Efficient and Selective Upcycling of Polyethylene to Alkylbenzenes under Moderate Hydrogen Pressure

Tech ID: 33229 / UC Case 2023-99M-0

BACKGROUND

Polyethylene (PE) is the most commonly used plastic material in the world with a global market volume of over 100 million tons per year. This material is also well-represented among the plastics that are fueling a global pollution crisis, which has motivated a significant effort toward recycling discarded polyethylene. A solution that upcycles polyethylene into something of higher value would be especially compelling. Polyethylene can be converted into valuable alkylaromatics, a feedstock for detergent manufacture, through catalytic partial depolymerization conducted under an inert atmosphere of nitrogen or argon. While this concept is promising, there is room for improvement in its slow reaction kinetics and low alkylbenzene product yields.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a polyethylene upcycling technique that offers high yields of valuable alkylbenzene compounds at accelerated reaction times under moderate hydrogen pressure. The use of moderate hydrogen pressure (which can itself be recycled, since very little is consumed in the process) in combination with a bifunctional catalyst with strong acidity enhances the selectivity of alkylbenzenes relative to polyaromatic compounds (which are environmental pollutants) resulting from the catalytic depolymerization of the plastic waste. This technology could make polyethylene recycling more cost-effective and efficient, signaling a commercially viable and sustainable solution to the formidable problem of plastic waste.

ADVANTAGES

- Produces high yields of valuable alkylbenzene compounds, the immediate precursors to alkylbenzene sulfonate surfactants
- Accelerates conversion times using moderate hydrogen pressure which is sparingly used and is itself recyclable
- Enhances selectivity of alkylbenzenes relative to polluting polyaromatic compounds

APPLICATIONS

- Industrial Chemistry
- Chemical Cecycling

PATENT STATUS

Patent Pending

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OTHER INFORMATION

KEYWORDS

Efficient upcycling, Selective upcycling, Polyethylene to alkylbenzenes, Moderate hydrogen pressure, Catalytic depolymerization, High yields of valuable alkylbenzene compounds, Bifunctional catalyst, Enhanced selectivity, Accelerated reaction times, Cost-effectiveness, Sustainability, Plastic waste recycling, Polyaromatic compounds reduction, Commercial viability

CATEGORIZED AS

- **Environment**
  - Other
- **Materials & Chemicals**
  - Chemicals

RELATED MATERIALS

- Polyethylene upcycling to long-chain alkylaromatics by tandem hydrogenolysis/aromatization - 10/23/2020

- Polymers

RELATED CASES

2023-99M-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Catalytic Upcycling Of Hydrocarbon Polymers To High Value Unsaturated Compounds

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