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Opinion Article

Transforming Plastics through Chemical Decomposition into Biomass-Resistant Polymers

Chiun Chao Qin*

Department of Logistics Management and Engineering, Nanning Normal University, Nanning, China

DESCRIPTION

Paper, cardboard, food scraps, grass clippings, leaves, wood, and leather products are examples of biomass, often known as biogenic (plant or animal products), materials. Plastics and other synthetic materials made from petroleum are examples of nonbiomass combustible materials. Global chaos, including the impacts of climate change, has been brought on by the huge and quick growth in human population and industrial activities. These problems are currently getting more extreme because of widespread consumption of resources that include the combustion of fossil fuels. Thus, every plan of action to mitigate climate change must incorporate techniques aimed at reducing greenhouse gas emissions, such as carbon dioxide (CO_2) emissions. China planned to reach its "double carbon" objective of reaching peak carbon emissions and carbon neutrality by 2030 and 2060, respectively. As the top two global CO_2 emitters, the United States promised to reduce emissions by up to 52% by 2030. Recent years have seen massive initiatives to switch from traditional fossil-based resources to renewable bio-based resources like biomass. Due to its second-highest natural polymer abundance, lignin, incorrect disposal of which could cause significant biomass loss and severe environmental effects. To achieve this, the current work proposes conceptual techniques to employ cellulose, hemicellulose, and lignin for the manufacturing of numerous value-added products using integrated biorefinery strategy.

Eliminating plastic has proven nearly impossible because of how heavily modern humans have absorbed plastic into their daily lives. Demand for energy, food, technology, and consumer goods has rapidly increased as a result of global modernization and population growth. However, this has also led to an enormous increase in the production of garbage worldwide, which now consists of 12% plastic waste, 44% food waste and green waste. The amount of plastic produced increased from 2 million tonnes per year in 1950 to 381 million tonnes per year in 2018, resulting in an annual trash generation of 464 million tonnes of plastic. Only around 20% of plastic garbage was recycled, 25% was burned, and the remaining 55% was dumped in landfills or other places. Plastic wastes that are released into the environment take a very long time to decompose. Chemical recycling is the thermochemical conversion of used polymers into chemicals, fuels, and new plastics. By using these techniques, plastics become a valuable resource in a circular economy. The circular economy concept has gained worldwide attention in the last two decades because it establishes frameworks to close material resource loops, lessen dependence on petrochemicals, minimize natural resource imports, reduce anthropogenic effects on the environment and climate change, as well as strengthening local economies. In comparison to landfilling or incineration, recycling and reuse of plastic waste will always be the better choice.

The physical difficulties of accumulation, segregation, and pretreatment (to remove pollutants, colorants, or adhesives) as well as the technical difficulties of chemical reactions between plastic trash and the processing chemicals limit the amount of plastic waste that may be recycled. A good approach for unreformable plastics (thermosets) and heavily polluted polymers is to thermochemical transform them into fuels or energy. Likewise, turning biomass waste into biofuels will increase the quantity of renewable energy available in the world because significant amounts of biomass waste are created each year but go unused. Only 40% of the trash generated by the agricultural industry, which accounts for over 140 billion tonnes annually, gets recycled. Only 4.5% of the lignocellulosic biomass produced by agriculture and forestry leftovers each year, which totals roughly 181.5 billion tonnes, is used for energy.

CONCLUSION

In order to increase the availability of bioenergy, reduce negative effects on the environment and climate, and create a circular bioeconomy, it is possible to convert the enormous amount of biomass and plastic waste produced globally each year into biofuels. The circular bioeconomy, also known as the bio-based

Correspondence to: Chiun Chao Qin, Department of Logistics Management and Engineering, Nanning Normal University, Nanning, China, Email: qinchaos@chiun789.cn

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circular carbon economy, promotes the closing of resource loops for biomass and plastic by transforming them into environmentally friendly biofuels, bioproducts, and biopower benefitting society, the economy, and the environment. A significant quantity of lignin waste is produced as a result of the inherent difficulties of lignin valorization and the current (hemi) cellulose-centered approach to lignocellulose valorization. The (hemi) cellulose components will be lost as a result of the action of pyrolysis, however, if a certain lignocellulose biomass is thought to be valorized.