Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

SLUkurs

Syllabus

PFG0073 Biorefinery Pilot Research, 5.0 credits

Syllabus approved

2020-06-02

Subjects

Technology

Education cycle

Third cycle

Grading scale

Pass / Failed
The requirements for attaining different grades are described in the course assessment criteria which are contained in a supplement to the course syllabus. Current information on assessment criteria shall be made available at the start of the course.

Language

English

Prior knowledge

This course is open to all PhD students with an interest to learn more about existing pilot scale biorefinery infrastructures and on how to take biorefinery research from lab to pilot scale.

Objective, including learning outcomes

The cities along the coast in Northern Sweden host a unique range of excellent biorefinery research facilities in pilot scale. These facilities provide unique opportunities

for senior and junior researchers and PhD students to develop their laboratory research work to also embrace experiments in pilot scale.

The objective of this course is to educate PhD students to understand how working conditions and approaches are distinguished between research in larger scale and work in a laboratory: both from a theoretical perspective and from experiences made at specific facilities.

Learning outcomes

At the end of the course, the students are expected to:
- be aware of the availability of pilot-scale biorefinery facilities and equipment in Northern Sweden (Piteå to Örnsköldsvik) and have an overall understanding of the technologies represented

- be aware of the availability of specific equipment relevant to one's own research work and what support one can get from technical staff regarding planning and advice for an appropriate experimental setup and help with practical experimental work.

- be able to operate single equipment with minor supervision

- have developed an understanding of the specific challenges encountered when performing pilot-scale research:
o technical issues: construction of equipment, measurement techniques, size-dependent process conditions
o feedstock and residual products: pre- and post-processing of larger material amounts
o experimental planning, scheduling, and costs
o need for research engineers for operation and maintenance
o safety issues
o financing issues

- critically analyze the strengths and weaknesses of pilot plants from different perspectives:
o scientific
o educational
o economical
o political
o societal

- be able to present a case describing the development process when she/he takes her/his own research to a larger scale

Content

The course consists of the following activities:
Three physical gatherings in 1) Piteå, 2) Örnsköldsvik and Umeå, 3) Umeå.

1) Piteå:

- Basic introduction and definitions from invention and innovation to pilot plants, historical development of pilots in Sweden, successful and unsuccessful experiences.

-Introduction to:
o gasification and pyrolysis principles and theories, experimental planning
o pilot facilities at ETC, students will do some practical work about sample preparation for gasification experiment. Theory and application of slurry hydrocracking

-The successful Sunpine story from fume hood to full scale

2) Örnsköldsvik and Umeå

- Technological and biotechnological uses of forest products and waste stream from biofuels, feeds and biofertilizers. E-Sekab from forest to bioethanol, nanocellulose and other chemicals different ways to exploit forest.

- RISE-Processum biotechnological strategies from forest residues to fish feed and biofuels, visit and lectures. RISE Processum is a fantastic R&D platform with deep expertise and knowledge on chemical and biotechnological exploitation of pulp industry waste streams for multiple products generations. The student will follow lectures and visit to several pilots.

- MoRe Research visit and lectures about different pilot for the production of fabrics and biofuels visit and lectures

- Domsjö Fabriken, production of special cellulose visit and lectures

3) Umeå

- Biomass Technology Centre: mechanical preprocessing of biomass, representative sampling, overview of industrial biomass handling and storage

- Dåva, Umeå Energi, the algae pilot, AREVO (biofertilizer), MTC (Miljö Tekniskt Centrum) visit and lectures. At Dåva the students will get a presentation and a visit of Umeå Energi combined heat and power plant. At the same location, the students will be able to follow how wastewater and the flue gases are treated and cleaned by the microalgae growing at algae pilot facilitiy. A lecture will be given about the use of microalgae for cleaning and multi products generation

- During the last day of the course, a final seminar will be arranged, where the students will present their pilot projects to a panel of experts.

All three gathering are compulsory.

The students will write a report length max 15 pages figures and references excluded. In the report, the students will critically analyze strengths and weaknesses and discuss the strategic values of the chosen pilot plant.

Requirements for examination

To pass the course the following three criteria has to be fulfilled:

- Participation at all three gatherings

- Task on critical analysis of one pilot facility visited or a pilot very related to the students research field. During the course the students will work on their task, will present at final seminar and will submit the final version of their written work after the last gathering.

- Evaluation sheets are handed in

Additional information

Each gathering has a theme of lectures, generally relevant for biorefinery R&D 1) Biorefinery, bioenergy, biotechnology and forest industry R&D over time and in a societal perspective 2) Innovation and upscaling of research ideas 3) R&D in co-operation with industrial partners.
On-site visits at pilot research facilities will contain lectures and demonstrations

of the multi-stage operated pilots, and overview instructions on how to use single unit operational pilots. Educational themes will be explored through seminars, literature, lectures, and panel discussions. Throughout the course, students will work on a task, exploring how to take their own research to a larger scale and/or implementation. Task descriptions will be handed in and discussed in groups at the last meeting final seminar.

Course will take place in different locations - Piteå, Umeå and Örnsköldsvik.
Very important to be on place.

We will meet on April 4-6th, April 25-29th and May 19-20th.

Responsible department

Department of Forest Biomaterials and Technology