rotation
- Maximum speed**:** 6000 rpm
- Stable, vibration-free REMI motor
- Digital control for speed and timer settings
- Compatible with multiple rotor types (swing-out / fixed angle)
- Safety lid-lock mechanism and imbalance detection
- Durable body suitable for routine &continuous laboratory use
- Separation of solids from liquid mixtures
- Sample clarification and sedimentation

NAME OF EQUIPMENT :
Hot Air Oven

TECHNICAL SPECIFICATIONS :

- Insulated hot air oven
- Drying, sterilizing, and heating samples using uniform hot air circulation.
- Temperature range typically 50–300°C
- Forced-air convection for even heating
- Digital temperature controller
- Drying polymer membranes
- Glassware sterilization
- Moisture removal from samples
- Thermal treatment of catalysts or chemicals

NAME OF EQUIPMENT :
Electrical Conductivity Meter

TECHNICAL SPECIFICATIONS :

- High Accuracy conductivity Meter
- Conductivity measurement range:
  - 20–2 µS/cm (micro Siemens)
  - 2–200 mS/cm (milli Siemens)
- Temperature control options:
  - Constant 25°C mode
  - Atmospheric/room temperature mode
- Automatic temperature compensation (ATC)
- Digital display for conductivity, temperature, and calibration status
- Multi-point calibration with standard KCl solutions

NAME OF EQUIPMENT :
P^H Meter

TECHNICAL SPECIFICATIONS :

- High Accuracy P^H Meter
- Wide pH measurement range: **0–14 pH**
- High accuracy with ±**0.01 pH resolution**

  (model dependent)
- Digital display for pH, millivolts (mV), and temperature
- Compatible with standard glass combination

  pH electrodes
- Automatic or manual temperature compensation
- Multi-point calibration using standard buffer solutions

  (pH 4, 7, 9.2/10)

NAME OF EQUIPMENT :
Peristaltic Pump

TECHNICAL SPECIFICATIONS :

- High Pressure Peristaltic Pump
- Accurate, adjustable flow rate
- Handles corrosive or viscous liquids
- No contact between liquid and pump components
- Filtration and membrane testing
- Feeding reactants to reactors
- Continuous sampling or dosing in experiments

NAME OF EQUIPMENT :
Thermogravimetric Analysis

TECHNICAL SPECIFICATIONS :

- **Temperature Range:** room temperature to 1000 °C or higher.
- **Heating Rate:** Adjustable heating rate, normally 1–50 °C per minute.
- **Sample Size:** Small sample required, 5–20 mg.
- **Atmosphere Control:** Can operate
- **Weight Measurement:** High-precision microbalance to detect very small weight changes.
- **Output Data:** Produces a TGA curve (weight vs temperature)

NAME OF EQUIPMENT :
Particle Size Analyser

TECHNICAL SPECIFICATIONS :

- **Particle size:** Suspensions, emulsions, dry powders
- **Technology:** Laser light scattering
- **Analysis method:** Mie and Fraunhofer scattering
- **Data acquisition rate:**10 kHz
- **Typical measurement time:**<10 sec
- **Dimensions (W, D, H):**690mm x 300mm x 450mm
- **Weight:**30 kg
- **Red light source:** Max. 4mW He-Ne, 632.8nm
- **Angular range**:0.032 - 60 degrees
- **Particle size:-** 1000 µm
- **Number of size classes:**100 (user adjustable)
- **Power:**100/240 v, 50/60 Hz 50W (no dispersion units connected) 200W maximum (2 dispersion units connected)
- **Operating temperature (°C):**+5°C to +40°C
- **Product storage temperature:**-20°C to +50°C

NAME OF EQUIPMENT :
Gas Chromatography-Mass Spectrometry (GC-MS)

TECHNICAL SPECIFICATIONS :

- Ion gauge controller
- **Ionization mode** - Electron Ionization (EI) / Chemical Ionization (CI)
- **Detector** - Flame ionization Detector (FID) and Thermal conductivity detector (TCD), mass detectors (MD)
- **Columns**-suitable for Packed and Capillary columns
- NIST Ms library and RTL database El library of common solvents
- **Includes :**
- Gas filter with Gas purifiers,
- gas cylinders
- UPS-1Hr back up

NAME OF EQUIPMENT :
Surface tension

TECHNICAL SPECIFICATIONS :

- **Measuring Range: Surface/interfacial tension:**1-1000 mN/m
- **Resolution:** 0.01 mN/m
- **Accuracy:** 0.2 mN/m
- **Calibration Method:** By external calibration weights
- **Sample Stage Operation:**
- **Speed:** 0.004-5.0 mm/s (software-controlled)
- **Stroke:** 48 mm
- **External Dimensions (WxDxH):** 255 x 309 x 369 mm
- **Weight:** Approximately 12.5 kg
- **Electrical Power:**
- **Voltage**: AC 100-240 V
- **Frequency:** 50/60 Hz
- **Power Consumption:** 35 W / 75 VA
- **Operating Environment:**
- **Temperature:** +10°C to +35°C
- **Humidity:** 30-80% RH (non-condensing)