Coffee grinder, old tires spur creation of sulfur-free oil

April 17 2024

Scrap tire chips were frozen with liquid nitrogen and ground using a coffee grinder, blended with plastics and placed in a furnace at 600°C. Credit: Monash University

Using a coffee grinder, a freezer and a furnace, researchers have discovered a chemical synergy between scrap tires and polystyrene can

be harnessed to create sulfur-free, light oil.

Believed to be the first study of its kind, chemical engineers at Monash found strong synergies between tire scrap and plastics including low-density polyethylene (LDPE) and polystyrene when they were treated together in a system using the process known as rapid pyrolysis that involves subjecting them to high temperatures over a short time.

Blending either polystyrene or LDPE with tire scrap for pyrolysis effectively eliminated the production of hazardous sulfur-containing compounds that are normally found in the liquid oil produced from the breakdown of tires.

Professor Lian Zhang, of the Department of Chemical and Biological Engineering, who led the research team, said LDPE and polystyrene are both very commonly used across a range of consumer goods including packaging, plastic bags and films, bottles and containers and even medical disposables.

"Adding these plastics and using this process to break down tires can substantially reduce the risk of releasing hazardous materials into the environment," said Professor Zhang.

"We believe our findings provide a very solid foundation and justification for using co-pyrolysis as an effective and value-added technology for upcycling potentially troublesome waste products."

Further analysis allowed the mechanisms underpinning the interactions between the chemical components in the system to be identified in detail, explained Ph.D. student Wahyu Narulita Dewi, first author of the study just published in the journal *Waste Management*.

The Monash team is already undertaking further work to develop and

optimize the technology with the aim of enhancing the yield and the quality of the sulfur-free light oil produced by the process.

Further related research will also be a focus of a new Australian Research Council (ARC) Industrial Transformation Research Hub for Value-Added Processing of Underutilized Carbon Waste, led by Professor Zhang, to be launched later in 2024.

More information: Wahyu Narulita Dewi et al, Synergistic interaction between scrap tyre and plastics for the production of sulphur-free, light oil from fast co-pyrolysis, *Waste Management* (2024). DOI: 10.1016/j.wasman.2024.03.007

Provided by Monash University