

SEPARATION PROCESSES

MODULE	SUBJECT	COURSE	SEMESTER	CREDITS	TYPE
Learning complements	Separation processes	3º	2º	6	Optional
PROFESSOR (S)			TUTORING CONTACT INFORMATION		
Delia Miguel Álvarez			Department of Physical Chemistry. Faculty of Pharmacy. University of Granada Campus Universitario de Cartuja. 18071 -Granada (Spain) Telf.:+ 958244274 dmalvarez@ugr.es , Room 202		
			TUTORING HOURS		
			<i>First term:</i> Tuesday from 09:30 to 11:30h Wednesday and Thursday from 12:00 to 14:00h <i>Second term:</i> Monday, Wednesday and Friday from 9:00h to 11:00h. Department of Physical Chemistry (Room 202)		
DEGREE IN WHICH THE SUBJECT IS TAUGHT			OTHER DEGREES IN WHICH THE SUBJECT COULD BE TAUGHT		
Pharmacy Degree					
PREREQUISITES AND/OR RECOMENDATIONS					
Proper knowledge about: <ul style="list-style-type: none"> - Instrumentals Techniques - General Chemistry - Basic Physics and Physical Chemistry - Organic Chemistry - Inorganic Chemistry - Biochemistry 					



BRIEF ACCOUNT OF THE SUBJECT PROGRAMME

Extraction. Thin layer chromatographic. Gas chromatographic. Liquid chromatographic
Electrophoresis. Centrifugation. Sedimentation.

DETAILED SYLLABUS OF THE SUBJECT

THEORETICAL SYLLABUS

UNIT 1. INTRODUCTION TO CHROMATOGRAPHY. HISTORY. CONCEPT OF CHROMATOGRAPHY. CLASSIFICATION. EQUILIBRIUM DISTRIBUTION. LINEAR ISOTHERMS. DISTRIBUTION PARAMETERS. LINEAR ELUTION CHROMATOGRAPHY. RETENTION PARAMETERS. MIGRATION.

UNIT 2. THEORIES OF CHROMATOGRAPHY. THEORY OF PLATES. COLUMN EFFICIENCY. KINETIC THEORY. GENERAL EQUATION. DIFFERENCES BETWEEN C. G. AND C. L. RESOLUTION. RETENTION TIME. OPTIMUM EFFICIENCY CONDITIONS OF THE COLUMN. GRADIENT ELUTION AND TEMPERATURE PROGRAMMING. APPLICATIONS. THE CALIBRATION METHOD USING STANDARDS. STANDARDIZATION AREAS. INTERNAL STANDARD.

UNIT 3. PLANE CHROMATOGRAPHY. CP AND CCF. HOW THE SEPARATION IS PERFORMED. PERFORMANCE CHARACTERISTICS. VARIABLES AFFECTING THE RF. QUALITATIVE AND QUANTITATIVE DETERMINATIONS.

UNIT 4. GAS CHROMATOGRAPHY. GC RETENTION VOLUME, SPECIFIC VOLUME. PHARMACEUTICAL APPLICATIONS. QUALITATIVE INTERPRETATION OF A CHROMATOGRAM. RELATIVE RETENTION. OSTER RELATIONSHIP. KOVATS RETENTION INDEX.

UNIT 5. GAS CHROMATOGRAPHY INSTRUMENTATION. CARRIER GAS. SAMPLE INJECTION. COLUMNS. STATIONARY PHASES. THERMAL CONDUCTIVITY DETECTORS, FLAME IONIZATION, ELECTRON CAPTURE, ATOMIC EMISSION. ATTACHMENT WITH MASS SPECTROMETRY.

UNIT 6. HPLC INSTRUMENTATION. MOBILE PHASE. PRESSURE SYSTEM. COLUMNS. COLUMN FILLING. DETECTORS: UV-V ABSORBANCE, FLUORESCENCE, ELECTROCHEMICAL, REFRACTIVE INDEX, DISPERSION.

UNIT 7. LIQUID CHROMATOGRAPHY. CLASSIFICATION. ADSORPTION CHROMATOGRAPHY. STATIONARY PHASES. SEPARATION MECHANISM. MOBILE PHASE, ELUENT FORTÉ (0B).

UNIT 8. LIQUID-LIQUID OR DISTRIBUTION CHROMATOGRAPHY. NORMAL PHASE CHROMATOGRAPHY. REVERSE PHASE CHROMATOGRAPHY. MOBILE PHASE POLARITY INDEX. MECHANISM. APPLICATIONS. ION PAIR CHROMATOGRAPHY.

UNIT 9. ION EXCHANGE CHROMATOGRAPHY. TYPES OF EXCHANGE RESINS. ION EXCHANGE MECHANISM. SUPPRESSOR COLUMN CHROMATOGRAPHY.

