

# Activated Carbon: Environmental Design and Application

ENV4932 Section 13305

Class Periods:

Location: Zoom Meetings

Academic Term: Fall 2020

## ***Instructor:***

**David W. Mazyck, Ph.D.**

Email: dmazyck@ufl.edu

Phone: 846-1039

Office Hours: Tuesday and Thursday, 1 to 2:30 pm

## ***Teaching Assistant:***

None

## ***Course Pre-Requisites / Co-Requisites:***

None

## ***Course Description:***

Theory and application of manufacturing activated carbon, its use in water treatment/remediation (i.e., design of activated carbon systems), and thermal reactivation. Credits: 3.

## ***Course Objectives***

To understand the fundamentals of manufacturing and reactivating activated carbon through the manipulation of its surface chemistry and physical properties for the separation of contaminants from fluids. At the completion of the course, students should have a thorough understanding of:

- Manufacturing of activated carbon including types of equipment
- Applications of activated carbon and why one raw material may be better suited for the application compared to another.
- Physical versus chemical adsorption
- Reactivation of carbon including equipment
- Tailoring activated carbon physical and chemical properties for applications

## ***Materials and Supply Fees***

None

## ***Required Textbooks and Software:***

None required

Course notes via powerpoint will be provided by instructor

## ***Course Schedule***

Carbonaceous precursors, physical and chemical activation, textural and chemical properties, design of activated carbon adsorbers (lab and full-scale), economics, thermal reactivation, and tailoring for specific adsorbates.

## **Special Notice:**

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Activated Carbon, ENV 6439

David W. Mazyck, Ph.D., Fall 2020

Example topics to be discussed include:

1. History of activated carbon and Hg legislation	Week 1
a. Past, present, and future of activated carbon	
b. Activated carbon overview (what is this material?)	
c. Hg legislation is here, for now?	
2. Activated carbon manufacturing – with an emphasis on how production may impact Hg adsorption	Weeks 2-3
a. Precursors (why wood vs. coal-based)	
b. Physical vs. chemical activation	
c. Activated carbon properties	
i. Physical	
1. Surface area, pore size, pore size distribution	
ii. Surface chemistry	
1. Water contact pH	
2. Oxygen functional groups	
3. Activated carbon applications	Weeks 4-7
a. Potable water treatment (PAC and GAC) with brief overview of others	
i. Taste and odor control	
ii. DBPs	
b. Coal-fired power plants	
i. Flue gas	
ii. Wet scrubbers	
4. Activated carbon adsorption of Hg	Weeks 8-10
a. Adsorption process	
b. Mechanisms responsible for Hg adsorption	
5. Activated carbon selection	Week 11
a. American Water Works Standards	
i. RSSCTs and Performance Based Testing	
6. Thermal reactivation of spent activated carbon	Week 12
7. Tailoring of activated carbon for specific applications	Weeks 13-15

***Attendance Policy, Class Expectations, and Make-up Policy***

None apply. Class is offered on-line via UF EDGE.

***Evaluation of Grades***

Project 85% - A 15-page (graduate student) paper (double-spaced) that focuses on an activated carbon topic (e.g., the role of surface chemistry for the removal of phenol from water) constitutes 100% of the grade. Additional examples of class papers can include a resolution to an activated carbon controversy or a comparison and contrasting of a specific topic (e.g., the role of photocatalysts doped on activated carbon surfaces for dye removal). Students are required to include in their paper text regarding how they would proceed to secure funding from NSF on their paper topic.

This paper will be assessed based on grammar, completeness of the literature review (journal articles (> 20) or text books only), and your ability to draw conclusions from the literature that demonstrates an in-depth understanding of the concepts. The paper should be 1” margins, 12 pt Times New Roman, and double spacing.

Presentation 15% - At the mid-way point in the class, students will make a presentation (5-15 minutes pending enrollment size) that outlines their paper (i.e., a proposal). The presentation will be graded based on organization, clarity, and Q&A session.

Assignment	Total Points	Percent of Final Grade
Presentation	100	15%
Paper	100	85%
		100%

### ***Grading Policy***

Percent	Grade	Grade Points
94.0 - 100	A	4.00
90.0 - 93.9	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
60.0 - 69.9	D+	1.33
0 - 59.9	E	0.00

### **DUE DATES:**

Sept. 17 and 19 – Class Presentations

November 26 – Class Papers

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

### ***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/scer/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### ***Campus Resources:***

#### *Health and Wellness*

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

**Sexual Assault Recovery Services (SARS)**  
Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.