Industrial & Engineering Chemistry Research
Vol 62/Issue 16
Article

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APPLIED CHEMISTRY April 11, 2023

Uncatalyzed Neutral Hydrolysis of Waste PET Bottles into Pure Terephthalic Acid

- Chizoom N. Onwucha
- Cyril O. Ehi-Eromosele*
- Samuel O. Ajayi
- Mareen Schaefer
- Sylvio Indris
- Helmut Ehrenberg

Abstract

Hydrolysis of waste polyethylene terephthalate (PET) into terephthalic acid (TPA) is a promising recycling method to manage this waste and can also serve as a feedstock for the re-production of PET. However, the drawbacks of this recycling method are the low degradation efficiency, complex/ecounfriendly separation of products, and low TPA purity. In this work, waste PET bottles were completely depolymerized using an uncatalyzed neutral hydrolysis, which was accompanied by a very simple solid product separation with no purification step. The influences of experimental parameters, such as hydrolysis time, the addition of ethylene glycol cosolvent, and the PET/water ratio on the TPA yield and purity, were investigated. Qualitative analyses showed that the solid product from the hydrolysis process was TPA, which was consistent with commercial purified TPA. The results showed that a long hydrolysis time, in the absence of any catalyst and a very high PET/water ratio, favored increased TPA yield, selectivity, and purity. The TPA yield increased from ~86 to ~98% as the hydrolysis time increased from 6 to 24 h. Furthermore, the TPA consisted of large particles and was easy to obtain without any complex extractive and purification processes. This facile and green approach for the depolymerization of waste PET to pure TPA with no isolation/purification steps promises a more efficient and inexpensive route for its full commercialization.

Subjects

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  - Hydrolysis

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Industrial & Engineering Chemistry Research
Cite this: *Ind. Eng. Chem. Res.* 2023, 62, 16, 6378–6385
https://doi.org/10.1021/acs.iecr.2c04117
Published April 11, 2023

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