

# Technical and Economic Feasibility of an Integrated Ethanol and Anthocyanin Coproduction Process Using Purple Corn Stover

## Background/objective

Corn stover is a promising candidate for cellulosic ethanol production, but due to its high capital investment and unit production costs, it is not competitive with gasoline or corn ethanol production. Production of high value co-products could increase plant revenue and improve the process economics. Purple corn stover (cobs, stem, and husk) is an inexpensive feedstock and contains purple corn cobs with relatively high anthocyanin concentration. Due to the high value of anthocyanin extract, an integrated process using purple corn stover can potentially increase revenue compared to conventional ethanol production. Here, we developed process simulation models for processes integrating ethanol production and anthocyanin extraction using purple corn stover, evaluated their techno-economic feasibility, and compared their performance with conventional ethanol production processes using corn stover.

## Approach

- ❖ The SuperPro Designer® (Version 10, Intelligen Inc., Scotch Plains, NJ, 2017) platform was used for process design, simulation, and techno-economic analysis.
- ❖ Processing capacity and plant operation period were assumed to be 2,000 dry MT feedstock/day and 350 days/year, respectively.
- ❖ Dilute acid pretreatment was used for ethanol production from conventional and purple corn stover, and anthocyanin recovery was modeled using countercurrent extraction in water and dilute acid.

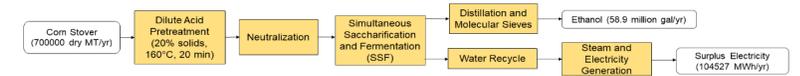
## Results

- ❖ Capital costs for the integrated processes using 2,000 dry MT corn stover/day ranged from \$443.7 to \$438.9 million, compared to \$365.1 million for ethanol production from corn stover.
- ❖ The integrated process using acid-based anthocyanin extraction (\$0.65/L) had lower minimum ethanol selling price compared to the conventional process (\$0.72/L) due to high value of anthocyanin extract, but the water-based anthocyanin extraction process had a higher minimum ethanol selling price (\$0.97/L) due to its lower extraction efficiency of anthocyanin.

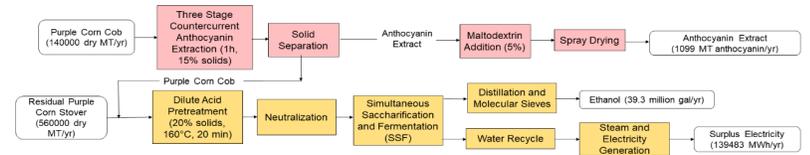
## Significance

The techno-economic analysis shows that ethanol and anthocyanin coproduction using purple corn stover can improve the process economics of cellulosic ethanol production for biofuels and provide anthocyanin extract to the food industry.

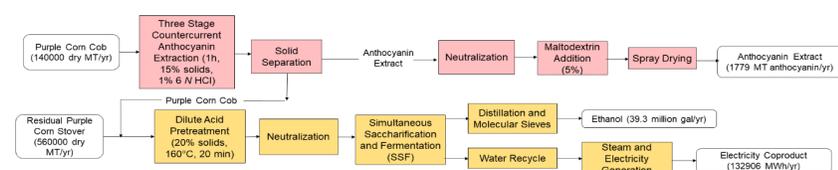
Corn stover with dilute acid pretreatment (ECS)



Water-based anthocyanin extraction and ethanol coproduction from purple corn stover (PCSW)



Water-based anthocyanin extraction and ethanol coproduction from purple corn stover (PCSA)



## Schematic representation of conventional and integrated bioethanol production processes