

## Faculty of Science and Engineering

### Profile report: Separation Processes and Sustainable Chemical Engineering

[NL: Scheidingsprocessen en Duurzame Chemische Technologie]

Discipline: Chemical Process Engineering, Separation Processes, Engineering  
Thermodynamics  
Level: Assistant Professor  
Focus: Education  
Fte: 0.8-1.0 fte

#### 1. Scientific discipline

The chemical industry is swiftly adopting sustainable practices through the incorporation of green chemistry and engineering principles, and the utilization of renewable raw materials to develop eco-friendly chemical processes. Within the realm of chemical engineering, separation processes play a vital role in sustainable process design, with the aim of achieving optimal separation efficiency while minimizing energy usage, waste production, and negative environmental impact. The separation processes are critical in the chemical industry, often accounting for a significant portion of the equipment in both upstream and downstream processing. For instance, in the context of a sustainable future based on renewable resources, effective separation of valuable starting materials from biomass is crucial, such as the cascading biorefinery concept.

#### 2. Vacancy

This position is opened by the board of the Faculty of Science and Engineering (to be added) and will be embedded in the Engineering and Technology institute Groningen (ENTEG), in the cluster Chemical Engineering. The position falls within the framework of the faculty's career system [Career Paths in Science and Engineering](#). As the focus domain of the position is education, the criteria of the career path with a focus on education apply. Please see the link for more information.

#### 3. Selection committee (BAC)

- Prof.dr. G.J.W. Euverink, Professor of Products and Processes for Biotechnology in the Biobased Economy, Educational director, ENTEG
- Prof. dr. B. Jayawardhana, Professor of Mechatronic and Control of Nonlinear Systems, Scientific director, ENTEG;
- Prof. dr. ir. H.J. Heeres, Professor of Green Chemical Reaction Engineering, ENTEG;
- Prof. dr. R. Bose, Associate Professor of Polymer Engineering, programme director BSc Chemical Engineering, ENTEG
- Prof. Dr. M. Ghanchi Tehrani, professor of Dynamics and Vibration, programme director Msc Mechanical Engineering ENTEG
- Prof. dr. Andrea Pucci, Professor of Industrial Chemistry, University of Pisa
- student (tbd)

Advisors:

- Dr. ir. J.G.M. Winkelman, Director EngD Sustainable Process Design
- Dr. P. Karka, assistant professor in Sustainable Process Design, ENTEG
- Prof. dr. F. Picchioni, Professor of Product Technology, ENTEG
- F. Salverda, HR advisor, ENTEG
- Dr. K.E. Voskamp, Scientific coordinator, ENTEG

#### **4. Area of expertise**

Separation processes play a crucial role in sustainable chemical engineering as they enable the extraction, purification, and recovery of valuable chemicals and resources from complex mixtures. One of the primary goals of sustainable chemical engineering is to minimize the use of non-renewable resources and reduce the production of hazardous waste. Separation processes can achieve these goals by enabling the recovery of valuable materials from waste streams and reducing the amount of waste generated.

In addition, separation processes can help to increase the efficiency of chemical processes by enabling the recovery of valuable byproducts and reducing the amount of energy required for purification. By optimizing separation processes, chemical engineers can reduce the environmental impact of chemical production while also improving the economic viability of industrial processes.

Overall, separation processes are critical for sustainable chemical engineering as they allow the recovery of valuable materials, reduction of waste, and increased efficiency in chemical processes. By prioritizing separation processes, chemical engineers can contribute to the development of sustainable and environmentally-conscious industrial processes.

The design of such processes requires new knowledge and strategies, which need to be conveyed to our students. The current position is meant to modernize, in terms of teaching and assessing methods, our existing learning lines and develop new advanced courses related to separation processes in green and sustainable chemical processes. Educational activities are in the new Engineering Doctorate (EngD) programme, and in the Bachelor and Master programmes of Chemical Engineering and Industrial Engineering and Management.

#### **5. Embedding: institute (and base unit)**

The research institute ENTEG ([www.rug.nl/enteg](http://www.rug.nl/enteg)) is the engineering science and technology institute of the Faculty of Science and Engineering of the University of Groningen. ENTEG research is highly multidisciplinary in nature and focuses on fundamental and engineering research on the development of new and innovative processes and products. The aim is to contribute to the smart and circular society. The research of ENTEG is conducted in three key research domains:

- Sustainable chemical engineering & biotechnology;
- Mechanical, materials & robotics engineering;
- Optimization, systems & control.

