

Ionic liquid-mediated enzymatic polyethylene terephthalate degradation.

Holly Baker^{a,*}

^aUniversity of Western Australia, Perth, Australia

*23328055@student.uwa.edu.au

Cholinium-based ionic liquids and polyethylene terephthalate (PET) hydrolase enzymes (“PETases”) can both be used to degrade PET plastic.¹⁻³ However, PETase action is very slow, as the crystalline polymer structure is difficult for enzymes to interact with.⁴ Cholinium-based ionic liquids are biocompatible, and have been seen to increase enzyme thermostability and catalytic ability.^{1,5} They can also solubilize PET, reducing polymer crystallinity.⁶ This research integrates the PET-degradation ability of four cholinium-based ionic liquids – cholinium phosphate, cholinium glycinate, cholinium formate, and cholinium acetate – with the action of enzymes TurboPETase and LCC ICCG^{16M}, to determine whether synergistic degradation can be achieved. PET will be solubilized and degraded first using ionic liquid and microwave heating, and then undergo enzymatic degradation. This research will determine if increased degradation can be achieved via this combined method, offering a low-energy, environmentally benign PET degradation process.

References

1. Sun, J.; Liu, D.; Young, R. P.; Cruz, A. G.; Isern, N. G.; Schuerg, T.; Cort, J. R.; Simmons, B. A.; Singh, S. *ChemSusChem* **2018**, *11* (4), 781-792.
2. Wang, H.; Liu, Y.; Li, Z.; Zhang, X.; Zhang, S.; Zhang, Y. *European Polymer Journal* **2009**, *45* (5), 1535-1544.
3. Deng, B.; Yue, Y.; Yang, J.; Yang, M.; Xing, Q.; Peng, H.; Wang, F.; Li, M.; Ma, L.; Zhai, C. *Communications Biology* **2023**, *6* (1), 39.
4. Maurya, A.; Bhattacharya, A.; Khare, S. K. *Frontiers in Bioengineering and Biotechnology* **2020**, *8*, Review.
5. Bisht, M.; Mondal, D.; Pereira, M. M.; Freire, M. G.; Venkatesu, P.; Coutinho, J. A. P. *Green Chemistry* **2017**, *19* (20), 4900-4911.
6. Zara, Z.; Mishra, D.; Pandey, S. K.; Csefalvay, E.; Fadaei, F.; Minofar, B.; Řeha, D. *Molecules* **2022**, *27* (1), 119.



Holly Baker is a Chemistry Honours student at the University of Western Australia. Her research focuses on chemical and biological methods for degrading PET plastic, to advance recycling methods and assist with pollution remediation.