

- Organic waste represents a promising and sustainable feedstock for polylactic acid (PLA) production, supporting circular economy strategies while reducing reliance on fossil-based plastics.
- The systematic comparison of hydrolysis, fermentation, and polymerization processes identified key operating conditions and synthesis routes that consistently achieve high PLA yields, providing valuable guidance for process optimization.
- Integrating techno-economic analysis and life cycle assessment (LCA) demonstrates that PLA production from residual biomass can significantly reduce environmental impacts, including greenhouse gas emissions, water consumption, and land use, compared with conventional production pathways.