CATALYST SYSTEMS USED IN THE CHEMICAL RECYCLING OF PET

KORDSA

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INTRODUCTION

The production of plastics reached 380 million tons in 2018, which demonstrates the recently increasing demand for plastics [1]. Studies have estimated that if plastic consumption continues at this rate, 122 million tons plastic waste will be generated in 2050, which obviously indicates the importance of recycling. Since its waste is being created quickly on a global scale and starts to endanger the natural environment plastic should be recycled [2]. The driving force of PET recycling is that it is widely used in the world, does not deteriorate under normal conditions, and its products have a slow natural degradation rate. The main chemical recycling methods of PET includes glycolysis, hydrolysis and methanolysis [3].-Considering the high paced plastic consumption and the environmental issues caused by this situation, the chemical recycling of PET was carried out.

AIM

1. Literature research of the potential ways of chemical PET recycling methods
2. Compare the impacts on using different catalysts in chemical recycling approaches
3. Determine PET recycling methods that are convinent to apply and provide high yields of monomer products.
4. Industrial yarn production from monomers obtained from chemical recycling of PET.

METHOD

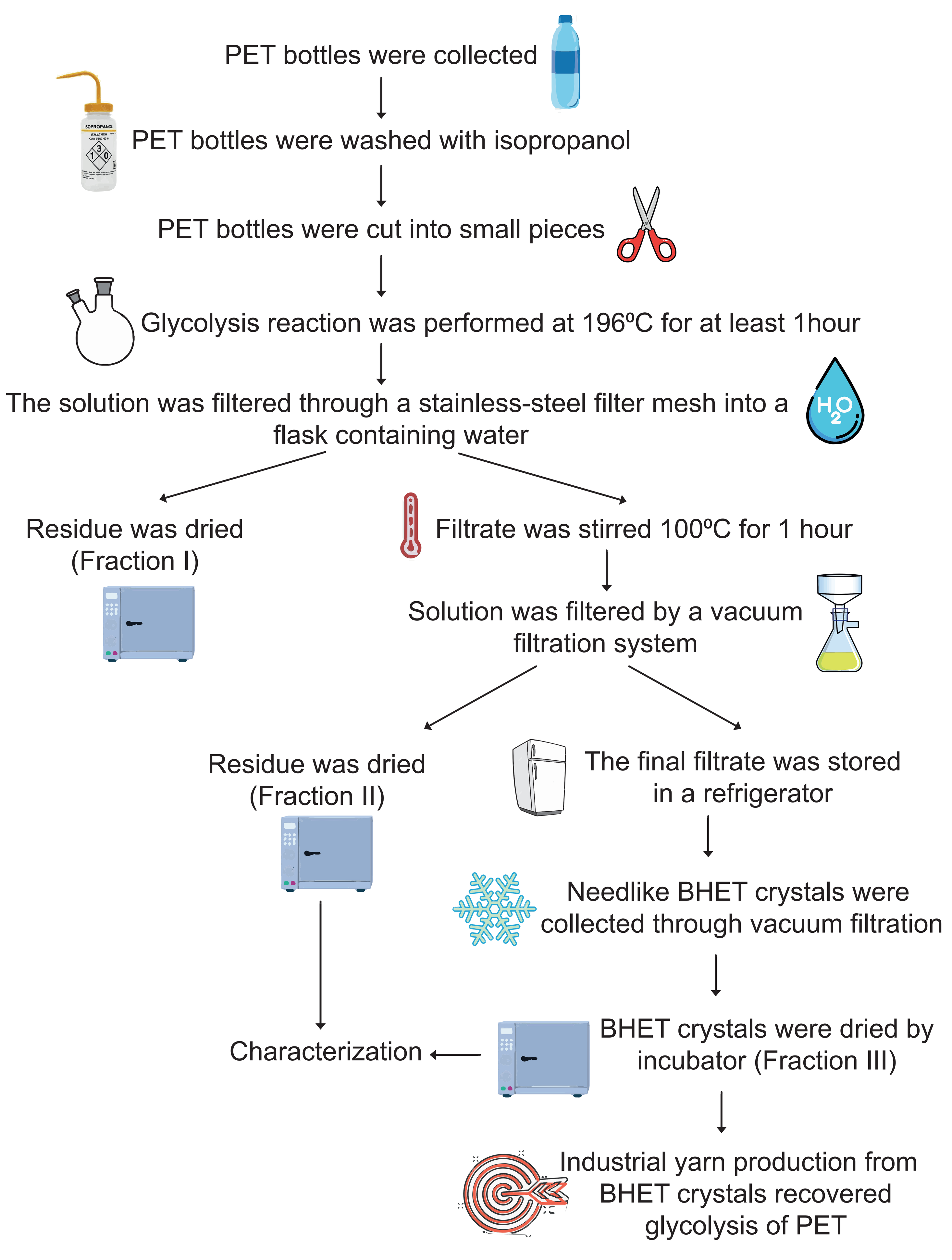


Figure 1. The overall methodolgy of the study.

Eight different experiments were conducted by using same methodolgy (SOP1-SOP8).The SOP1 and SOP6 experiment were conducted under conditions that give the highest yield as in the reference article [4]. In SOP2 and SOP5 the chemicals used in the SOP1 and SOP6 were doubled.SOP3 and SOP4 we used polyester yarn instead of PET and the amounts of chemicals were the same as SOP1 and SOP6.In SOP 7 and SOP 8, we used colored PET (green) instead of PET flakes and the amounts of chemicals were the same as SOP1 and SOP6.

RESULTS

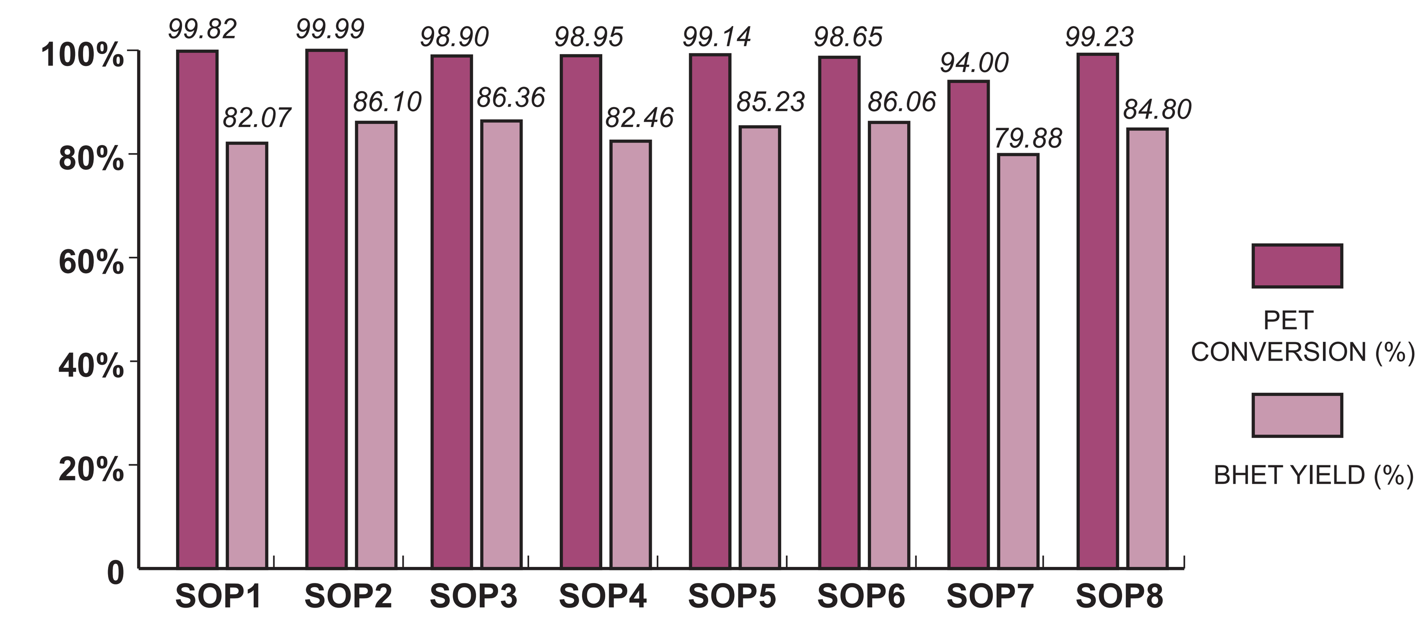


Figure 2. Percent of PET conversion and BHET yield.

