

Cellerate[®]

Process Technology

In a league of its own

- Access new markets and increase the ROI potential of your co-products
- Helps to significantly increase total ethanol production based on your existing asset base
- Helps to improve your corn oil production
- Generate cellulosic ethanol D3 income



syngenta[®]

Cellerate® process technology converts corn kernel fiber into a diversified income stream and has been proven to increase dried distillers grains (DDG) protein levels to up to 40% (dry matter basis), significantly increase throughput and improve corn oil production.¹

With an approved D3 RINS EPA pathway for over three years, Cellerate process technology can help you access new markets, transform your operation and be more competitive.

Cellerate process technology enables you to leverage your existing infrastructure and significantly increase total production by using pre-existing assets such as:

- Feedstock receiving and storage
- Product separation
- Final product storage

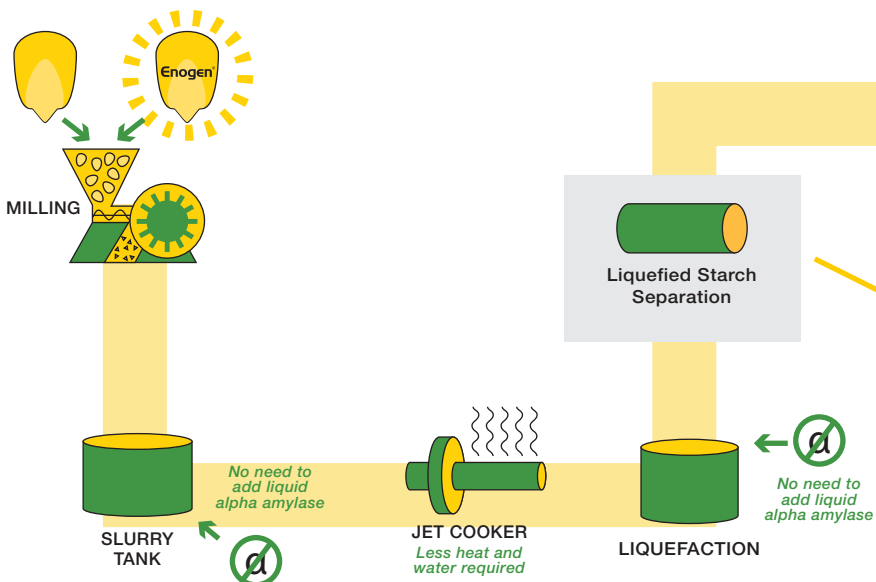


Advantages of the Cellerate process*

- Higher value DDG and increased DDG dryer capacity
- Increased throughput
- Improved corn oil production (yield)
- Opportunity to de-bottleneck your operation; not just a “bolt-on” technology, but a complete upgrade to high capabilities with total integration
- No changes to the conventional starch ethanol process
- Whole stillage is processed without the requirement to separate fiber through a fiber treatment
- Adds distillation capacity; not just “bolt-on”
- Secondary fermentation captures residual starches, sugars and cellulosic component (additional production is expected once hemicellulosic yeast is commercially available)
- Allows a plant to load significantly more solids and capture residual starch in a second fermentation process
- Fiber is pre-treated as part of the conventional starch processes
- Pre-treatment breaks down fiber, allowing mild whole stillage fiber treatment
- Reduced time, chemicals and energy required because of pre-treatment
- Lower carbon intensity – reduce CO₂ emissions and a lower carbon intensity score

*Source: Quad County Corn Processors, 2014-18

The Cellerate Process

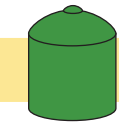


The Cellerate Difference: As demonstrated at Quad County Corn Processors over 3 1/2 years of commercial production

