BEE 499/599 (478/578) Biofuel Feedstocks and Production  
Biological and Ecological Engineering, Oregon State University

Course Description
Bioethanol is one of the important alternatives to fossil fuels. This course will provide an overview of the biofuel feedstocks for production of fuels, feed and industrially valuable chemicals. Issues in feedstock utilization such as suitability, availability, sustainability and economic viability will be addressed. This course will cover the preprocessing, post processing and fermentation technologies in ethanol production. Influence of feedstock composition and process technologies on ethanol and coproducts will be discussed.

By the end of this course, you must be able to:

- Identify potential feedstocks for biofuels and bioproducts.
- Propose suitability of feedstocks based on chemical composition, agroclimatic conditions and process technologies.
- Describe key processes in ethanol production from biobased feedstocks.
- Differentiate starch and cellulose based ethanol production technologies.
- Assess effects of process conditions and analytical techniques used in ethanol production.
- Evaluate sustainability of feedstock production and assess its impact on socio economic parameters.

Class Topics
1. Overview of biobased economy: Introduction, bioethanol, emphasis on systems analysis and sustainability. (1 lecture)
2. Technologies for bioprocessing for fuels and chemicals: An overview of available technologies and introduction to biorefinery concept, thermochemical technologies, consolidated bioprocessing. (2 lectures)
3. Feedstocks: Chemical and physical properties; starch, cellulose, hemicellulose and lignin composition. (3 lectures)
4. Feedstocks: An overview of issues involved in selection of feedstocks based on suitability, availability, sustainability and economic potential. (1 lecture)
5. Types of feedstocks based on composition
   - Starch rich feedstocks (1 lecture)
   - Lignocellulosic feedstocks (1 lecture)
6. Fermentation technologies for ethanol production: An overview of yeast, novel pentose fermenting yeasts and microorganisms, enzymes, effect of process conditions and a summary of analytical techniques used. (3 lectures)

Mid term Examination
7. Ethanol production from starch rich feedstocks: Unit operations, SSF, distillation and post processing and utilization of coproducts. (5 lectures)
8. Ethanol production from cellulosic feedstocks: Pretreatment technologies, hydrolysis, fermentation, and post processing and utilization of coproducts. (6 lectures)
9. Systems Analysis: Introduction to process modeling and economic analysis. (2 lectures)
10. Systems Analysis: Introduction to life cycle analysis. (2 lectures)
11. Summary: State of the art and future outlook. (1 lecture)
12. Project Reviews: In class presentations. (1 lecture)

Final Exam 14 – 18th March, 2011
Learning Resources

- Lecture notes will be provided for some of the lectures.
- Class slides will be available on the course web site (http://stl.bee.oregonstate.edu/courses/BFP/index.htm). However, they can only be a supplement and not a substitute to the material covered in the class.
- Links to relevant journal articles will be posted on the course web site (Blackboard).

Evaluations

Undergraduate option (499): Two tests (25+40% of the total grade) will be conducted. Home works will account for 30% of the grade. Unannounced, in-class tests will account for 5% of the grade.

Graduate option (599): Two tests (20+35% of the total grade) will be conducted. Home works will account for 10% of the grade. Unannounced, in-class tests will account for 5% of the grade. One of the following additional assignments must be completed for graduate option.

- Project on biofuel pathway analysis (process modeling/economic/life cycle analysis).
- Review of at least two biofuels research related peer reviewed journal articles.

The assignments must be submitted as in peer reviewed journal article format and presented (15 min) in the class at the end of the course. More details on the review will be provided in the class. (30% of grade)

Policies

Discussion among peers is encouraged, especially for the review of the article; however separate reviews must be submitted. No discussions are permitted for the examinations. University regulations (please refer to academic regulations, particularly AR 15 and http://oregonstate.edu/admin/stucon/achon.htm) will be followed in letter and spirit.

All assignments are due at the beginning of lectures. Late work will receive no credit. Computer crashes cannot be an excuse for late submission. All submitted material will be graded and returned to the students.

Statement Regarding Students with Disabilities: Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

Instructor Information:
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Office Hours: Open door policy. It is recommended however to seek prior appointments (Email at least 2 times that work for you and I will get back to you within 24 hrs with the meeting time).