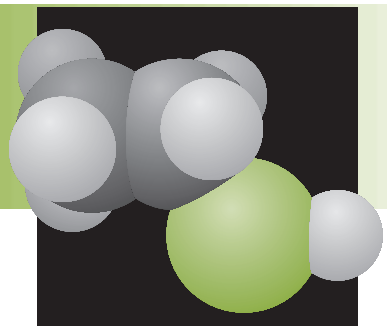
CHEMICALS
Project Fact Sheet



Novel Membrane-Based Process for Producing Lactate Esters - Nontoxic Replacements for Halogenated and Toxic Solvents

Benefits

- Cuts the cost of lactate esters in half
- Potentially replaces 80 percent of 3.8 million tons of toxic solvents
- Energy savings of 101 trillion Btu in 2020
- Reduction in waste salt by 1.8 million tons annually
- Reduction in CO_2 emissions by 2.9 million tons per year

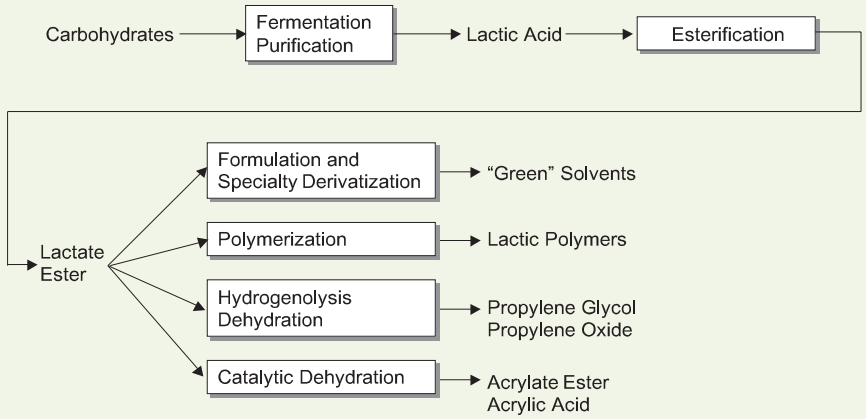
Applications

The market for lactate esters and derivatives is projected to surpass 11 billion pounds per year by 2020. The lactate esters produced using the new process will become economically viable alternatives to many chemical products ordinarily derived from petroleum. These may include packaging, biodegradable plastics, paints and paint strippers, grease removers, cleansers, aerosols, adhesives, and recycled paper products. If the solvent is used in semiconductor manufacturing, it could affect all products with computer chips.

Lactate Esters from Renewable Carbohydrate Feedstocks Can Replace Petroleum-Derived Solvents

Lactate esters are versatile solvents that are biodegradable, nontoxic, and applicable to a wide range of industrial and consumer uses. Until now, it was not economical to produce lactate esters for widespread use by industry. Research has been on-going to develop a technology for producing lactate esters from renewable feedstocks. Industry will improve its environmental performance by replacing the toxic solvents it ordinarily uses in various processes with the "green" solvents available using this new technology. These lactate esters are also building blocks for industrial production of polymers and commodity chemicals, so this production method will reduce the use of petroleum as a feedstock. The new process for converting carbohydrate feedstocks to lactate esters is also energy efficient and cost effective.

Lactate Ester Production



Solvents, oxychemicals, and polymer feedstocks are produced from carbohydrate-derived lactate ester.

Project Description

Goal: To further develop a novel process for using renewable carbohydrates as feedstocks to produce non-toxic, environmentally benign solvents that can replace petroleum-derived toxic solvents.

Researchers at Argonne National Laboratory (ANL) have developed a membrane-based, cost-effective, proprietary process for producing lactate esters. This technology combines fermentation with esterification to chemically convert bio-based feedstock to lactate esters. Through advances in electrodialysis and pervaporation, the process overcomes the major technical hurdles of (1) salt formation, (2) product purity; and (3) undesired by-product formation.

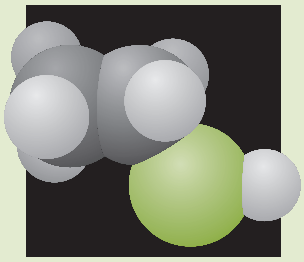
Future tasks, to be funded by the industrial partner and other sponsors, will focus on commercializing the lactate ester process, developing novel applications of lactate ester solvents, and developing technologies for converting ethyl lactate into large-volume oxychemicals.

Progress and Milestones

- An electrodialysis-based purification process was developed to recover and purify lactic acid without generating waste salt.
- Laboratory development of the acid esterification process for lactate ester production was completed in 1996.
- The pilot-scale integration of the process was successfully completed in 1997, and a highly pure ethyl lactate product was obtained.
- The first commercial plant will be a small demonstration plant of about 10 MM pounds per year, added to a large industrial complex.

Awards and Patents

- 1998 Presidential Green Chemistry Challenge Award.
- 1998 Discover Magazine Award for Technology Innovation - Environment.
- Tsai, S.P., S.H. Moon, and R.D. Coleman. 1995. Fermentation and Recovery Process for Lactic Acid Production. U.S. Patent 5,464,760.
- Tsai, S.P. 1997. Electrodialysis-Based Separation Process for Salt Recovery and Recycling from Waste Water. U.S. Patent 5,645,703.
- Datta, R., and S.P. Tsai. 1998. Esterification of Fermentation-Derived Acids via Pervaporation. U.S. Patent 5,723,639.



Project Partners

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