# Methanolysis of PET using Ionic Liquid Catalyst

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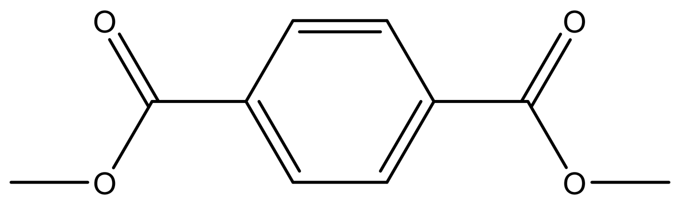
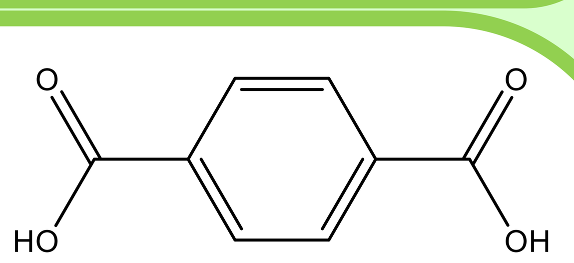
## 1. Introduction

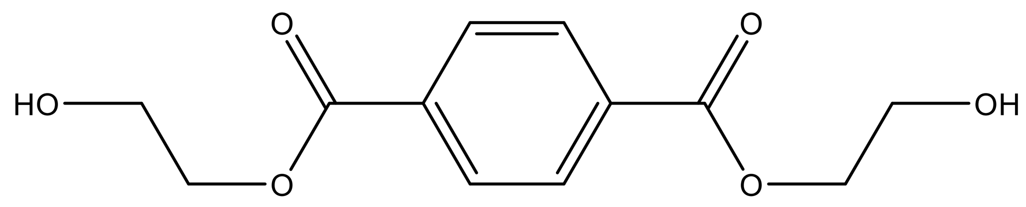
- PET can be chemically recycled into its monomers, dimers or oligomers. This can be done by a range of processes, our focus is methanolysis to produce DMT (dimethyl terephthalate), hydrolysis to produce TPA (terephthalic acid), and glycolysis to produce BHET (bis(2-hydroxyethyl)-terephthalate).
- The current mechanical recycling process results in weaker plastics which end up being unfit for use. Chemical recycling aims to restore plastic back to its monomer, so plastic use can be a closed loop system.



**Dimethyl terephthalate (DMT)**

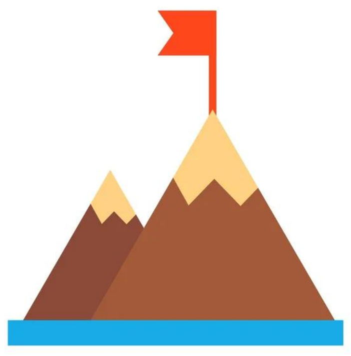


**Terephthalic acid (TPA)**



**Bis(2-Hydroxyethyl) terephthalate (BHET)**

## 2. Challenges and goals



- Energy intensive
- Burning in reactor
- Isolation of products
- Purity of products

