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Towards a Circular Economy: Valorisation of End-of-Life-Tyre Char into Photothermal Composites

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ABSTRACT

Tyres no longer suitable for their intended purpose are considered end-of-life tyres (EOLTs). The growing global demand for tyres has led to the generation of massive amounts of EOLTs once they reach the end of their service life. Over 1 billion EOLTs are generated annually, with 75% discarded in landfills, contributing to tremendous environmental problems. Consequently, effective management of EOLTs is crucial. While conventional waste management methods are still widely employed, a global emphasis is on adopting sustainable practices. Pyrolysis is an effective approach for converting EOLTs into valuable products. Despite its potential for resource recovery, the utilization rate of the EOLT pyrolytic char, a carbon-rich byproduct, remains low. Simultaneously, waste glass poses a major environmental concern, as a large portion is disposed of in landfills despite its high recycling potential. While various recycling efforts exist, efficient glass waste management remains an unresolved challenge. Accordingly, there is a growing interest in finding innovative and efficient solutions for waste glass. Consequently, this study aims to explore the application of EOLT pyrolytic char in waste glass powder-based composites as a novel approach to giving a second life to these waste materials. The composites with varying ratios of waste glass powder and EOLT char were fabricated using the cold pressing technique followed by the sintering technique. The resulting composites were evaluated for their photothermal conversion performance using a solar simulator setup. Experimental findings indicate a positive trend in the photothermal conversion performance, suggesting the potential of the developed composite for photothermal applications. Ongoing experiments are focused on determining the potential of the composite for use in photothermal water purification. Valorising these waste materials offers a circular economic approach while reducing the waste volumes in landfills.

KEYWORDS

Waste-to-value, Tyre waste, Glass waste, Circular economy, Composite materials, Photothermal conversion

BIOGRAPHY

R.M.N. Sulochani (MPhil., BSc.) *is a PhD student in the Department of Chemical Engineering at RMIT University, Australia. As she identifies waste as a valuable resource, she is currently working in the field of waste-to-value-added materials development. With a passion for transforming waste into value-added materials and the circular economy, she has authored and co-authored several research papers, book chapters, and international conference proceedings in waste management and waste-derived value-added composite materials.*

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