Plan 298 Ing. Químico

Asignatura 44323 DISEÑO INTEGRADO DE PROCESOS

Grupo 1

Presentación

Broadening of design knowledge through: 1) ‘process integration’, from a conceptual point of view, and 2) evaluation of flow diagrams using ‘process simulators’.

Programa Básico

Objetivos

* Find the essential required specifications in the design of the reactor and the recirculation-separation system, to achieve an integrated design process.

* Calculate and evaluate alternative PFD"s using a commercial process simulator.

* Identify and analyze the influence of the key variables in a given PFD.

Programa de Teoría

PART I. Chemical plants design using process simulators

01.- INTRODUCTION.

02 .- DETAILED SPECIFICATION: FORMS. Problem Specification. Process flow diagrams.

03 .- DETAILED SPECIFICATION: BASIC FORMS I. Setup. Components: Databanks, Selection, User Defined.

04 .- DETAILED SPECIFICATION: BASIC FORMS II. Components: electrolytes. Design of reliable new components. CSTR kinetic reactors.

05 .- PROCESS ANALYSIS. Copying, Pasting, and OLE. Sensitivity Analysis.

06 .- DESIGN SPECIFICATIONS. Design Specifications, Control Panel: Control of the calculation sequence. Calculator block: FORTRAN.

07 .- PRACTICAL EXERCISES. Distillation: analysis of the feed stream vapor fraction. Separation of a azeotropic mixture in two columns operating at different pressures.

08 .- SPECIFICATIONS CONTROL. Calculator block: EXCEL. User defined Parameter.

09 .- EXTRACTIVE DISTILLATION. Balance. PFD mode. Report. Heat/work streams. Heat exchangers. Stream properties.

10 .- SEPARATION OF A MIXTURE METHANOL + WATER. Selection of the Property Method. Model parameters. Correlation of experimental data. Optimization. Columns specification.

PARTE II. Process integration: process flow development.

01.-   HIERARCHY IN THE DESIGN OF CHEMICAL PROCESSES. Process development stages. Development of an "irreducible" structure. "Reducible superstructure" optimization.

02.-   REACTOR SELECTION (I). Synthesis route. Some definitions types of reactions. Some definitions Performance behavior. Objectives.

03.-   REACTOR SELECTION (II). Flow model. Concentration. Temperature. Pressure. Phase.

04.-   REACTOR SELECTION (III). Real reactors. Exercise.

05.-   SEPARATION SYSTEM SELECTION (I). General considerations. Distillation: Criteria for selecting the operation variables.

06.-   SEPARATION SYSTEM SELECTION (II). Distillation: Mixtures of low relative volatility and azeotropes. Absorption.

07.-   DISTILLATION SEQUENCES. Ideal columns: Previous criteria, Heuristic rules, Minimum steam flow, Key components flow. Complex columns: Single column prefractionators, Thermal coupling.

08 .- RESIDUES MAP. Construction of the diagram. Typology of residues maps. Using the diagram. Generation of diagrams with Aspen Plus.

09.-   REACTOR - SEPARATION INTEGRATION. Single and global yields. Byproducts. Selectivity increase. Not-recirculable products. Food impuritues. Using solvents. Using solvents as heat absorbers. Example. Gas phase recirculation. Liquid-gas recirculation.

Programa Práctico

Evaluación

Final mark is given by the sum of three contributions:

(1) One individual practical exercise, which accounts for 20% of the final grade. Evaluation is assessed by a written report.

(2) One group project design, which accounts for 40% of the final grade. It is assessed by written report and oral presentation.

(3) Written exam. It consists of two parts: a) development of a PFD from limited information of the process (25% of the final mark), and b) a practical exercise using the process simulator (15%). A minimum score of 3.5 on each part is required to pass the course. Only the failed part of the exam will be taken in September.

Bibliografía

ROBIN SMITH, Chemical Process Design. McGraw-Hill, 1995.

J.M. DOUGLAS, Conceptual Design of Chemical Processes. Chemical Engineering Series. McGraw Hill, 1988.

Guía del Usuario y Manuales de Referencia del software de simulación de plantas químicas ASPEN PLUS. Aspen Technology, Inc., 2002.