Formation - Applied chemical engineering for the refining and petrochemical industries

ACE-EN-P | Présentiel | 52 jours

This course provides a comprehensive understanding of the refining and petrochemistry chain involved and the equipment used in the refining and petrochemical industry

Niveau

Fondamentaux

Public

Engineers interested in applied chemical engineering relating to Oil & Gas products, refining processes and polymers

Objectifs

Attendees will be able to implement the following skills:

- master the main thermodynamics concepts encountered in industrial processes dealing with fluids and know in which case and how they can be simulated
- provide a better understanding of the supervision and optimized operation of industrial distillation units
- understand the practical meaning of fluids physico-chemical behavior as well as chemical reactions
- master the fundamentals on refining processes (general process scheme, technologies involved, range of operations, constraints, optimization criteria, economics)
- understand the technology and operating conditions of thermal equipment
- understand the operating conditions of rotating machinery
- improve the understanding of control instruments and problems related to their use
- be aware of the main potential technical dangers associated with various industrial processes and with the use of products
- get acquainted with the various safety, environment and quality global management systems, and of the various systematic techniques used to implement and monitor their application

Pédagogie & ressources techniques

- E-learning modules
- Many applications and case studies based on industrial experience
- Applications using process dynamic simulators (RSI IndissPlus simulator)
- Applications using static simulation software (PRO II)
- A refinery visit is organized to visualize some units during the Oleum trip
- A visit of a supermarket is organized to show the relation between the intrinsic properties of the polymer and the final application in packaging

Évaluation des acquis

In the case certification is selected by the participant, 4 written and 1 oral tests have to be taken all along the program

Prérequis

A degree corresponding to 4 or 5 years of higher education, such as a French 'Diplôme d'ingénieur' (in 5 years),

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an American BSc (in 4 years), or another equivalent degree

Informations complémentaires

This course is administered alongside IFP School “Processes & Polymers Master” candidates. The course content corresponds to the first trimester of the Masters program

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Programme

SEPARATION PROCESSES — 18 days

Applied thermodynamics:

- Material and energy balances applied to continuous processes.
- Fluid properties, law of corresponding states, equations of state.
- Liquid-vapor equilibria, computation principles, thermodynamic models applicable to hydrocarbon mixtures and their application fields.
- Non-ideal mixtures, water-hydrocarbon mixtures.

Distillation:

- Overview on separation processes as an introduction on what will be seen in the refining, base chemicals and polymers processes.
- Parameters of industrial column operation: material balance, pressure, operation of liquid- vapor contact equipment, heat balance, reboiler and condenser operation, liquid-vapor flow rates, temperature and composition profiles.
- Distillation column process control: basic control, sensitive tray, variable and advanced control.
- Operation of multi-draw off columns, azeotropic and extractive distillation.

Distillation project:

- Introduction to the ProII/Provision simulation software with the help of an e learning module.
- Conception, design and cost estimation of a given industrial distillation column.

Instrumentation/Process control:

- Function and constitution of control loops and on/off control systems.
- Control loops: simple, cascade, split-range, calculated variables, feed forward.
- Main types of instruments, tags and symbols.
- Control valves: technology, safety position, intrinsic and real characteristics.
- Controllers: tuning, practice on dynamic simulator.
- Reaction run-away. Process control as an element of safety and quality.

FOUNDATIONS OF THE POLYMER INDUSTRY — 17.5 days

Industrial catalysts:

- Catalysis mechanism.
- Industrial catalysts properties.

Hydrocarbons physico-chemistry:

- Principal components of petroleum products.
- General hydrocarbon classification and main impurities.

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- Physical properties of hydrocarbon mixtures, correlations.

Crude Oils & Petroleum Products:

- Crude oils: analysis, average properties, yields in petroleum cuts, principal problems related to quality, classification.
- Petroleum products: classification, market, specifications, required quality for end use, new trends (biofuels, reformulated gasoline, ...).

Crude oil fractionation units:

- Crude oil desalting, atmospheric distillation, gas and gasoline separation. Vacuum distillation.

Refining Processes:

- Catalytic reforming and isomerization, hydrorefining processes, scrubbing treatments, catalytic cracking and alkylation, hydrocracking, thermal conversion processes, mineral lube base manufacturing processes.
- Economics of supply and refining operations.

Olefins and aromatics in petrochemicals:

- Overview of base chemicals and monomers manufacturing from chemistry to polymers.
- Sources, outlets and main industrial uses of olefinic and aromatic intermediates.
- Steam cracking and treatment of the cuts produced.
- View of the different schemes available, how to choose the correct one for design.

Synergy: an opportunity for the refining and petrochemical industries:

- Understand the synergy between Refining and Petrochemicals.
- Identify opportunities – existing units vs new designs.

For each process of monomers manufacturing:

- Basic chemistry.
- The main steps of the industrial process(es), description of the industrial plant(s).
- Technical evolution of the process(es).
- Product specifications.
- Main producers, trends of the market, economics.

On-Purpose Olefins:

- Overview of the main “on-purpose” technologies and related processes: FCC propylene, ethanol dehydration, propane dehydrogenation, ethylene + butene-2 metathesis, MTO-OCP, MTP.

Introduction to Polymer Chemistry and Characterization:

- Polymer structure - Conformation / Properties relationships.
- Characterization methods relevant to industrial polymerization: molecular weight distribution, melt index, intrinsic viscosity, Nuclear Magnetic Resonance, Gel Permeation Chromatography, light scattering.

FLUID TRANSPORT AND HEAT TRANSFER EQUIPMENT 10.5 days

Heat Transfer:

- Conduction and convection: parameters affecting heat exchange, resistance caused by the walls and by fouling, calculation methods.
- Radiation: emission, absorption, application to furnaces and boilers, tube skin temperature, influence of fuel burned, fouling effects.

Heat Exchangers:

- Functions, classification, TEMA standard nomenclature.
- Selection criteria for different types of shells and front and rear ends, principles of heat exchanger sizing.
- Variation in performance as a function of changes in operating conditions.

Furnaces boilers:

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- Different types of furnaces and functions, operating conditions, furnace efficiency and energy recovery.
- Combustion phenomena, distribution of supplied heat.
- Burners: fuel, air supply and mixture.
- Air and flue gas circulation: natural draft, forced draft.
- Simulations on furnaces operations.

Fluids dynamic:

- Liquid flow in a line, volume and mass flow, circuit characteristics.
- Pressure, pressure drops calculation in the lines and accessories.

Rotating machinery:

- Centrifugal and volumetric pumps: main types, technology, maintenance, specifications.
- Reciprocating and centrifugal compressors: main types, operating conditions, technology.

OPERATIONS, ENVIRONMENT, RISK MANAGEMENT & PROCESS SAFETY — 6 days

Safety intro & integrated management systems:

- Structure of an integrated management system.
- Commitment and responsibilities of plant management staff.
- Sharing the integrated management system responsibilities.
- Communication requirements.

Risk Management & Process Safety:

- Definition of risk.
- Introduction to process safety (hazard potential, scenarios).
- Historical major accidents.
- Inherent safe design principles.
- Hazard identification techniques.
- Layer of protection analysis.
- Safety critical measures.
- Plant site layout development.

Introduction to industrial polymer processes:

- Some historical milestones, importance of plastics in today's world, nomenclature.
- Main polymerization reactions and processes.
- Main industrial problems (impurities, heat removal, fouling, run-away, polymer recovery and finishing, change-over between grades, ...).
- Methodology for polymer process development.

Sessions

Rueil-Malmaison - Du 01/09/2026 au 27/11/2026 — **19500 €/HT**

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