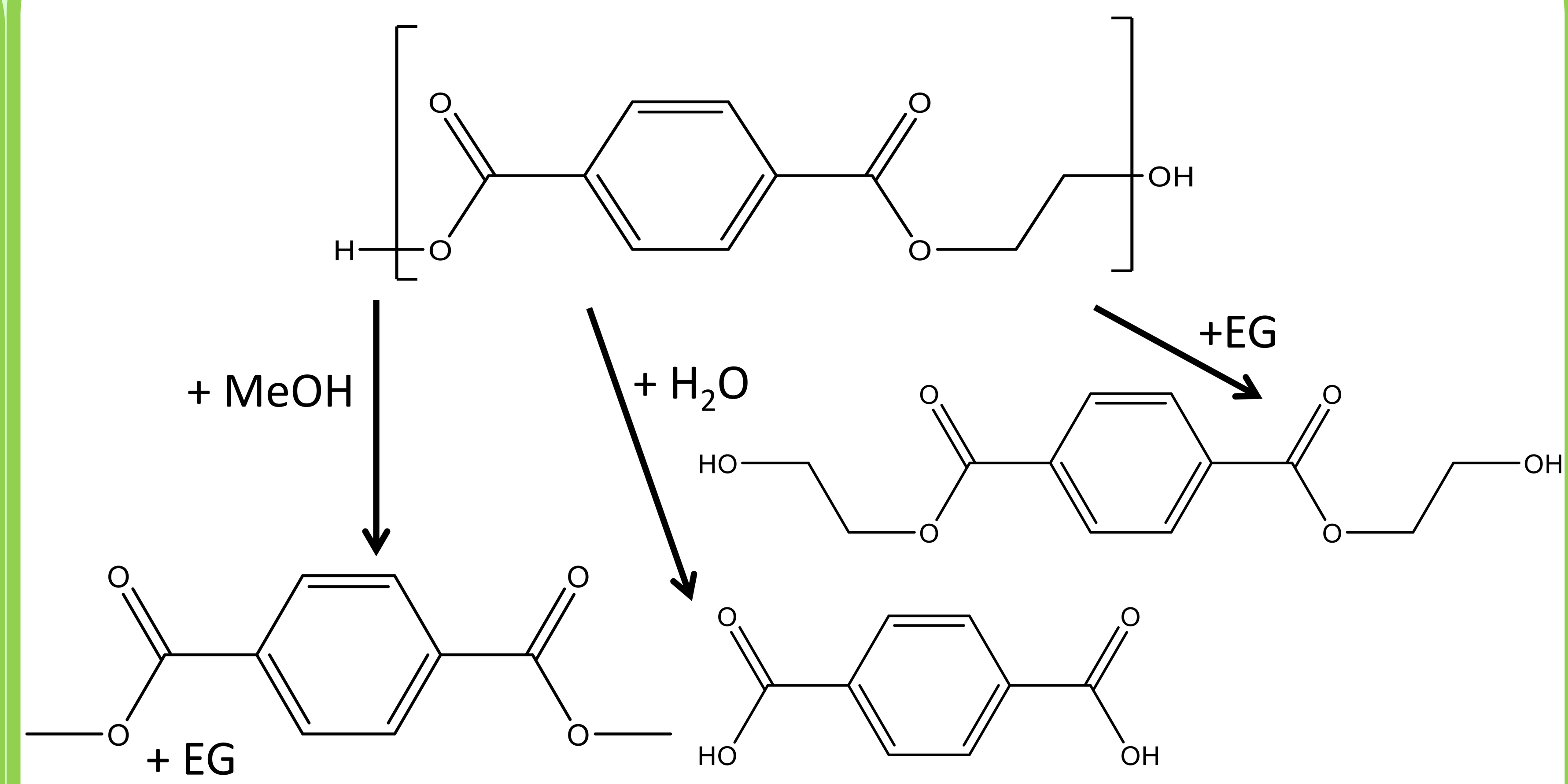
To determine the most efficient way to preform methanolysis, hydrolysis and glycolysis using $[HN_{222}][HSO_4].H_2SO_4$ and to determine the best way to extract the product.

**Benefits:**

Robust, cheap IL catalyst

Relationship between ILs and microwaves for efficient heating[1]

