CHBE 486 Waste Management for Resource Recovery

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Lectures:	Mon Wed	4:30 – 6:00 pm CHBE 102	
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Website: http://canvas.ubc.ca
Course notes: No prescribed textbook. Lecture notes and additional materials will be provided through the course website.

Evaluation:	Assignments (4)	16%
	Midterm exam (Mar 1)	30%
	Quiz (Mar 27)	4%
	Oral presentation (Mar 29, Apr 3, Apr 5, Apr 12)	10%
	Term paper (due Apr 17)	40%

Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Classify the sources and types of wastes
- Characterize different types of solid waste and wastewater
- Develop a conceptual understanding of integrated resource recovery from wastes
- Discuss and analyze various thermal/thermochemical and biological/biochemical processes for solid waste management
- Apply preprocessing and pretreatment methods for solid wastes
- Determine the quality of products and know the applicable standards
- Analyze wastewater treatment processes for various forms of resource recovery

Topics

1. **Introduction**
   Classifying the sources and types of wastes: forest-origin, agricultural, industrial, municipal
   Waste management practices and integrated resource recovery

2. **Solid waste management – waste characteristics and technologies for resource recovery**
   Characteristics of solid wastes
   Types of processes and systems – an overview
   Recovery of resources – energy, bioproducts, industrial products
   Product quality assessment
   Preprocessing and pretreatment methods
   Thermal processes
   Physical and chemical processes
   Biological processes
   Waste air utilization

3. **Wastewater management – wastewater characteristics and technologies for resource recovery**
   Characteristics of wastewater
   Types of processes and systems – an overview
   Recovery of resources – energy, nutrients, potable water
   Physico-chemical processes
   Biological processes
   Thermal processes

References

Technical reports
Journal papers
Articles from magazines
Conference proceedings
etc.

Books

Macaskie LE, Sapsford DJ and Mayes WM (Eds.) 2020. Resource Recovery from Waste: Towards a Circular Economy. Royal Society of Chemistry, UK

Taherzadeh MJ, Bolton K, Wong J and Pandey (Eds.) 2019. Sustainable Resource Recovery and Zero Waste Approach. Elsevier, St. Louis, MO.

Rada EC. 2016. Waste Management and Valorization: Alternative Technologies. 1st ed. Apple Academic Press. Palm Bay, FL.

Metcalf & Eddy, AECOM. 2014. Wastewater Engineering: Treatment and Resource Recovery. 5th ed. McGraw Hill. New York.

Christopher L (Ed.) 2013. Integrated Forest Biorefineries. RSC Publishing, Cambridge, UK.

Knoef HAM (Ed.) 2012. BTG Biomass Technology Group BV. 2012. Handbook of Biomass Gasification. 2nd ed. Enschede, The Netherlands.

Kreith F and Kreider JF. 2011. Principles of Sustainable Energy. CRC Press. Boca Raton, FL.

Obernberger I and G. Thek G. 2010. The Pellet Handbook: The Production and Thermal Utilization of Biomass Pellets. Earthscan. London, UK; Washington, DC.

Rao SR. 2006. Resource Recovery and Recycling from Metallurgical Wastes, Vol. 7, 1st ed. Elsevier Science. Amsterdam, The Netherlands.

Metcalf & Eddy Inc. 2003. Wastewater Engineering: Treatment and Reuse. 4th ed. McGraw Hill. New York.

Tchobanoglous G and Kreith F. 2002. Handbook of Solid Waste Management. McGraw-Hill. New York.

Rhyner CR, Schwartz LJ, Wenger RB and Kohrell MG. 1995. Waste Management and Resource Recovery. 1st ed. CRC Press. Boca Raton, FL.

Term Paper - 3 students per group

Purpose:

The purpose of the term paper is either:

1) To perform and summarize literature review, with critique, on technologies relevant to waste management for resource recovery; or

2) To propose and analyze waste management options for resource recovery, for a specific industry, community, or region (for instance, conducting a feasibility study).

Scope:

- Background description (outline of the problem, the approach to be adopted, and the significance of the work)
- Waste characterization
- Discussion and analysis of alternatives (physico-chemical, biological and/or thermal methods)
- Performing engineering calculations where applicable
- Recommendation of the selected option based on your analysis, where applicable
- Economic analysis (optional)

Please discuss the scope of your term paper with the instructor if it will be somewhat different.

Report:

An essay of 4,500-5,000 words PLUS references, illustrations (diagrams and data, presented in tables and figures format), and appendices

Evaluation will be based on technical contents (75%) and organization (25%)

Please submit an electronic copy of your term paper via the course website (http://canvas.ubc.ca) by the due date.