

Waste Valorization (0000172)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0

Study time 150 h

Course offerings and teaching methods in academic year 2025-2026

A (semester 2)

English

Incheon

independent work
lecture

Lecturers in academic year 2025-2026

Meers, Erik

LA24

lecturer-in-charge

Fernandes De Souza, Marcella

LA24

co-lecturer

Luo, Hongzhen

LA24

co-lecturer

Ronsse, Frederik

LA24

co-lecturer

Offered in the following programmes in 2025-2026

[Bachelor of Science in Environmental Technology](#)

crdts

5

offering

A

Teaching languages

English

Keywords

Climate change, waste, energy, circular economy, biogas, pyrolysis, gasification

Position of the course

Contents

This course contains 3 parts:

A. Bioeconomy, circular economy and biorefineries

1 The role of biomass in the circular economy and the food x fuel dilemma

2 Introduction to the concept of biorefineries

3 Biochemical valorization of waste streams;

4 Case study 1: 2G ethanol

5 Case study 2: creating value from residual grass clippings

6 Case study 3: creating value from food wastes

7 Roadmap to waste biomass valorization

B. Biogas as biorefineries – producing energy, fertilizers and other added value products from organic wastestreams

1 Biogas introduction – energetic dimensioning

2 Biogas as biorefineries producing more than renewable energy

3 Nutrient Recycling

4 Impact on climate change of waste-to-energy using biogas

C. Thermochemical processes of energy and materials recovery

1 Relevant physicochemical properties of waste for thermochemical recovery

2 Incineration and combustion of solid waste: hazardous versus non-hazardous waste, oven configurations, monitoring, flue gas treatment options

3 Energy recovery in combustion: Rankine (steam) and organic Rankine cycles, efficiency, cogeneration, district heating networks

4 Pyrolysis for chemical/fuel recovery: principle, reactor configurations, chemistry of waste biomass and plastic pyrolysis, application of pyrolysis products

5 Gasification for chemical/fuel recovery: principle, reactor configurations, chemistry, syngas applications, hydrogen gas production

6 Wet thermal conversion techniques: hydrothermal processing

Initial competences

Basic knowledge on Climate change, Environmental Technology and Organic Chemistry (building from previous courses) is required in order for the students to be able to fully comprehend the practical cases

Final competences

- 1 Define biorefinery, circular economy and bioeconomy
- 2 Basic knowledge of the main processes and products obtained via biochemical and thermochemical processes
- 3 Ability to propose a valorization route to obtain several products from waste biomass in a biorefinery configuration
- 4 Developed communication skills in a scientific context

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, Lecture, Independent work

Extra information on the teaching methods

Theory is taught via plenary lectures, this goes as well for the theoretical exercises. Students are divided into groups and each must develop a case study applying the concepts learned in class.

Study material

None

References**Course content-related study coaching**

In addition to lectures, the students will be guided towards presenting their own case. Students enjoy access to individual feedback moments (microteaching) in the development of their assignment.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Oral assessment, Peer and/or self assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

The written exam amounts for 50% of the final score. In addition, students also need to prepare a presentation in frame of a specific assignment, which itself also amounts to 50% of the score. This presentation is conducted outside the examination period, during the academic semester.

Calculation of the examination mark