Upcycling Waste Biomass into Bio-plastics: A Path for bioeconomy

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Abstract (in 12 Pt Arial Font)

Conventional plastics are derived from non-renewable petroleum. With price volatility and limited supply, we need to find alternative feedstocks for plastic production. Biomass is a renewable source of sugars. The biomass-derived sugars can be fermented into polyhydroxyalkanoates (PHAs), bio-plastics with potential replacement of petroleum-derived plastics. Although promising, the recalcitrant nature of biomass makes it difficult to release sugars in a high yield. Here we show a biochemical pathway for the production of PHAs from rice straw and hemp hurd. We combined ambient-temperature chemical pretreatment, enzymatic hydrolysis, and bacterial fermentation. The ambient pretreatment partially fractionated hemicellulose and lignin; these effects increased cellulose accessibility to enzymes and enabled a high sugar release (up to 83 % glucose yield) at high solid loading. Therefore, we obtained 69 wt.% mcl-PHAs from pretreated hemp hurd. These findings lay the groundwork for producing biodegradable plastics from renewable feedstocks. Moreover, unlike hazardous petroleum-derived plastics, polyhydroxyalkanoates are biodegradable, and do not pollute our ecosystems or contaminate food chains. This developed process can be extended to other biomass species, provide revenue to the agricultural sector, mitigate global warming from petroleum processing, and potentially reduce plastic pollution.

Biography of Presenter (in 12 Pt Ariel Font)

Noppadon Sathitsuksanoh (his colleagues call him "Tik' for short) is an Associate Professor in Chemical Engineering at the University of Louisville (USA). His group integrates physical chemistry, materials science, and process development to produce clean energy and renewable materials from organic waste materials (plant biomass, discarded plastics, and industrial waste) and carbon dioxide. Currently, his group focuses on non-traditional catalysis, battery interfacial chemistry, and catalytic CO_2 conversion. His work enables a transition to a clean energy economy, creates environmental sustainability jobs, mitigates GHG emissions, and supports rural economies.