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Scientists Use LEDs to Upcycle Plastics into Chemical Ingredients for Energy Storage

By Alan Caldwell

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Researchers at Nanyang Technological University, Singapore (NTU Singapore) have developed an innovative process to upcycle waste plastics into chemical ingredients that can be used for energy storage. This breakthrough method utilizes light-emitting diodes (LEDs) and a commercially available catalyst, all at room temperature, making it highly energy efficient and environmentally friendly.

One of the biggest challenges in recycling plastics such as polypropylene (PP), polyethylene (PE), and polystyrene (PS) is breaking down their inert carbon-carbon bonds, which require a significant amount of energy. The current commercial method for recycling these plastics, pyrolysis, is costly and generates greenhouse emissions.

Led by Associate Professor Soo Han Sen, the NTU Singapore team used LEDs to activate and break down the carbon-carbon bonds in plastics with the help of a vanadium catalyst. Vanadium is a common element found in minerals, coal, and petroleum, and it is widely used in the chemical industry as a catalyst for various processes.

The researchers dissolved or dispersed the plastics in an organic solvent and mixed them with the catalyst. The solution was then exposed to LED light, which provided the necessary energy to break down the carbon-carbon bonds. The resulting end products were chemical ingredients like formic acid and benzoic acid, which have applications in fuel cells and liquid organic hydrogen carriers.

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Unlike traditional pyrolysis, this new method is energy efficient and can be powered by renewable energy sources like solar or wind. It has the potential to significantly increase the recycling rate of plastics, which currently stands at only 9% globally. Furthermore, it aligns with Singapore's Zero-Waste Masterplan to reduce plastic waste and increase recycling rates.

The NTU team has filed a patent for their innovative process and is now seeking partners to commercialize the technology. This development holds promise for a more sustainable approach to plastic waste management and energy storage.

Sources:

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