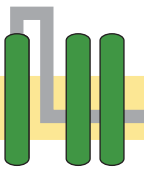


Process Design	✓
Successful Commercial Production	✓
D3 RINS EPA Pathway	✓
Simple Pathway Compliance	✓
Throughput Increase	Up to 20%
Feed Protein Levels (dry matter basis)	As much as 40%
Oil Yield Improvement	1.6 lb/bu potential
Cellulosic Ethanol (gallons as a % of total gallons produced)	Approximately 6%

MASH COOLING



FERMENTATION



DISTILLATION



MOLECULAR SIEVE

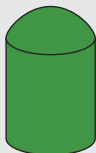
ETHANOL
 C_2H_6O



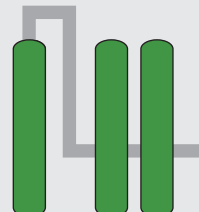
Cellerate™ Process Technology



Whole Stillage Pretreatment



Whole Stillage Fermentation



Whole Stillage Distillation

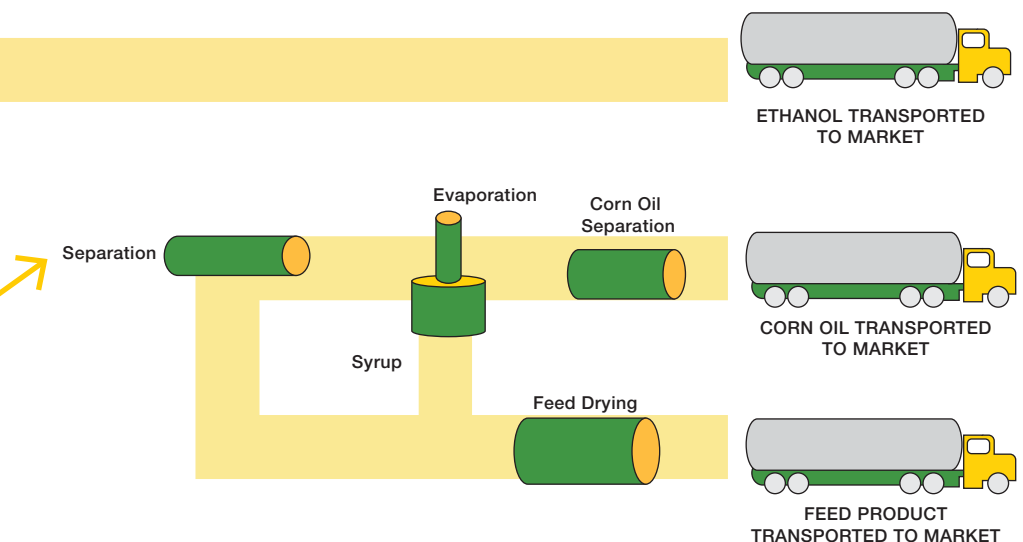
Cellerate and Enogen® corn enzyme technology: Better together

Cellerate process technology has been producing D3 RIN-qualifying cellulosic ethanol on a commercial scale at Quad County Corn Processors (QCCP) since 2014 and has produced more than 6.75 million gallons to date.²

Performance results achieved at QCCP to date through combining Cellerate with Enogen corn include: a six percent yield increase plus a 20 percent throughput increase combined for a 26 percent increase in total ethanol production; higher protein feed co-products; and improved oil yield.³

Together, Cellerate and Enogen can help deliver notable benefits to ethanol plants beyond what can be achieved through either technology alone – including increased throughput and yield and a notable reduction in natural gas, electricity and water usage.

To help make the benefits of Cellerate process technology more broadly available, Syngenta is working with Fagen Inc., the world leader in the design and construction of biofuels facilities.





To inquire about incorporating Cellerate into a dry grind ethanol plant, contact Jeff Oestmann at jeff.oestmann@syngenta.com.

For more information about Cellerate technology enhanced by Enogen corn, visit www.Enogen.com.

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¹ QCCP commercial production from 2014-2018

² Based on QCCP cellulosic ethanol production as of 2/1/2018

³ Based on third-party verification procedures performed by Christianson & Associates PLLP, a firm of certified public accountants and consultants.