Department of Food Technology

College of Agricultural Engineering Sciences

University of Salahaddin

Subject: Advanced Separation methods

Course Book – Postgraduate-PhD study

Lecturer's name: Assist Prof Dr Bashdar Abuzed Sadee

Academic Year: 2023/2024

*Course Book

1. Course name	**Autumn semester**
2. Lecturer in charge	**Assist Prof Dr Bashdar Abuzed Sadee**
3. Department/ College	**Food Technology Department / Agricultural Engineering Sciences College**
4. Contact	**e-mail:bashdar.sadee@su.edu.krd** **Tel: 009647504681186**
5. Time (in hours) per week	**Theory: 2**
6. Office hours	**5 day a week**
7. Course code	**--**
8. Teacher's academic profile	**https://academics.su.edu.krd/bashdar.sadee** **https://scholar.google.com/citations?user=a89t09EAAAAJ&hl=en**
9. Keywords	**Separation techniques, HPLC, GSMS, Extraction, Solid phase extraction, Liquid Chromatography, Precipitation**

10. Course overview:

In this section the lecturer shall write an overview about the subject he/she is giving. The course overview must cover:

Separations are extremely important in synthesis, in industrial chemistry, in the biomedical sciences, and in chemical analyses. Separation methods are techniques used to isolate and purify substances from a mixture. These methods are crucial in various scientific, industrial, and laboratory settings where the goal is to obtain pure components for analysis, use, or further processing. There are several types of separation methods, each suitable for specific applications. These separation methods can be used alone or in combination to achieve the desired level of purity and separation efficiency for a given application. The choice of method depends on the specific properties of the substances involved, the scale of the process, and the intended outcome. Separation is a preliminary step of analysis. The student will be introduced to the concept and principles of various separation methods.

- The importance of studying the subject
- Understanding of the fundamental concepts of the course
- Principles and theories of the course
- A sound knowledge of the major areas of the subject
- Sufficient knowledge and understanding to secure employment

This should not be less than 200 words

This course provides an introduction to the fundamental principles and theories of Separation techniques. It drives the researches how to isolate analyte of interest based on the actual types of the samples of different origin. It also, leads how to get pure analye that will be free from interferences.

12. Student's obligation

Students must follow the instructions illustrated by the department. The students must attend all classes otherwise the lecturer should report the administration at the department.

Students must take quiz, midterm examination, writing an article review and deliver a presentation through the course.

13. Forms of teaching

لێرە مامۆستا ڕێگەی وانە ووتنەوە دەنووسێت، بۆ نموونە: داتاشۆ و پاوەرپۆینت، سەر تەختەڕەش، تەختەی سپی، سمارتبۆردیان مەلزەمە... هتد

Different teaching approaches will be used in the class in order to deliver the main topics of the subject. Prior the class the hard copy of the lecture will be passed to the students in order to make notes by them. Different forms of teaching will be used to the reach the objectives of the subject such as using data show to deliver the presentation and other classical tools for more clarification.

14. Assessment scheme

Breakdown of overall assessment and examination

لێرە مامۆستا جۆری هەڵسەنگاندن (تاقیکردنەوەکان یان ئەزموونەکان) دەنووسێت بۆ نموونە تاقیکردنەوەی مانگانە، کویزەکان، بیرکردنەوەی ڕەخنەگرانە (پریزەنتەیشن)، ڕاپۆرت نووسین، ووتار نووسین یان ئامادەنەبوونی خوێندکار لە پۆلدا...هتد. ئامانە چەند نمرەی لەسەردەبێت و مامۆستا چۆن نمرەکان دابەشدەکات؟

First Exam after five lectures

Second Exam after ten lectures.

Mark Distribution:

Midterm Exam, 20%

Quiz, 5%

Seminar, 10%

Article Review, 15%

Final Exam 50%

Final Mark 100%

15. Student learning outcome:

پرکردنەوەی ئەم خانەیە زۆر گرنگە، مامۆستا دەرئەنجامەکانی فێربوون دەنووسێت. بۆ نموونە:ڕوونی ئامانجە سەرەکیەکانی کۆرسەکە (بابەتەکە) بۆ خوێندکار

گونجاندنی ناوەڕۆکی کۆرسەکە بە پێویستی دەرەوە و بازاڕی کار

قوتابی چی نوێ فێردەبێت لە ڕێگەی پێدانی ئەم کۆرسەوە؟

This should not be less than 100 words

At the end of the course the students will learn how to separate interferences (unwanted substance) from the analyte of interest. They are also able to use various technique for purification of samples that required prior the analysis. Students will learn how to use this information in the next stage of their study.

