**A bio-enabled platform to access polyamides with built-in target properties**

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The polymer industry has been a key driver in the quest for green-alternatives to petroleum-derived chemicals. While current efforts have predominantly focused on bio-derived structural or functional replacements of petrochemical molecules, a more appealing strategy would be to target bioprivileged molecules. These platform molecules exhibit the versatility to be converted into both “drop-in” replacements and novel chemicals. Herein, we present a functionalization strategy to effectively convert bioprivileged muconic acid (MA) into an array of diacids exhibiting custom property enhancements. *Trans,trans*-MA (*tt*MA) offers a conjugated double bond with the potential for grafting vinyl groups to tether desired properties and yield polymers with built-in enhancements like hydrophobicity or flame retardance.

As a proof of concept, hydrophobic diacids were prepared by reacting alpha olefins with MA-derivatives and inserting them in a Nylon-6,6 backbone. The resultant polyamides were fully tested for moisture absorption and characterized through GPC, TGA, DSC, WAXS, and DMA. The resulting polyamides exhibited polymer property customization by reducing water-uptake of over three-folds without affecting visco-elastic properties of nylon-6,6. This functionalization strategy was further extended to aromatic vinyl groups and the resulting polyamides demonstrating a 60% improvement in char production. Overall, we demonstrate a bio-enabled platform for diversification of muconic acid utilizing Diels-Alder chemistry to access a new library of diacids with custom property enhancements.

