

Process to Manufacture Branched Caprolactone

IP Status: Pending US Patent; Application #: 16/562,971

Two-stage process manufactures methyl-ɛ-caprolactone (MCL)

A cost effective, new two-stage chemical process manufactures methyl-ɛ-caprolactone (MCL) from cresol, a fossil or bio-renewable feedstock. Details for designing a process optimized for net present value (including unit operation design of two reactors, distillation and integrated heat transfer) were determined via process simulation. The two-reaction process first hydrogenates cresol to methyl-cyclohexanone, which is then followed by Baeyer-Villiger oxidation to MCL. Improvements in overall selectivity via catalytic performance of the Baeyer-Villiger oxidation catalyst boost the overall economics of the process, rendering it a low-cost process broadly applicable to multiple classes of alkyl-phenol feedstocks. The novel process can manufacture MCL for use in polymer/plastics.

MN-IP Try and Buy

- Try
- Trial period is up to 6 months
- Trial fee is \$5,000 for six months
- Trial fee is waived for MN companies or if sponsoring \$50,000+ research with the University
- No US patent expenses during trial period

Buy

- \$25,000 conversion fee (TRY to BUY)
- Royalty rate of 3% (2% for MN company)
- Royalty free for first \$1M in sales

Combines all reaction, separation and purification operations

Polymers related to poly-ε-caprolactone (PCL), which have many biomedical and industrial field applications, could be derived from biobased starting materials, but the challenge has been finding a cost effective route to the starting monomer. This new process uses already-existing chemistry in a brand new way, putting all reaction, separation and purification operations together in a cost-competitive manner. The result is a high yield and inexpensive method of producing 4-methyl-ε-caprolactone (and other alkyl caprolactones) from lignin or petroleum-based starting materials.

Phase of Development

Technology ID

2019-011

Category

Engineering & Physical Sciences/Chemicals Engineering & Physical Sciences/Materials Engineering & Physical Sciences/Sustainable Technology

View online page



• Proof of concept. Simulation models with technical description of chemical process conditions and unit connectivity with economic analysis.

Benefits

- Low-cost process; potential for extremely lucrative chemical product
- High process yield potential
- Broadly applicable to multiple classes of alkyl-phenol feedstocks
- Aspen model based technoeconomic analysis available

Features

- Manufactures methyl- ϵ -caprolactone (MCL) (and other alkyl caprolactones) from biobased cresol, lignin or petroleum based starting materials
- Two-stage chemical process
- Baeyer-Villiger oxidation catalyst improves overall selectivity
- Combines all reaction, separation and purification operations together

Applications

- Chemicals/polymers
- Caprolactone
- Monomers
- Methyl-e-caprolactone (MCL) manufacture

Researchers

Paul Dauenhauer, PhD Associate Professor, Chemical Engineering Materials Science External Link (www.cems.umn.edu) Marc Hillmyer, PhD Professor, Department of Chemistry External Link (chem.umn.edu)

Publications

<u>Techno-Economic Analysis of a Chemical Process to Manufacture Methyl-ε-Caprolactone</u> from Cresols

ACS Sustainable Chem. Eng., Publication Date (Web): September 28, 2018

Interested in Licensing?

The University relies on industry partners to scale up technologies to large enough production capacity for commercial purposes. The license is available for this technology and would be for the sale, manufacture or use of products claimed by the issued patents. Please contact us to share your business needs and technical interest in this technology and if you are interested in licensing the technology for further research and development.