We have conducted eight different experiments and the BHET yields we found for each experiment are 82.07%, 86.1%, 86.36%, 82.46%, 85.23%, 86.09%, 79.88%, 84.8% respectively.

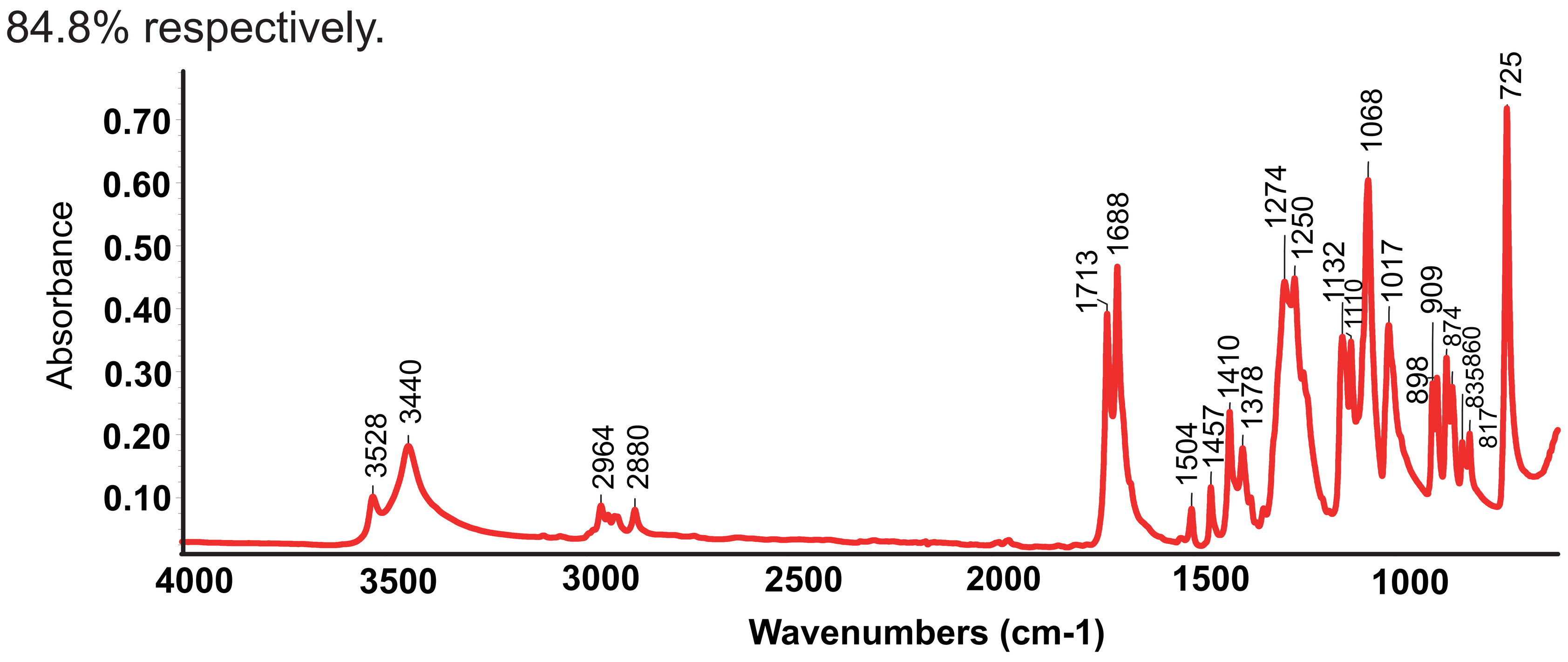
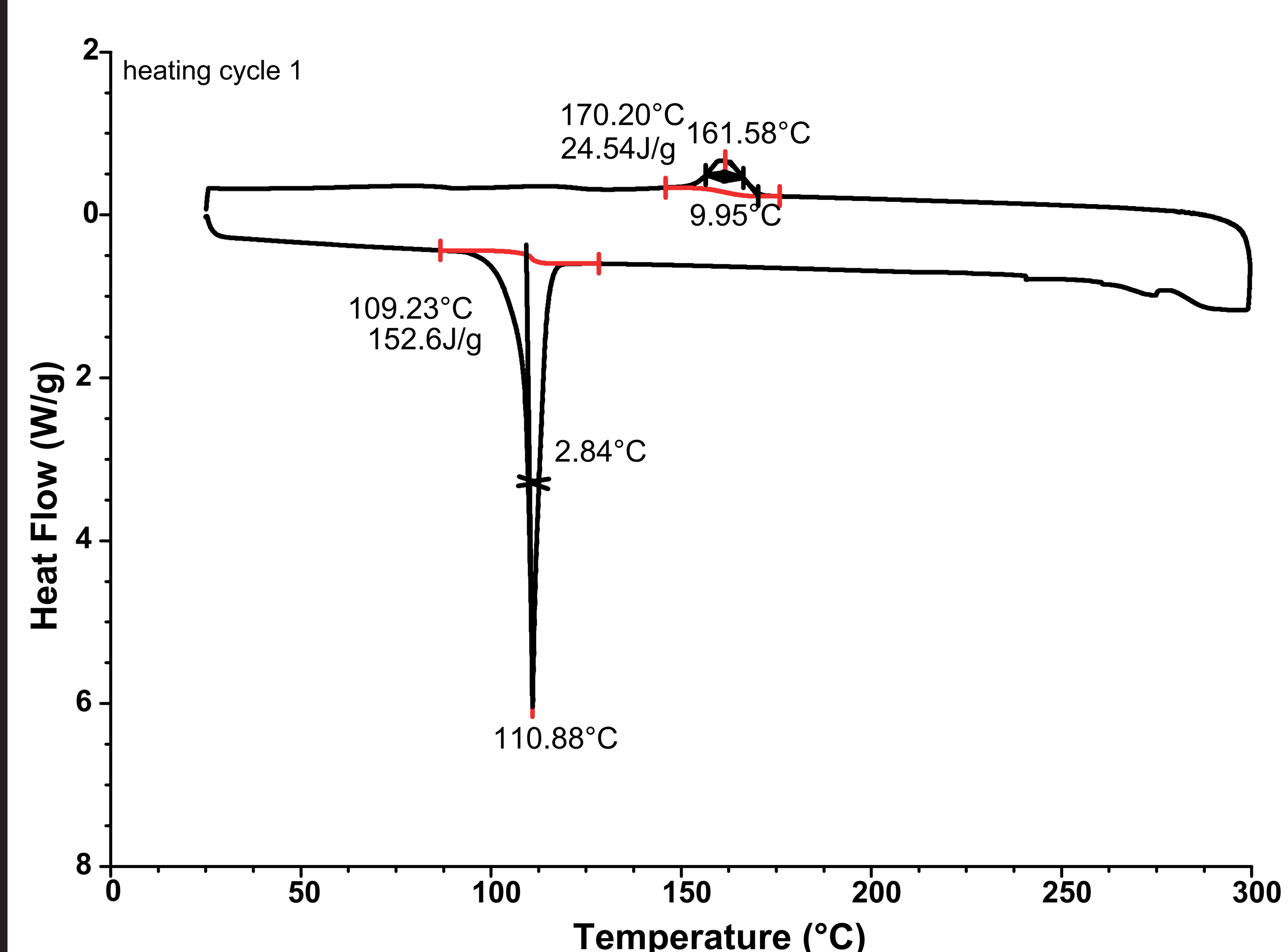


Figure 3.FTIR result of SOP1 Fraction III.

FTIR result of Fraction III demonstrates the absorption peak at 1713 cm-¹ representing the C=O stretching, two peaks at 1250 cm-¹ and 1110 cm-1 representing C–O stretching and peak at 3440 cm-¹ representing the –OH stretching.



DSC result demonstrates a sharp endothermic peak at 110ºC, which corresponds to the melting point of BHET.

Figure 4. DSC result of SOP1 Fraction III.

CONCLUSION

We performed PET glycolysis reactions and used zinc acetate as catalyst.We can only further evaluate SOP1 experiment, due to recent conditions and respectable BHET yield result (82.07%) of SOP1. We performed all desired characterization methods to SOP1 to utilize the purity of BHET and to determine the yarn production capacity which is last step of our project. SOP1 characterization results indicated us that we obtain pure BHET crystals successfully. The first step of the project was completed successfully.We believe that producing industrial yarn by using recycled PET is a new approach to chemical recycling and it can be very useful to protect the environment.

REFERENCES

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