KE2355 Resource recovery from waste 7.5 credits

Resursåtervinning från avfall

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for KE2355 valid from Autumn 2024

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Chemical Science and Engineering

Specific prerequisites

Completed credit degree project 15 credits, 50 credits in chemical engineering, environmental engineering, chemistry, energy and environment, materials science or mechanical engineering. English 6/B.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

Creating economically and environmentally sustainable processes for resource recovery from primary and secondary raw materials is one of the challenges in realizing a circular economy. This course covers novel processes and techniques for resource recovery. This includes using several separation processes to enable recovery of water, energy and materials, and tools for the evaluation of the environmental impacts of such processes.

After completing the course, the students should be able to:

- Describe and analyze waste streams in terms of resource recovery
- Identify and describe suitable resource recovery processes from different waste streams
- Critically examine sustainability aspects of different resource recovery processes from waste streams and evaluate its environmental impacts
- Apply operational and environmental conditions, and elect design criteria for resource recovery processes

Course contents

The scarcity of natural resources is a big drawback for humankind. Due to populational growth and technological development, the exploitation of natural resources keeps on accelerating while primary sources continuously decrease. In parallel, anthropogenic activities also generate ever-growing waste and pollutants. Considering this scenario, a paradigm shift is essential to ensure the maintenance of society and technological advances, especially concerning the transition from a linear to a circular economy and from fossil fuels to renewable energy sources. Several policies have been drawn to push for the change on the same lines. Achieving the goals proposed by the United Nations (Sustainable Development Goals - SDGs) or the targets on the Paris Climate Agreement and reaching carbon neutrality in Europe by 2050 depends on adopting novel perspectives. Facing such challenges demand that the engineers not only acquire knowledge on novel technologies to address these complex and important issues, but also develop critical thinking regarding resource and waste.

This course presents an overview of processes and techniques for resource recovery from different sources. This includes using wastewaters, industrial effluents, food and municipal waste, and waste electronical and electrical equipment as sources for raw materials, devising strategies for the recovery using biochemical tools and specific separation strategies.

The overall aim is to provide a deep understanding of the ‘Resource recovery from waste’ concept and how this is applied in sustainable waste treatment processes.

The course will approach:

Recovery of water

- Black and greywater
- Biological treatment of wastewaters
- Desalination

- Technologies to recover water from mining tailings

Recovery of energy

- Gasification of biomass
- Biogas production
- Biohydrogen and biofuel production
- Microbial fuel cells

Recovery of materials

- Volatile fatty acids and bioplastics production
- Recycling of waste electronic and electric equipment
- Critical raw materials
- Nutrient recovery
- Bioleaching

Assessment of environmental impacts:

- Sustainable development, circular economy, planetary boundaries and energy transition
- Life cycle assessment (LCA)

Examination

- PRO1 - Project assignment, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 5.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.