

## 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
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**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**

<a href="#">Bachelor of Science in Environmental Technology</a>	crdts	offering
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5 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**