



Determination of Syrup Solids at DDGS Evaporators for Increased Energy Savings

Relevant for:
Bioethanol Industry, DDGS Production

Process

Water management, as it relates to the drying of co-product distillers dried grains with solubles (DDGS), is an important part of an ethanol plant's overall operation and energy use. An ethanol plant that can establish itself as a low-cost producer of its products can expect to weather tough economic times.

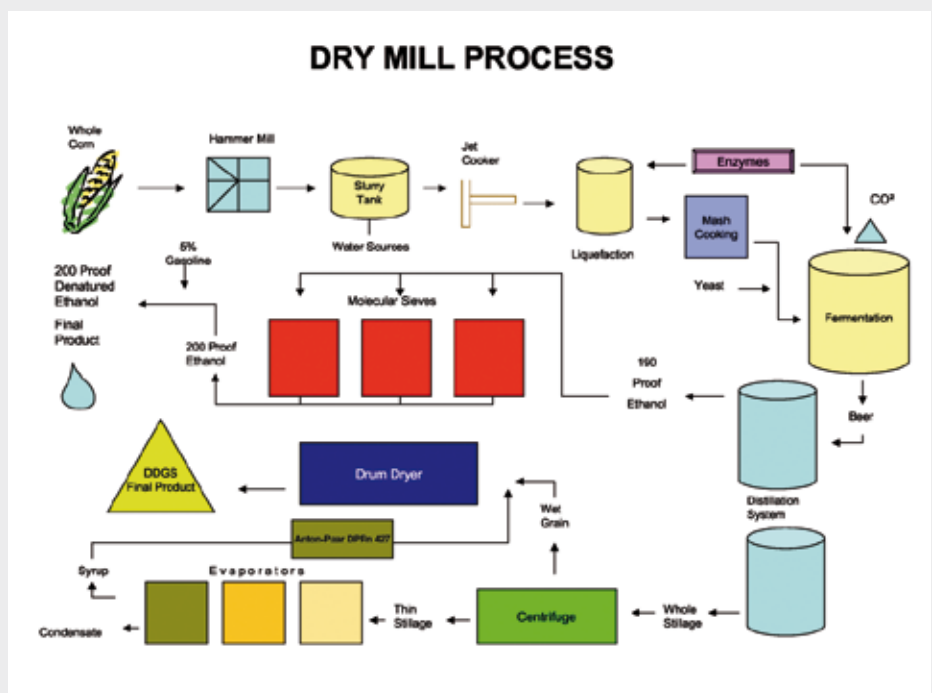
After the alcohol has been extracted from the mash, the job of producing DDGS begins by separating the solid fraction from the soluble fraction using decanters. The solid fraction, or cake, is sent to the dryers, and the soluble fraction is sent to the evaporators. The goal during evaporation is to increase solids content by driving the water out of the product, thus concentrating the soluble fraction to make condensed distillers solubles or "syrup". This "syrup" is then applied to the cake as it enters the dryers and is co-dried to make DDGS. Because rotary dryers are not an efficient way to evaporate water the goal is to make "syrup" as high in solids as possible, yet not adversely affect evaporator operations.

Instrumentation

Ethanol plants use several tools to monitor evaporator operations. These include, but are not limited to, flow rate, pressure fluctuation, and product composition. Historically, operators will pull syrup samples every couple of hours and analyze them in the laboratory to determine solids content. The problem with this technique is that it only gives a snapshot of overall evaporator operations, and the product can fluctuate in the time period between samples. Another option is to have online density transducers monitoring evaporator operations and solids content on a real time online basis. This information is then used to monitor

trends in the process. The operators can use it to minimize product being produced out of plant specifications. With this you can optimize syrup solids, which will in turn maximize system throughput. This is most easily accomplished by controlling the flow rates of the syrup out of the evaporators. A slower flow rate leads to higher retention times and thicker syrup. The opposite condition of higher flow rates will produce thinner syrup if other inputs are constant.

The flow diagram shows a typical dry grind ethanol plant and the placement of a DPRn 427 density transducer and an mPDS 2000V3 evaluation unit in the process.



Picture 1 shows the actual unit as it is installed.

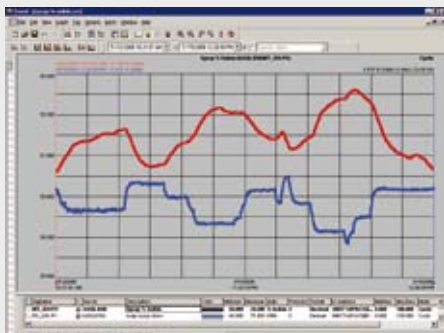


Picture 1

The pressure side of the syrup pump maintains syrup flow into the DPRn 427 with the return line being sent back to the suction side of the same pump.

Results

Graph 1 indicates that as the syrup flow rate (blue line) was increased, the syrup solids meter (red line) showed a decrease due to the reduction in retention time. The opposite was true as the syrup flow rate was decreased: the solids meter showed a corresponding increase in syrup solids due to the increased retention times in evaporation. This is important because operations use this information to run evaporation efficiently and smoothly. They are able to make several minor changes



Graph 1

rather than large corrections which upset the process, resulting in less efficient operation.

A system can easily be developed to automate the above application by simply tying the syrup flow rate to the syrup solids meter. If target solids are 34 %, a program can be developed to maintain this concentration.

By controlling the flow rate in this way, in one shift 6000 gallons of water less than before went to the dryers. The cost savings are real and obvious.

Conclusion

As with most production facilities, consistent operations are the goal. By maintaining constant syrup solids, you allow for more efficient plant operation by ensuring less variation of syrup feed to the dryers. In the end you have produced your products in the most cost-effective way, and thus produced a more consistent DDGS for your customers.

System configuration

- ▶ DPRn 427 density transducer
- ▶ mPDS 2000V3 evaluation unit
- ▶ Program "Extract of wort"
- ▶ Temperature ~85 °C (185 F)

Actual application at Badger State Ethanol, WI, U.S.A.

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