

CHEMICAL RECYCLING OF PET WASTE BY ALKALINE HYDROLYSIS UNDER MICROWAVE IRRADIATION

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Abstract

Hydrolytic depolymerization of polyethylene terephthalate (PET) waste in alkaline solution using microwave irradiation as heating technique was investigated in order to obtain pure terephthalic acid in high yields.

Introduction

PET has become one of the most valuable recyclable materials because of the wide range of applications [1]. Although PET is a non-toxic material, its non-biodegradability and the large amount of waste is a serious problem concerning environmental pollution [2]. Therefore, recycling processes are the best option to economically reduce the amount of PET waste.

Experimental

Colorless post-consumer PET bottles were manually cut into small flakes, then washed and dried. 1g PET waste flakes and aqueous solution of NaOH (5-10 mL) were charged in high-pressure teflon reactors without stirring. The following microwave program was used: step 1 (preheating): 160°C, 5 min.; step 2: 160-220° C, time in the range 2-120 min.

Results and discussion

The influence of reaction time, temperature and the amount of alkaline solution on the TPA yield have been determined in order to establish the optimum parameters at which the reaction is completed. The reaction products were analyzed by using FT-IR spectroscopy, X-ray diffraction, scanning electron microscopy and NMR.

Conclusion

The use of microwave offers extremely short reaction time for complete degradation of PET waste as compared to the conventional heating. PET depolymerization was carried out completely for PET: alkaline solution ratio (w/v) of 1:10 after 5 minutes of reaction at 220°C, 20 minutes at 210 and 200°C, and 30 minutes at 190°C. TPA yield reached more than 98%.

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References

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