



# Engineering Polymers for a Beyond-the-bin Strategy to Recycle Mixed Plastic Waste



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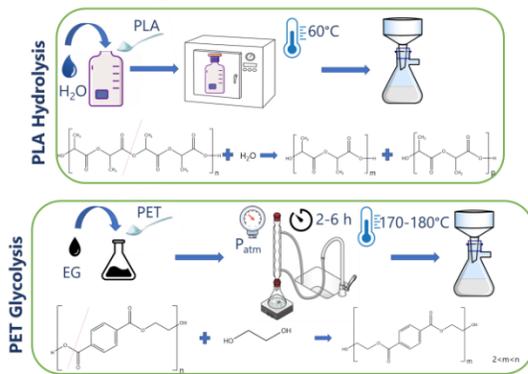
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## Introduction

PLA and PET slow degradation rates raise concerns regarding environmental pollution. Due to similar applications and properties, post-consumer PLA is anticipated to contaminate PET waste streams, causing hazing and degradation in rPET. Selective enzymatic depolymerization of PLA/PET mixtures is herein suggested as an innovative route for plastic waste separation and recycling.

## Experimental Part

### Chemical depolymerization



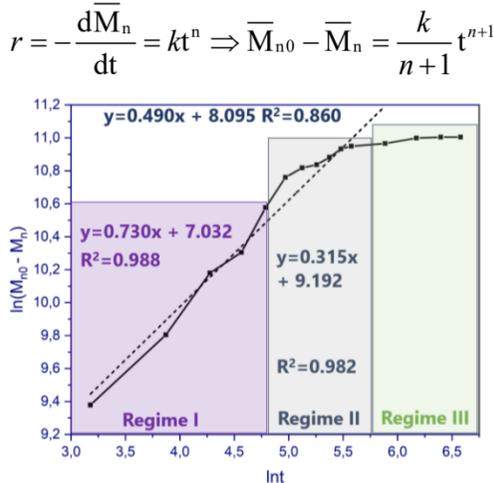
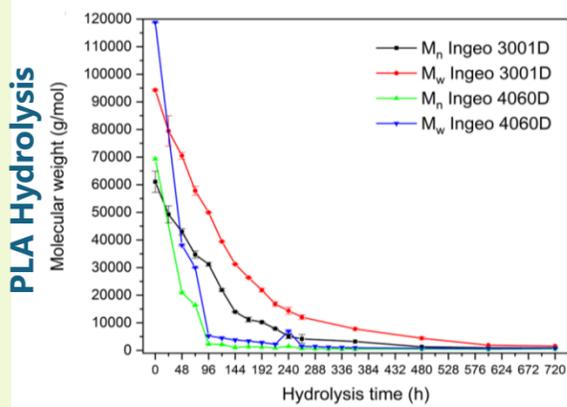
### Accelerated weathering

**QUV tester (ISO 4892-3)**  
Simulating

**Incubation in artificial seawater – ASTM D1141-98 (2021)**  
Simulating

## Results and Discussion

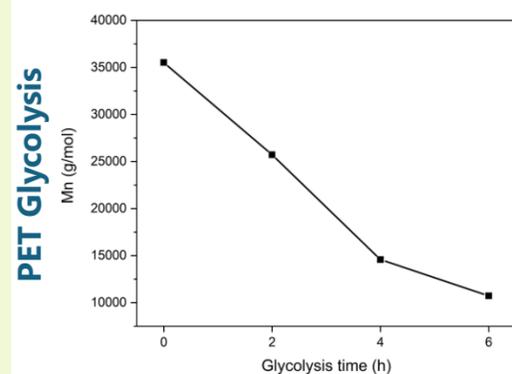
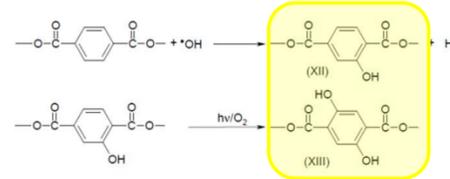
### Chemical depolymerization & kinetics



### Accelerated Weathering



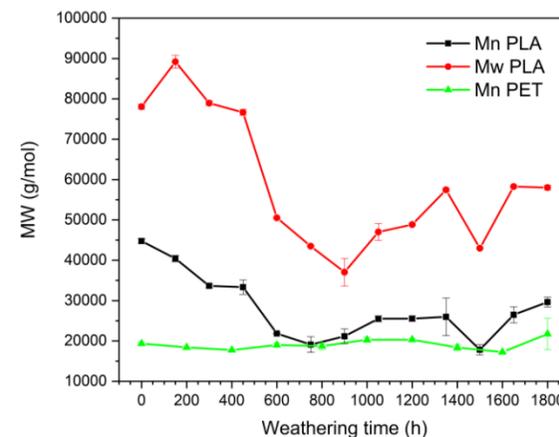
### PET photo-oxidation



Non- autocatalytic end-group models						
$n$	$k$ units	$1000k_{plot}$	$R^2$	$1000k_{mean}$	RSD (%)	$\Delta S^2$
0	meq/(kg h)	$1.1 \cdot 10^4$	0.970	$8.8 \cdot 10^3$	33.9	6.1
1	1/h	$2.1 \cdot 10^2$	0.985	$1.9 \cdot 10^2$	15.9	$1.8 \cdot 10^{-4}$

Power-law model						
$n$	$k$ units	$1000k_{plot}$	$R^2$	$1000k_{mean}$	RSD (%)	$\Delta S^2$
-0.13	kg/(meq h <sup>0.87</sup> )	4.87	0.960	4.89	10.1	$2.6 \cdot 10^{-10}$



## Conclusions

- Different PLA and PET waste models were prepared to simulate improper disposal:
- Kinetic models predicting the PLA and PET oligomers' molecular weight during hydrolysis and glycolysis were developed.
  - PET: susceptible to UV radiation during accelerated weathering, but no chain scission due to hydrolysis or photolysis.
  - PLA: susceptible to hydrolysis and photolysis, up to a critical value at 600 h of accelerated weathering.

## Acknowledgement

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