Students should know the basic principles and have actual practice with the operational techniques of a wide variety of Analytical methods. In addition, they should be familiar with a great many other methods of separation that may be useful in the future.

16. Course Reading List and References:

1. Fundamentals of Analytical Chemistry; Eighth Edition, by Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch. by: Skoog& West
2. **Dynamics of Chromatography: Principles and Theory by: J. Calvin Giddings**
3. **Techniques and Practice of Chromatography by: Raymond P.W. Scott**

17. The Topics:	Lecturer's name
Week 1: Introduction to separation Methods Week 2: Separation by Precipitation, Separations Based on Control of Acidity and Sulfide Separations Week 3: Separations by Other Inorganic Precipitants , Separation of Species Present in Trace Amounts by Precipitation and Salt-Induced Precipitation of Proteins, Separation by Extraction Week 4: Separating Ions by Ion Exchange and Applications of Ion-Exchange Methods Week 5: Midterm Examination Week 6: Chromatography Definition ,-Chromatographic Theories and Classification of Different Chromatographic Methods Week 7: Partition Chromatography -Mobile phase Operations in Chromatography 1- Elution 2- Frontal 3- Displacement	Lecturer's name Dr Bashdar Abuzed ex:(2 hrs)

Week 8: Paper Chromatography (PC) Type of paper Choice of solvent in PC Techniques of Paper Chromatography I-Ascending Paper Chromatography. II-Descending Paper Chromatography. III-Two-dimensional Separations on Paper IV-Horizontal or Circular Paper Chromatography Preparative paper chromatography Quantitative application of PC Week 9: Thin Layer Chromatography (TLC) - Additive to the Stationary layer in TLC Week 10: Ion Exchange Chromatography (IEC) -Classification of Ion-Exchanger -Resin Capacity Week 11: Liquid Chromatography (LC) Week 12: High performance Liquid Chromatography (HPLC) -Elution System in HPLC 1- Isocratic Elution 2- Gradient Elution Week 13: Ion-Pair Chromatography - Ion Chromatography Week 14 Gas Chromatography	
18. Practical Topics (If there is any)	

19. Examinations:

1. *What are separation methods? Explain them*

Answer

Separation Methods

Method	Basis of Method
1. Mechanical phase separation	
a. Precipitation and filtration	Difference in solubility of compounds formed
b. Distillation	Difference in volatility of compounds
c. Extraction	Difference in solubility in two immiscible liquids
d. Ion exchange	Difference in interaction of reactants with ion-exchange resin
2. Chromatography	Difference in rate of movement of a solute through a stationary phase
3. Electrophoresis	Difference in migration rate of charged species in an electric field
4. Field-flow fractionation	Difference in interaction with a field or gradient applied perpendicular to transport direction

2. What are class of column chromatographic methods

Answer

Classification of Column Chromatographic Methods

General Classification	Specific Method	Stationary Phase	Type of Equilibrium
1. Gas chromatography (GC)	a. Gas-liquid (GLC)	Liquid adsorbed or bonded to a solid surface	Partition between gas and liquid
	b. Gas-solid	Solid	Adsorption
2. Liquid Chromatography (LC)	a. Liquid-liquid, or partition	Liquid adsorbed or bonded to a solid surface	Partition between immiscible liquids
	b. Liquid-solid, or adsorption	Solid	Adsorption
	c. Ion exchange	Ion-exchange resin	Ion exchange
	d. Size exclusion	Liquid in interstices of a polymeric solid	Partition/sieving
	e. Affinity	Group specific liquid bonded to a solid surface	Partition between surface liquid and mobile liquid
3. Supercritical fluid chromatography (SFC) (mobile phase: supercritical fluid)		Organic species bonded to a solid surface	Partition between supercritical fluid and bonded surface

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review پێداچوونەوەی هاوەڵ

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.

هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت.