



# Alternatives for whole stillage management

The huge increase in ethanol production has resulted in a significant increase in distillers grains production. This year, 13.6 million tonnes are expected to be produced, with the amount reaching 21.7 million tonnes by 2017.

An increasing supply of distillers grains will suppress the market value of the co-products even as corn (maize) prices increase. Nearly 50% of the energy demand at most ethanol facilities goes to produce distillers grains through drying and evaporation. Energy costs have more than doubled in the last five years. What was once a profitable operation for ethanol plant operators will become a cost center.

It may be time for ethanol plant operators to re-evaluate their distillers grains production process. The current spent grains processing scheme was developed under very different conditions than exist today.

The questions to ask include: How can operations be modified or changed to be more economical and sustainable for the current and future situation? How can the overall energy footprint be reduced? How can the considerable energy potential of stillage best be tapped?

## CO-PRODUCT OPPORTUNITIES

Ethanol plant operators have several opportunities to make the most out of their spent grains. High-rate anaerobic treatment can be used to produce biogas from soluble organics. The resulting biogas will be about 60% methane, which can be substituted for natural gas.

Another option would be to capture spent grain solids at the front of the process. The grains have a value as feed, fuel or high solids digestion. This allows a producer to maintain flexibility depending on the market conditions.

The objective of solids separation is to produce cake with the highest total solids (TS) possible, which reduces the energy needed for drying. An additional objective is to produce the lowest total suspended solids (TSS) in the solubles fraction. A low TSS means more of the solids are captured where they have value. It will also improve evaporator performance and have a

Capturing spent grains at beginning of ethanol production process coupled with anaerobic treatment improve facility's energy use

by Susan Reidy

stream more suitable for high-rate anaerobic treatment.

Several options are available for solids separation including centrifuges; belt, plate and frame presses; settling and flotation; and screw presses. Screw presses use less energy and generate higher TS than centrifuges.

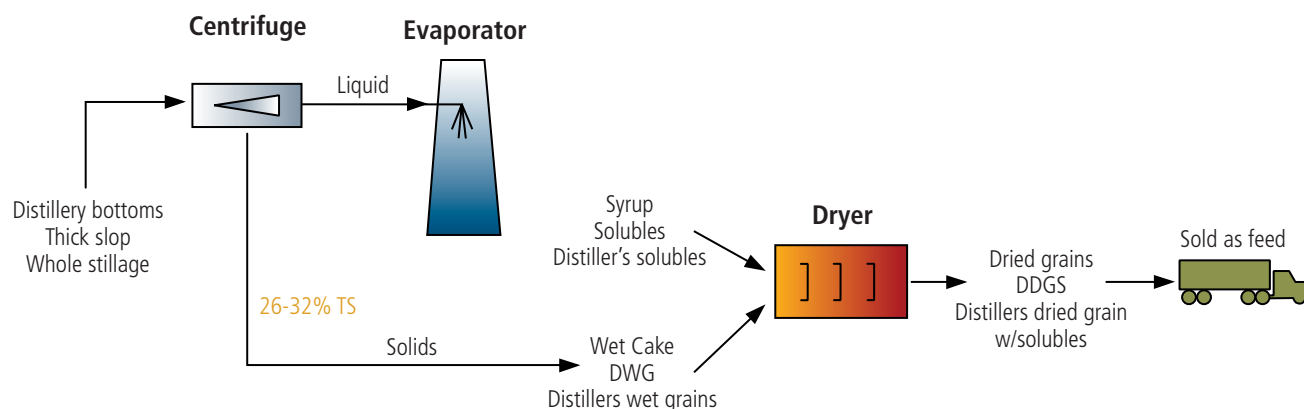
With proper preconditioning before the screw press, a filtrate TSS of 1,500 to 3,000 milligrams per liter (mg/L) and a cake TS of about 40% can be achieved.

During a two week on-site demonstration of screw presses at two bourbon distilleries, 38% to 42% solids were achieved with a filtrate of 1,500 to 3,000 mg/L TSS. The filtrate had high soluble chemical oxygen demand (COD) of between 24,000 and 50,000 mg/L, which is suitable for anaerobic conversion to biogas.

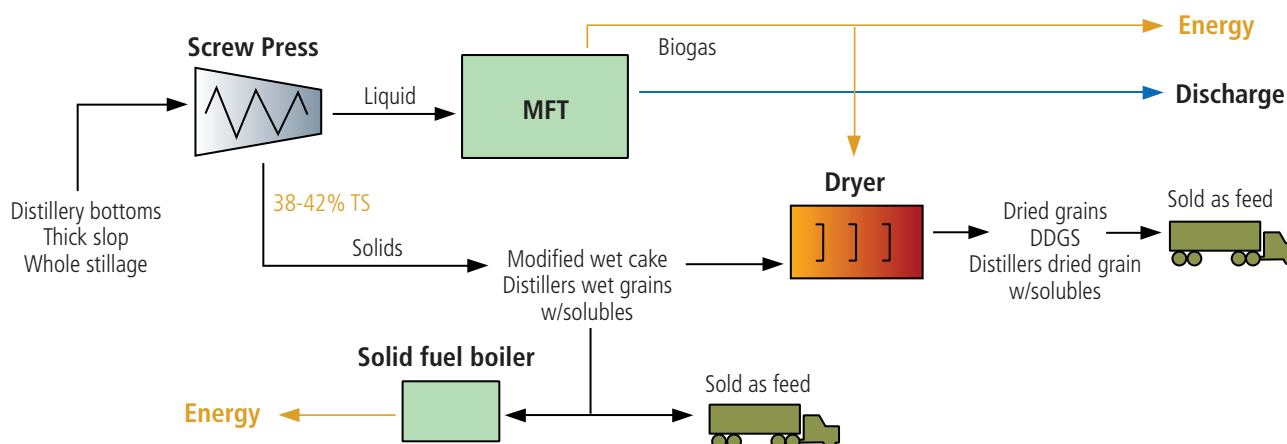


Screw presses use less energy and generate higher total solids than centrifuges.

### Typical dry house



### Ecovation's total solution



In the separation process, the whole stillage is run through the screw press. The liquids removed can continue onto anaerobic treatment while the 38% to 42% solids can be used in a solid fuel boiler, as an animal feed or for high-solids anaerobic digestion.

Using a screw press could potentially allow an ethanol plant operator to eliminate aging, less efficient solids separation equipment. A higher TS content of screw press cake solids means reduced drying energy requirements. An increase from 32% to 34% TS to 40% TS is equivalent to a 30% reduction in the amount of water needed to be removed in order to achieve 90% TS. Additionally, the screw press filtrate is suitable for high-rate conversion to energy in the form of biogas.

The distillers grains equivalent produced using the screw press had virtu-

ally the same composition as normal distillers grains including protein, crude fat, crude fiber and amino acid profile.

#### ANAEROBIC TREATMENT

Anaerobic treatment has a huge energy potential for an ethanol production facility. The typical 100 million gallon per year facility requires roughly 3 million MMBtus (million British Thermal Units) of energy per year. The plant will produce 155 MM pounds of COD per year, and for every COD pound converted, 5.61 standard cubic feet (SCF) of methane is produced.

Capturing and utilizing 85% of that methane will result in 603,000 MMBtu per year, or 20% of the ethanol plant's overall energy use.

In this scenario, an Ecovation Mobilized Film Technology (MFT) is used for the anaerobic treatment process. The

technology uses heavy, small diameter inert particles on which the bacteria can adhere in a thin film. The high density promotes the passing of undegraded suspended material from the reactor without displacing the active biomass.

Plug flow in the MFT ensures a first-in, first-out method of treatment, which allows for maximum organic reduction and gas production at minimum retention times. Combining the screw press with anaerobic treatment can significantly improve the overall energy footprint needed for stillage management. The system can reduce drying costs as well as evaporation costs. **BB**

This article is based on a presentation by Ecovation, Inc., [info@ecovation.com](mailto:info@ecovation.com), from the International Fuel Ethanol Workshop, St. Louis, Missouri, U.S.

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