Number of module: 4	Module: Bioenergy - Biofuels
Coordinator of module	**Prof. Dr.-Ing. Th. Willner**
Lecturer	Prof. Dr.-Ing. Th. Willner
Period	1th and 2nd semester
Credits	5 CP
Workload	on campus program: 64 h, self study: 86 h
Status	Optional obligatory module
Prerequisites	Basic knowledge in Thermodynamics and Chemistry
Max. number of participants	40
Language	German or English

Skills to be acquired / Learning objectives

Subject based and methodical skills

The students are able to ...

• identify and assess global challenges of energy supply quantitatively based on material and energy flow data;
• analyze and present concepts of alternative fuel generation based on thermodynamic, chemical, ecological, economical and scientific data;
• estimate potentials and climate relevance of biofuel scenarios;
• analyze and assess publicly discussed statements concerning problems of alternative fuel supply, climate change and food production based on own calculations;
• evaluate and discuss own concepts of biofuel production including optimization options;
• use literature sources according to scientific requirements.

Personal and social skills

The students are able to …

• reach the learning objectives by creative learning and adequate time management
• present scientific assessment results based on literature data and own calculations
• generate and present results from team work

Contents

• global challenges of energy supply considering demand, potentials, climate change and CO_2 balances
• thermodynamic, chemical, ecological and economical fundamentals of conventional and alternative fuels
• Chemistry of biomass
• Chemistry and thermodynamics of biological and thermochemical conversion of biomass into liquid and gaseous fuels
• 1st, 2nd and 3rd generation biofuels considering latest research and development results including activities at the Hamburg University of Applied Sciences

Related courses • Biofuels	
Teaching skills	Seminar type lecture Team work presentations
exam	1. Written examination (graded performance test) 2. Report and oral presentation of analyzed literature data (ungraded performance test)
Literature / Teaching aids	Lecture training manuscript and handouts. Examples of literature related to biofuels: • Overend, Milne, Mudge Eds.: Fundamentals of Thermochemical Biomass Conversion. Elsevier, London 1985 • Soltes, Milne: Pyrolysis Oils from Biomass – Producing, Analyzing and Upgrading. ACS Symposium Series 376, Washington DC 1988 • Bridgewater, Kuester Eds.: Research in Thermochemical Biomass Conversion. Elsevier, London 1988 • Bridgwater, Grassi: Biomass Pyrolysis Liquids Upgrading and Utilisation. Elsevier, London 1991 • Fachagentur Nachwachsende Rohstoffe e.V.: Biocrudeoil. Gülzower Fachgespräche Band 28, Gülzow 2008-10-30 • Fachagentur Nachwachsende Rohstoffe e.V.: Diverse Informationsbroschüren zu allen Arten von Biokraftstoffen; www.fnr.de • Geitmann: Mit neuer Energie in die Zukunft – Erneuerbare Energien & Alternative Kraftstoffe. European Energy Consult Holding (EECH) AG, Hamburg; Hydrogeit Verlag, Kremmen 2005 • Kaltschmitt, Hartmann: Energie aus Biomasse – Grundlagen, Techniken und Verfahren. Springer, Berlin 2001 • Reiser: Ermittlung von motor- und verbrennungstechnischen Kenndaten an einem Dieselmotor mit Direkteinspritzung bei Betrieb mit unterschiedlich aufbereitetem Rapsöl. Dissertation, Universität Hohenheim 1997 • Klee: Charakterisierung verschiedener Pflanzenölkraftstoffe hinsichtlich ihrer Eignung als Dieselkraftstoffsubstitute unter besonderer Berücksichtigung ihrer chemischen und physikalischen Eigenschaften. Dissertation, Universität Kaiserslautern, 1999