

# Master of Science in Circular Bioprocess Technology, the first educational program in Belgium for engineers that fully focusses on circularity in industrial processes

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Today, the impact of science on technological innovation is greater than ever. Engineers play a crucial role in this. They develop new products, devise new technologies and have an important social task in many applications for food, health and the environment. To fulfil the growing need of the chemical, biochemical and food processing industry for engineers that are familiar with the latest techniques on circularity and sustainability, the University of Ghent started a new and unique educational program in 2018 that focusses fully on those topics. This (bio) industrial engineer training is offered at the UGent Campus Kortrijk and is affiliated with the Faculty of Bioscience Engineering. The uniqueness also lays in the fact that the program is of a highly technical nature and developed in consultation with the regional industry. The presented engineering courses such as chemical and biochemical engineering, downstream processing, process software simulations, environmental technology, energy management, pinch technology, recycling technology, food processing and packaging, fermentation technology, life cycle analysis, etc. all have one thing in common: circularity is the primary goal. This focus is often still lacking in many of the more traditional engineering programs while the chemical, biochemical and food processing industry is already transitioning towards a more circular economy. Resources are becoming scarce and geopolitical changes will only further speed up this process.

To make a relevant and up-to-date academic program for engineers, it needs to be imbedded in applied research as to make future students aware of this by involvement. This is done in several ways. We developed teaching modules where students are directly involved in academic research. Examples of this are the teaching modules Sustainability Assessment, Resource Recovery and Process intensification. In the latter for instance the students worked a whole semester on the chemical recycling of polymers by dissolution precipitation of pure polymer and the recovery of additives by cross filtration.

The teaching professors in the program are also involved in research on circularity and are affiliated with two relevant departments of the faculty of Bioscience Engineering, namely the Department of Green Chemistry and Technology and the Department of food technology. Last year VEG-i-TEC, a new pilot hall, was opened and focusses on the sustainability and circularity of food processing, packaging and the validation of food waste streams trough fermentation (<https://www.ugent.be/veg-i-tec/en>). December 2023 a new research hall will be taken in service, which will accommodate two other research groups (LIWET and LCPE) focusing on waste water reuse (<https://www.ugent.be/bw/gct/en/research/greentech/research/liwet>) and circular process engineering (<https://www.ugent.be/bw/gct/en/research/greentech/research/chemtech/projects.htm>). The number of researchers that are involved in all of those programs is steadily increasing. The LCPE group, involved in a number of research projects in the fields of plastic and organic waste valorization, has attracted major funding, including EU funded projects. On top of that, funding was recently granted for a pilot scale plant for the chemical (pre)treatment of plastic waste streams which is unique in Belgium.

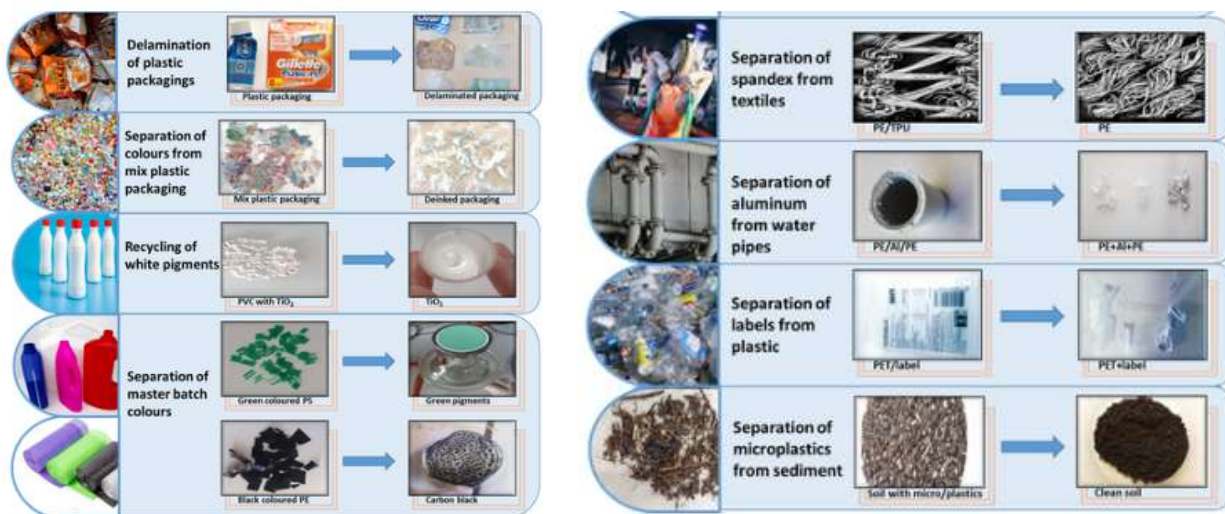


Fig.: A glance at some typical results of research done by LCPE

All those facts mentioned above highlight the relevance of the new master program. Therefore, this presentation is aimed at giving more visibility to this, give inspiration, exchange ideas, and also give an overview of all related research that is imbedded into the courses, inducing cooperation and exchange of information between students and researchers.

## Poster Presentation

Name Presenter : Joël Hogie

General Background : Chemical Engineering, 25+ years of experience, Lecturer

Research background :

- purification of chemically treated plastic waste streams (e.g. purification of pyrolysis oil, purification of dissolved polymer streams)
- validation of organic waste streams (VFA purification of anaerobic digested waste)

Intro on this atypical poster session:

- The treated topics are not purely research oriented but rather try to induce a discussion on the relation between research and educational programs.
- The reason for this is that we experienced that young researchers often lack knowledge if it comes to induce circularity and sustainability in traditional production processes
- This will be illustrated by some examples of processes.

Main two purposes of the presentation:

- First: Lay focus on the gap between more
  - o ecologically oriented programs,
  - o biochemical and food processing
  - o traditional engineering programs
- Second: Brief overview of research of the lecturers involved in the program and induce cooperation.

Examples of shortcomings to illustrate this gap, experienced by researchers:

- E.g. biological water treatment: validation of organic waste such as active sludge: anaerobic digestion: most are familiar with the microbiological aspects but gap: downstream processing: VFA purification CHE techniques, modeling of microbiological processes
- Biorefining in general: e.g. fermentations setting up unstructured models, coupled with process software such as Aspen Plus for filtration, drying washing, etc.
- Link between waste validation through production of pyrolysis oil and further purification by using refinery techniques such as lumping of chemical components, setting up ASTM assets, etc.
- Production of fatty acids: complex feedstock modeling through lumping (refinery technique)