A Technology Opportunity of the University of Liège

Continuous-flow process for the production of polyethylene glycol

Polyethylene glycol (PEG) is a hydrophilic polyether compound commonly used for various purposes (thickening agent, lubricant, excipient, ...) in cosmetics, personal care products, pharmaceuticals, inks and food industry. PEG is industrially produced by polymerizing ethylene oxide at high temperature and high pressure. The production method is based on macroscopic batch processes which come with various shortcomings (poor mixing,…) ultimately accounting for low productivity, quality deficiency and poor flexibility. Besides, a high chemical risk is associated with classical large scale batch processes, especially as ethylene oxide, a highly reactive, toxic and explosive gas is involved.

Description

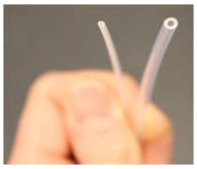
The technology relates to a new scalable, efficient and intensified **continuous-flow process in micro/mesofluidic reactors for the production of polyalkylene oxides such as polyethylene glycol**. The invention provides a safer and cost effective solution by allowing faster polymerization rates at lower temperatures and lower pressures by comparison to the current batch procedures used in industry.

Microfluidic reactors

Channel Ø: 100 µm
V_{int}: 100s µL

-Explore and develop chemistry
-Optimize reaction (R&D)

Mesofluidic reactors



Channel Ø: 800-1000 µm
V_{int}: up to 10+mL

- Pilot and production
- Up to 3500 t/y production

Advantages

- overcomes the shortcomings of the batch processes :
  - better mixing and heat transfer
  - better control over the reaction conditions
  - improved yield production
  - product with a constant quality and purity profile
  - fast scaling up
- production at low temperature (0-100 ° C) and low to moderate pressure (0-20 bar)
- accurate control over molecular weights and molecular weight distributions
- accurate control over chain ends functionality
- safer process (reduced risk of explosions)
- faster process (< 60 minutes)
- cleaner process (minimal footprint)

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Potential Applications

The patented technology consists in a safer and cost effective alternative to produce tailor-made polyethylene glycol (PEG), or to manufacture other polyalkylene oxides such as polypropylene glycol (PPG) or polybutylene glycol (PBG).

Patent Status

Patent application pending.

Research Team

This technology has been developed by Jean-Christophe Monbaliu's team, from the Center for Integrated Technology and Organic Synthesis (CiTOS) at the University of Liège (ULg).

The Center for Integrated Technology and Organic Synthesis is a multidisciplinary team with research interests around synthetic organic chemistry, with a particular focus on continuous flow processes for the preparation of high value-added chemicals.

Jean-Christophe Monbaliu completed his PhD thesis at UCL (Belgium). After a first Postdoctoral position at the University of Ghent in Belgium (2008-2010), he joined the Center for Heterocyclic Compounds at the University of Florida in Gainesville (USA). In 2012, he was appointed at the Massachusetts Institute of Technology (MIT) in Cambridge, MA. During his postdoctoral experiences, he studied chemical engineering and became a specialist in the application of microfluidics to organic chemistry. In 2013, he came back to Belgium, and settled at ULg where he created the Center for Integrated Technology and Organic Synthesis (www.citos.ulg.ac.be). He has published several papers related to the continuous manufacturing of active pharmaceuticals, among which a seminal work was recently published in Science.

Opportunities

Research collaboration and/or license agreement

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- ❑ I am interested in learning more about the general aspects of this technology. Please contact me.

The best time to reach me is: _____

- ❑ I would like an electronic version of this technology.
- ❑ I would like to learn more about the specifics of this technology and would be wiling to complete a Confidential Disclosure Form in order to discuss it further.
- ❑ I am not interested in this technology because: _____

_____

_____

- ❑ I am not interested in this technology but would be interested in learning more about (please specify): _____

_____

Name: _____

Title: _____

Company: _____

Address: _____

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