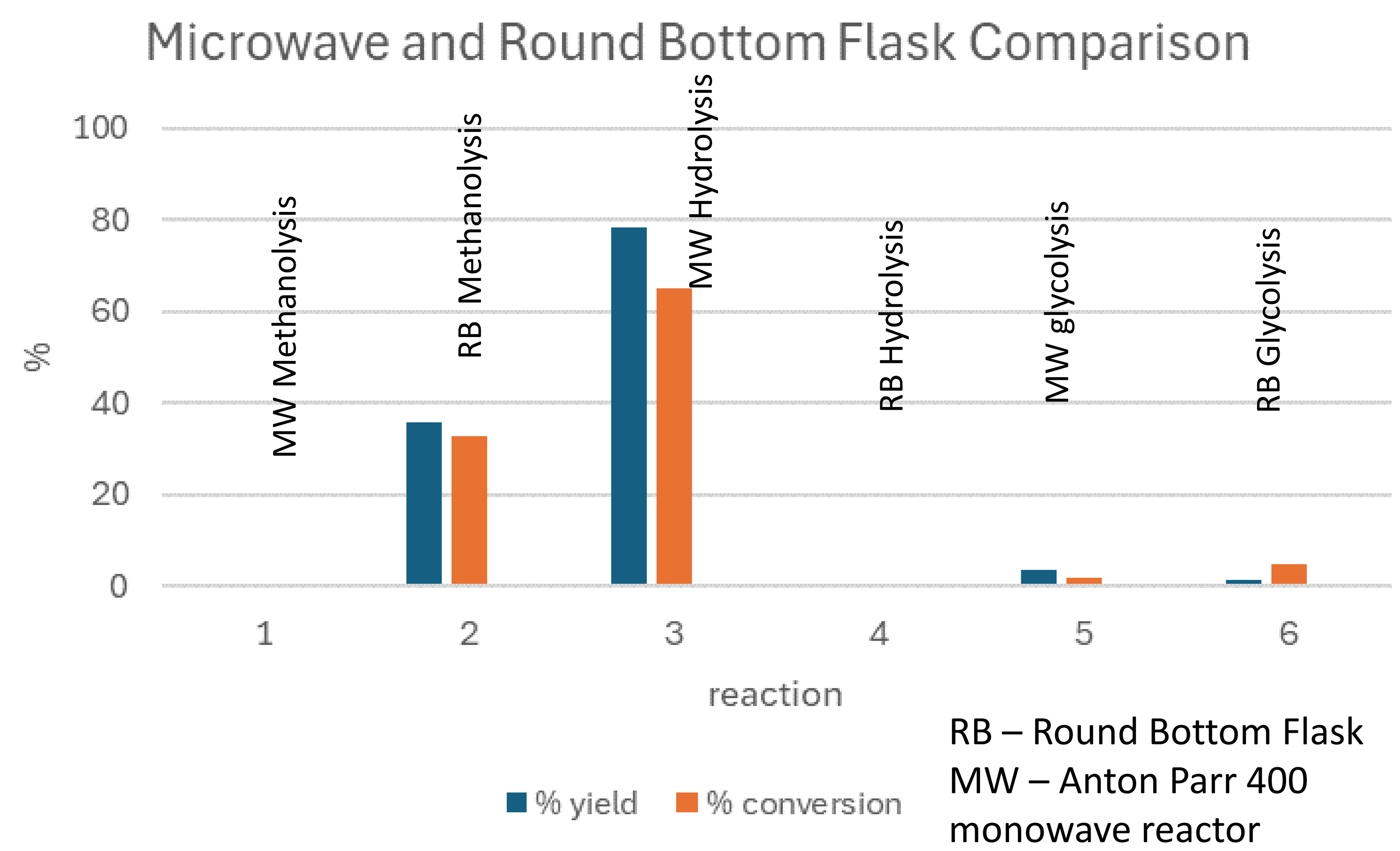
## 3. Reactions



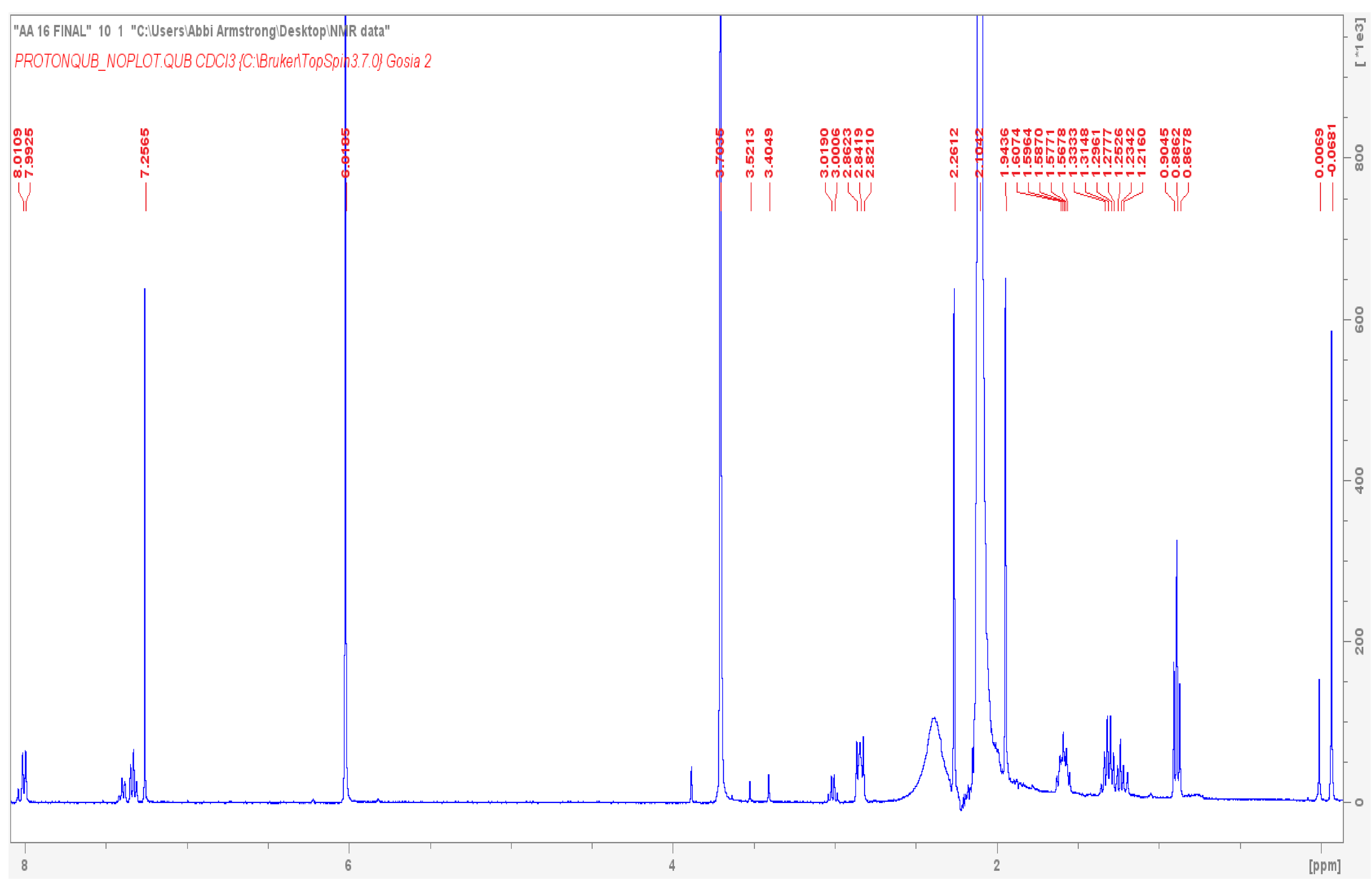

**$[HN_{222}][HSO_4].H_2SO_4$ Anton Parr 400 monowave reactor**
**EG – Ethylene glycol**

## 4. Results

1g PET, 3g $[HN_{222}][HSO_4].H_2SO_4$, 5g $H_2O$ / EG / MeOH, 3h 180˚C, (round bottom glycolysis conducted at 120˚ C due to burning)




RB – Round Bottom Flask
MW – Anton Parr 400 monowave reactor



$^1H$ NMR (400 MHz) $CDCl_3$

## 5. Conclusion and References

- The IL produces TPA at low catalyst loading using the Anton parr monowave 400 reactor
- The IL produces DMT at low catalyst loading when heated in a round bottom flask equipped with a condenser
- Successful analysis of product by NMR
- Future work could include investigating colours produced and further glycolysis methods

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1. *Chem. Rev.*, 2024, **124**, 2651–2698, Q. F. Yue, C. X. Wang, L. N. Zhang, Y. Ni and 2. Y. X. Jin, *Polym Degrad Stab*, 2011, 96, 399–403