

Room-temperature decomposition of PET

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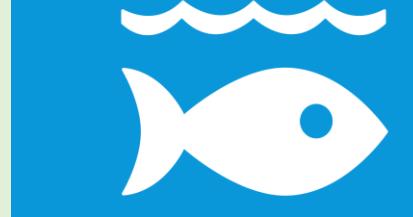
12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



1, Introduction

► Research Background

- Plastic → stay in nature (400~1000 years)
- Plastic disposal

Burning

Huge Cost

CO₂, NO_x

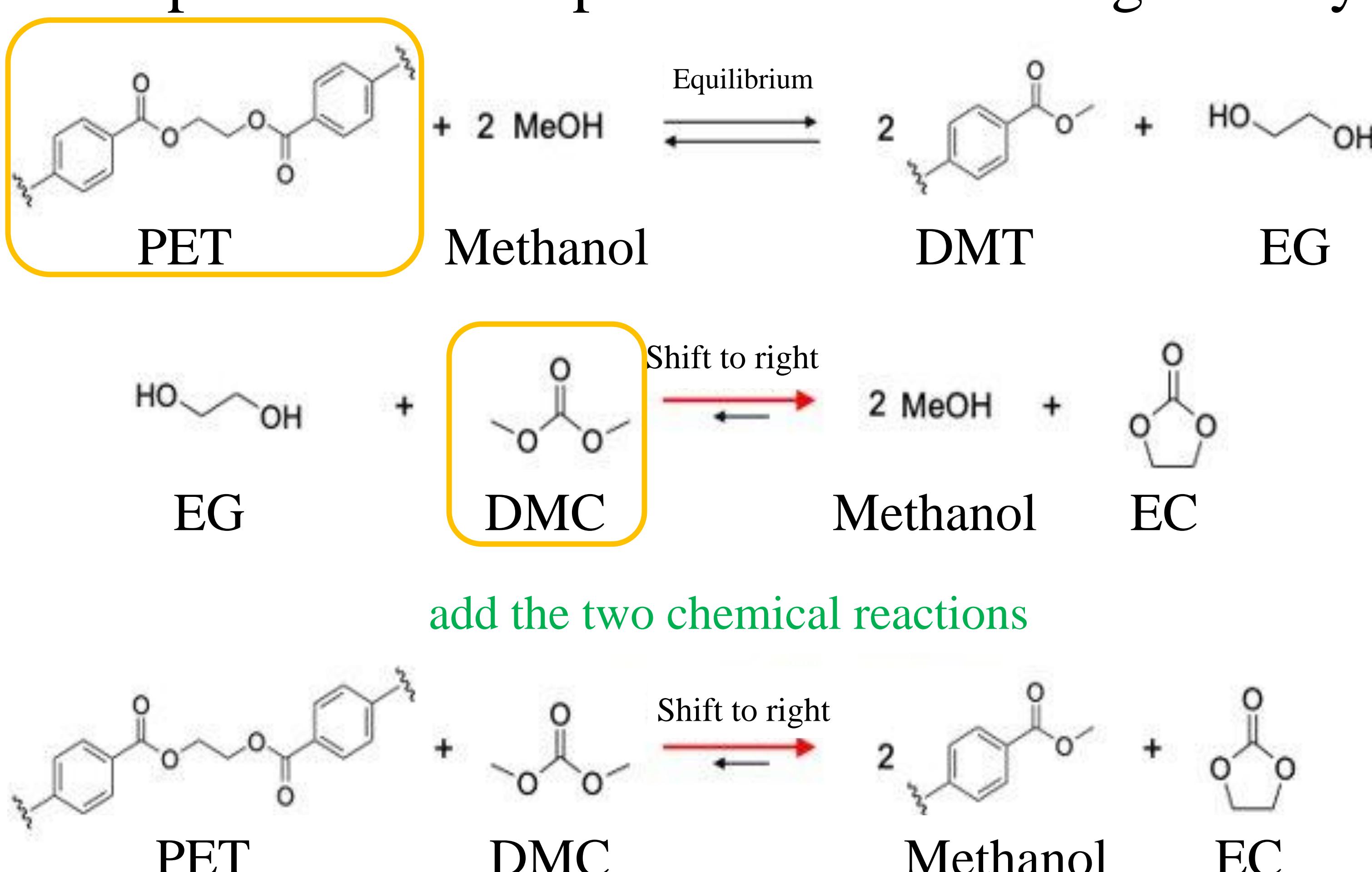
Thrown into the ocean (8M tons/year)¹⁾

Marine Pollution (Microplastic)

We need a,,,
Lower-energy Less-CO₂
method

► Previous Research

Room-temperature decomposition of PET using a catalyst²⁾



Our Difficulty → Low reproducibility

Research Objective

To explore { the causes of reaction failure
the possibility of decomposition of other polymers

2, Experiment 1 : Repeated experiments (about 25°C)

Materials

- PET bottle pieces: 4g
- Methanol: 27ml
- alkoxide catalyst(NaOMe): 2.3g
- DMC(Dimethyl carbonate): 200ml



► Result
1 success out of 3 tries

Low Reproducibility

Other factors may prevent this reaction

Shifted equilibrium based on Le Chatelier's principle

3, Experiment 2

Lower temperature (about 5°C)

Materials : same as Exp.1

► Result
No reaction

4, Experiment 3

Higher temperature (about 85°C)

Materials : same as Exp.1

► Result
No reaction

5, Consideration ~ Reason why the reaction wasn't promoted? ~

Temperature
to promote the reaction

But...

No effect was observed

Other reasons

1. Substances

- Methanol
- Stain of PET

2. Condition

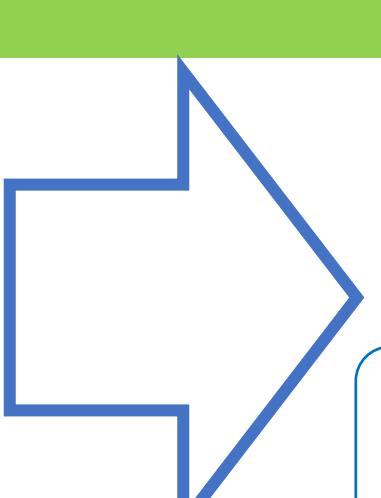
- Humidity

Solutions

Dehydrated methanol
Control conditions more strictly

6, Future challenge

- 1 To make this experiment successful
- 2 To Apply to other polymers>>(PEN,PEG,etc)



Innovative plastic recycling method

CO₂-free

Low-energy

= Sustainable

References

(1)ambeck, J. R., et al. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768–771.

(2)Shinji Tanaka et al(2021) Capturing ethylene glycol with dimethyl carbonate towards depolymerisation of polyethylene terephthalate at ambient. *Green Chem.*, 2021, 23, p9412–9416.