UNIT 10. EXCLUSION CHROMATOGRAPHY. MECHANISM. PARAMETERS. APPLICATIONS.

UNIT 11. OTHER CHROMATOGRAPHS. AFFINITY CHROMATOGRAPHY. MATRIXES AND LIGANDS. BIOSPECIFIC AND NONSPECIFIC CIRCUMVENTION. SUPERCRITICAL FLUID CHROMATOGRAPHY.



PROPERTIES OF SUPERCRITICAL FLUIDS. INSTRUMENTATION. STATIONARY AND MOBILE PHASES. PRESSURE EFFECT. DETECTORS. COMPARISON WITH OTHER METHODS. ATTACHMENT TO MASS SPECTROMETRY: CHEMICAL IONIZATION UNDER ATMOSPHERIC PRESSURE. ELECTRO-SPRAY.

UNIT 12. ELECTROPHORESIS. ELECTROKINETIC PHENOMENA. ZONE ELECTROPHORESIS. FACTORS AFFECTING ELECTROPHORESIS. IMMUNOELECTROPHORESIS.

UNIT 13. POLYACRYLAMIDE GEL ELECTROPHORESIS. APPLICATION TO THE SEPARATION OF PROTEINS. NON-DENATURING CONDITIONS. FERGUSON REPRESENTATION. DENATURING CONDITIONS. P.A.G.E.-SDS. ESTIMATION OF MOLECULAR MASSES. TRANSFER MEMBRANES. ELECTROFOCUSING. TWO-DIMENSIONAL ELECTROPHORESIS.

UNIT 14. AGAROSE GEL ELECTROPHORESIS. APPLICATION TO THE SEPARATION OF NUCLEIC ACIDS. PULSED-FIELD ELECTROPHORESIS.

UNIT 15. CAPILLARY ELECTROPHORESIS. INSTRUMENTATION. MIGRATION AND PLATE HEIGHT IN E.C. ELECTROSMOTIC FLOW CHARACTERISTICS. E.C DETECTION ZONE. CAPILLARY ISOELECTRIC FOCUSING. CAPILLARY ELECTROCHROMATOGRAPHY. CAPILLARY CHROMATOGRAPHY. MICELLAR ELECTROKINETIC.

UNIT 16. SEDIMENTATION. SEDIMENTATION AND ULTRACENTRIFUGATION. TRANSPORT UNDER CENTRIFUGAL FORCES. LAMM EQUATION. SOLUTIONS TO THE LAMM EQUATION. SVEDBERG EQUATIONS. DETERMINATION OF MOLECULAR PARAMETERS. MULTICOMPONENT SYSTEMS. SEDIMENTATION EQUILIBRIUM. DENSITY GRADIENT EQUILIBRIUM.

PRACTICAL SYLLABUS

PRACTICE 1. SEPARATION OF DNA FRAGMENTS BY ELECTROPHORESIS.

PRACTICE 2. HPLC

PRACTICE 3. POTENTIOMETRIC DETERMINATION OF PHOSPHATE IN A YEAST EXTRACT POWDER BY ION EXCHANGE CHROMATOGRAPHY.

PRACTICE 4. LIQUID GEL EXCLUSION CHROMATOGRAPHY.

BIBLIOGRAPHY

FUNDAMENTAL BIBLIOGRAPHY

RECOMENDED INTERNET LINKS

TEACHING METHODOLOGY

- Theoretical lessons.
- Practical lessons in a laboratory.
- Practical resolution of exercises.



- Oral statements.
- Private tutorials.

SYSTEM FOR ASSESSING THE ACQUISITION OF THE COMPETENCES AND KNOWLEDGE

Two ways of evaluation would be considered:

1. **Continuous evaluation:** global qualifications of students will be the sum of three factors:
 - a) SE.1.- Written exam about lessons described in the program, with a weight of 70%.
 - b) SE.8, SE.10.- An oral/written exam of the practical sessions. Moreover, a notebook with the description and resolution of all the practices should be handed to the teacher at the end of the practical lessons. It is compulsory to attend and to pass the practical lessons to pass the subject. The contribution of this part is 10%.
 - c) SE.11, SE.12. SE.15- Seminar preparations and class attending will contribute with a 20% to global qualifications.

2. **Single evaluation.**

This kind of evaluation will be applied to students that cannot be evaluated continuously by a justified reason. Students should request this type of evaluation to the department director in a maximum of two weeks period since they perform the enrolment.

This evaluation will be a single exam. To pass the subject it is compulsory to prove a homogeneous knowledge of the subject and also to attend and to pass practical lessons.

ADDITIONAL INFORMATION

- Passing partial exams allow the students not to be tested of that syllabus in final exams in June and September.

