Biomass research collaboration seeks to improve biofuel efficiency, bio-products quality

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A Kansas State University biochemical engineer is part of a national collaboration working to advance biomass as a leading source for more efficient drop-in biofuels, bio-power and animal feed.

Biomass is a renewable energy source typically made from plant materials. It can be converted into biofuels, such as drop-in renewable biodiesel, and other energy sources. Drop-in biofuels are so structurally similar to current transportation fuels that they can be developed with the existing technology and infrastructure used to make petroleum-based fuels, saving on fiscal overhead for new technology.

Praveen Vadlani, the Gary and Betty Lortscher associate professor of renewable energy in Kansas State University's department of grain science and industry, is a co-principal investigator in a more than $6.5 million biomass research project between universities, industries and federal agencies. The three-year project, a jointly funded effort by the U.S. Department of Agriculture's National Institute of Food and Agriculture and the U.S. Department of Energy, seeks to refine and improve the conversion of biomass into better drop-in biodiesel, bio-lubricants, jet fuel and other value-added products.

"This is a high-risk, high-reward project," Vadlani said. "The goal is to increase commercial industries' interest in the products that are developed from biomass by adding value to those products. It will be a

technical challenge because we want to optimize every component used in the production cycle and make sure that the production cycle is done in a closed-loop system without any emissions since we're using a renewable energy source."

The project is being led by Ceramatec Inc., a ceramic, fuel and electrochemical research and development company in Salt Lake City. In addition to Kansas State University, collaborators include Texas A&M, Rice University, Drexel University and the Chevron Corporation.

Vadlani and colleagues are studying biomass made from switchgrass and sorghum, both bioenergy-rich crops. Switchgrass is a warm season grass that can be converted into large amounts of biomaterial, while sorghum is a major grain crop, livestock feed and the primary source for biofuels production. Biomass was selected because it is a more cost-efficient sustainable energy source to produce.

Researchers are evaluating biomass made from these grasses, starting from their growth in the field throughout the production cycles.

Vadlani is focusing on pretreatment and fermentation steps in the production cycle to convert biomass into drop-in biodiesel, jet fuel and bio-lubricants. This includes deconstructing biomass to its core components; separating the sugars from the bio-contaminants; fermentation of useful products; scaling up the production levels from test tubes to liters; and evaluating the energy efficiency of the biofuels produced from the modified production cycle.

"My critical expertise comes in the form of essentially connecting the dots of all of the individual processes in order to make sure that the whole production cycle works efficiently from the first step all the way until the end," Vadlani said. "Each step in the production cycle may work by itself, but once they are put together there may be conflicts and

inefficiencies. That results in lower-quality bio-products being produced."

In addition to advancing biomass research and bio-product development, the project has strong mentorship and educational aspects to it.

Vadlani will work with a graduate student and postdoctoral research assistant, who also will work with undergraduate students and students in the university's summer research experience for undergraduates program.

"Along with making advancements to biofuels and industry, I'm looking at this as an opportunity to mentor undergraduate students who will one day go on to make future advancements in biofuels and eco-friendly materials," Vadlani said.

Provided by Kansas State University

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