UNIVERSIDADE FEDERAL DE SANTA CATARINA

UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO TECNOLÓGICO (CTC)
Departamento de Engenharia Química e Engenharia de Alimentos (EQA)
Programa de Pós-Graduação em Engenharia Química (POSENQ)

PLANO DE ENSINO

TRIMESTRE 2024.3

I. IDENTIFICAÇÃO DA DISCIPLINA

Código	Nome da disciplina	Créditos	Período
ENQ xxxx	**Tópicos Avançados em Engenharia Química:** Activated carbons – Preparation, Characterization and Application	1 crédito = 15 horas	2024/3

II. PROFESSOR MINISTRANTE/RESPONSÁVEL

Jarosław Serafin
Dachamir Hotza

III. TUTOR

N/A

IV.CURSO E PÚBLICO-ALVO

Mestrado/Doutorado em Engenharia Química,
Extensivo a Mestrado/Doutorado em Engenharia de Alimentos, e Ciência e Engenharia de Materiais

V. EMENTA

Introduction to Activated Carbons. Preparation Techniques. Characterization Methods. Industrial Applications. Optimization of Adsorption Processes.

VI. OBJETIVOS

The proposed course seeks to fulfill the following specific objectives:

1. Understanding the Fundamentals: Gain a comprehensive understanding of the basic principles and concepts involved in the preparation of activated carbons.

2. Preparation Techniques: Explore various techniques used in the preparation of activated carbons, including physical and chemical methods, and understand the factors influencing their efficiency.

3. Characterization Methods: Learn about different characterization techniques employed to assess the structural and surface properties of activated carbons, such as surface area, pore size distribution, and functional groups.

4. Application in Various Fields: Explore the diverse applications of activated carbons in different industries, including but not limited to environmental remediation, water treatment, gas purification, and energy storage.

5. Optimizing Adsorption Processes: Understand how the properties of activated carbons influence their adsorption capacities and learn methods to optimize adsorption processes for specific applications.

VII. CONTEÚDO PROGRAMÁTICO

Module 1: Introduction to Activated Carbons
1.1 Definition and Properties
- Basic concepts and characteristics of activated carbons
- Overview of the importance and versatility in various industries

1.2 Types of Activated Carbons
- Classification based on raw materials and activation methods
- Distinctive features of each type and their applications

Module 2: Preparation Techniques
2.1 Physical Activation
- Activation using gases, steam, or air
- Influence of temperature, time, and activation agents on the final product

2.2 Chemical Activation
- Activation with chemical agents like acids, bases, or salts
- Comparative analysis of physical and chemical activation methods

Module 3: Characterization Methods
3.1 Surface Area and Pore Size Distribution
- Techniques such as BET analysis for assessing surface area
- Pore size distribution analysis and its implications

3.2 Structural Characterization
- X-ray diffraction (XRD) and other methods to understand the crystal structure
- Fourier-transform infrared spectroscopy (FTIR) for functional group analysis

Module 4: Applications of Activated Carbons
4.1 Environmental Applications
- Water treatment and purification
- Air and gas phase adsorption for environmental remediation

4.2 Industrial Applications
- Use in pharmaceuticals, food processing, and chemical industries
- Energy storage applications, including batteries and supercapacitors

Module 5: Optimization of Adsorption Processes
5.1 Factors Influencing Adsorption
- Temperature, pressure, and concentration effects
- Kinetics and equilibrium considerations

5.2 Designing Adsorption Systems
- Strategies for optimizing adsorption processes
- Case studies on successful application

VIII. METODOLOGIA DE ENSINO / FORMA DE TRABALHO

O curso será oferecido de 19 a 23/08/2024, aproveitando a visita do Prof. Jaroslaw Serafin da Universidade de Barcelona neste período no âmbito do programa CAPES PRINT na UFSC.

Será ministrado em inglês, na intenção de internacionalizar o PósENQ e abrir perspectivas de intercâmbio de aluno de Mestrado e Doutorado.

Será organizado em 5 módulos (aulas) de 3 horas de duração cada, de modo presencial e/ou híbrido, a depender do público alvo inscrito.

IX. METODOLOGIA DE AVALIAÇÃO

A avaliação será feita sob a forma de questionários individuais ao final de cada modulo.
A média final será calculada pela soma das notas dividida pelo número total de questionários (até 5).

X. CRONOGRAMA (5 aulas de 3 horas cada)

Module 1: Introduction to Activated Carbons
Module 2: Preparation Techniques
Module 3: Characterization Methods
Module 4: Applications of Activated Carbons
Module 5: Optimization of Adsorption Processes

XI. BIBLIOGRAFIA

- Dziejarski, B., Serafin, J., Andersson, K., & Krzyżyńska, R. (2023). CO2 Capture Materials: A Review of Current Trends and Future Challenges. Materials Today Sustainability, 100483.
- Serafin, J., & Dziejarski, B. (2023). Activated carbons—preparation, characterization and their application in CO2 capture: A review. Environmental Science and Pollution Research, 1-55.
- Serafin, J., & Dziejarski, B. (2023). Application of isotherms models and error functions in activated carbon CO2 sorption processes. Microporous and Mesoporous Materials, 354, 112513.
- Serafin, J., Dziejarski, B., & Sreńscek-Nazzal, J. (2023). An innovative and environmentally friendly bioorganic synthesis of activated carbon based on olive stones and its potential application for CO2 capture. Sustainable Materials and Technologies, 38, e00717.
- Serafin, J., Ouzzine, M., Cruz Jr, O. F., Sreńscek-Nazzal, J., Gómez, I. C., Azar, F. Z., ... & Rambo, C. R. (2021). Conversion of fruit waste-derived biomass to highly microporous activated carbon for enhanced CO2 capture. Waste Management, 136, 273-282.

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