



Ultra-High Yield Para-Xylene from Biomass-Derived 2,5-Dimethylfuran

P-Xylene from Biomass Feedstocks

A new series of phosphorous-containing solid catalysts produces ultra-high yields of p-xylene by suppressing competing side reactions. Among them, phosphorous-containing BEA zeolite (P-BEA) with 12 membered-ring (12 MR) structures and phosphorous-containing self-pillared pentasil (P-SPP) zeolite nanosheets with 10 MR exhibit exceptional activities up to 97% yield of p-xylene at 99% conversion of DMF. The Diels–Alder cycloaddition of 2,5-dimethylfuran (DMF) and ethylene and the subsequent dehydration of the cycloadduct intermediate is an attractive reaction pathway to produce renewable p-xylene from biomass feedstocks. Passing the Diels–Alder cycloaddition product of ethylene and DMF over this catalyst technology, a conversion rate of 97% can be achieved. The renewable p-xylene produced is an important precursor for production of PET and other related plastic materials.

Higher Yields at Potentially Lower Costs

Recent advances using Diels–Alder reactions for producing renewable aromatics (including p-xylene, toluene, benzene and other aromatic derivatives) could not exceed a 75% p-xylene yield. The phosphorous-containing solid catalysts in this technology produced p-xylene yields of up to 97%. Using ethylene (the most highly produced petrochemical) with DMF (which can be derived from fructose) may provide a more economical method of para-xylene production. Furthermore, P-containing zeolite Beta is an active, stable and selective catalyst for this reaction. It can catalyze the dehydration reaction selectively without producing alkylated and oligomerized products, unlike Al-containing zeolites and other solid phosphoric acid catalysts. This unique aspect establishes a commercially attractive process for renewable p-xylene production.

BENEFITS AND FEATURES:

- Cost effective phosphorous-containing solid catalysts
- Ultra-high yield production of p-xylene
- No competing side reactions
- Renewable p-xylene

APPLICATIONS:

- Precursor for terephthalic acid used in the production of PET and other related plastic materials
- Beverage bottles, automotive, fibers for clothing and carpeting

Phase of Development - Prototype

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Publications

[*Renewable p-Xylene from 2,5-Dimethylfuran and Ethylene Using Phosphorus-Containing Zeolite Catalysts*](#)

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