The new position will strengthen the teaching and research activities of the Chemical Engineering cluster. Depending on the experience and research interests of the candidate, the position will be embedded either in the basic unit Product Technology (PT), Green Chemical Reaction Engineering (GCRE), or Products and Processes for Biotechnology in the Biobased Economy (PPBBE). These units typically consist of 1 or 2 full professors, accompanied by associate professors, tenure track assistant professors and a team of PhD-students and

postdoctoral fellows. The staff is strongly linked to the new EngD programme and the degree programmes in Chemical Engineering and Industrial Engineering and Management.

Research of the basic units PT, GCRE and PPBBE has a pivotal role in industrial projects within the renewable carbon domain. It is focused on the development of highly intensified thermal and catalytic reactor technology, of renewable products such as fuels and chemicals, and of biotechnological processes in the biobased economy. The research includes CO<sub>2</sub> purification and usage in new processes, pseudo-chemical separation in bio-cascading such as the production of aromatics from lignin sources, and thermodynamics and phase equilibria of complex systems.

The staff of the PT, GCRE, and PPBBE units is the core teaching staff for the EngD programme, and the Bachelor and Master programmes in Chemical Engineering and in Industrial Engineering and Management (track Sustainable Process Engineering (SPE)). The candidate is expected to be involved in both degree programmes and the EngD programme, and as such will be involved in hard-core process design activities.

## **6. Local and (inter)national position**

An EngD is a specialized postgraduate degree emphasizing design-oriented engineering, tailored to address industry and societal demands for innovation in products, processes, and systems. The Sustainable Process Design EngD is comparable to two programmes of other (technical) Dutch universities: Process and Equipment Design (TUDelft) and Process and Product Design (TU/e). Compared to these programmes, the EngD programme at the University of Groningen is embedded in a large classical research university with expertise across all relevant fields, such as economics, social sciences, environmental sciences, and law, ensuring a well-rounded and interdisciplinary approach to problem-solving. This can be especially important when addressing complex and interconnected issues related to sustainability in industry. Internationally similar programmes exist. They all typically focus on applying advanced technical knowledge to practical technological issues, driving innovation in industry and society, comparable to the Dutch EngD programmes.

In addition, the research activities of the Chemical Engineering units within ENTEG have a by far stronger chemistry/catalysis flavour than those of comparable research groups in the technical universities in the Netherlands offering a unique opportunity for the development of integrated sustainable separation processes.

## **7. Expected contributions to education**

The candidate will, at the level of Assistant Professor, contribute 60% of his/her time to education. More specifically, besides the actual lecturing, the candidate is expected to take a leading role in innovating the teaching, setting up courses, and assessment methods for courses such as:

- Advanced Separation Processes (EngD)
- Advanced Thermodynamics (EngD)
- Separation Processes (BSc CE)

However, in the longer term, we certainly do not expect the candidate to be limited to just these areas of the curriculum. The candidate is expected to critically evaluate the current teaching and assessment methods and potentially develop more modern approaches, incorporating elements such as groups work, modelling, and hybrid (combining online and onsite) teaching methods, thus aligning with industrial best practices. In addition, the

candidate is also expected to develop new courses and supervise projects for the EngD programme.

#### **8. Expected contributions to research**

The candidate will, at the level of Assistant Professor, contribute 30% of his/her time to set up a research line with a focus on sustainable separation processes within either the GCRE, PT, or PPBBE unit, related to the ongoing activities in this unit. The embedding ensures that the teaching activities are informed by relevant and state-of-the-art research, contributing to cutting-edge advancements in the field. This includes translating relevant research activities into separation processes and related elements of the relevant educational programs, as well as supervising bachelor and master students in courses with research elements, and supervision of EngD and PhD students.

Several industrial partners are already collaborating with the research unit staff on related topics, which is highly attractive from an industrial perspective and especially beneficial for the chemical clusters in the North of the Netherlands (Eemshaven/Delfzijl and Emmen). The candidate is expected to enhance these industrial partnerships and bring a “sustainability”-oriented viewpoint to various existing and upcoming projects.

#### **9. Expected contributions to the organization**

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. The candidate will furthermore contribute to the organization of the faculty, for example by participating in working groups and committees, in the domains of education, research and management. The candidate will contribute to relevant organizational activities on the national and international level.