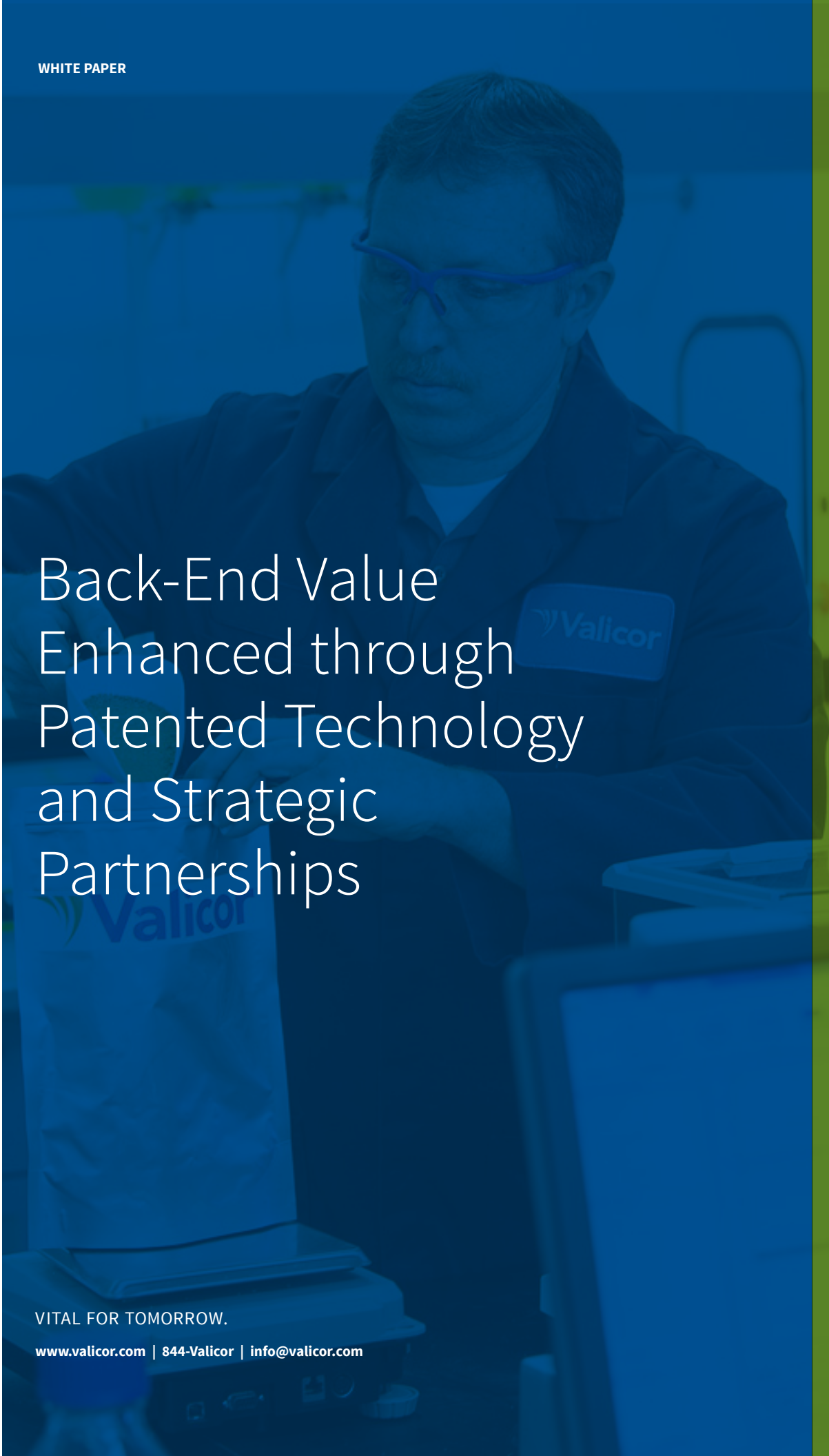
WHITE PAPER



Back-End Value Enhanced through Patented Technology and Strategic Partnerships

Valicor®

VITAL FOR TOMORROW.

www.valicor.com | 844-Valicor | info@valicor.com

Valicor Inc. is a leading US-based supplier of process systems to the fuel ethanol industry for the centrifugal recovery of distiller's corn oil (DCO). At present, 59 Valicor corn oil separation system (COSS) units have logged over 132 machine-yrs of operation at 40 different North American ethanol facilities. The rapid growth of DCO production over the past decade was propelled by the constant need for facility owners to derive greater financial return per bushel of grain. Valicor COSS units, with innovatively designed high speed bowl centrifuges, now deliver industry leading yields of up to 0.7 pounds per bushel and are recognized for high mechanical reliability backed by exceptional on-site service.

VFrac® Platform Sets High Bar for Coproduct Recovery

In 2014, Valicor introduced the patented VFrac® stillage fractionation technology capable of achieving DCO yields in excess of 1.1 pounds per bushel. The recovery of additional oil is made possible by the hydrothermal treatment reactors of the VFrac® system which heat stillage to temperatures in the range of 225 – 300 degrees F. Heating imparts several physicochemical changes to the stillage, including desorption of oil from fiber and solid surfaces, denaturing and agglomeration of proteins and yeast cells, solubilizing slightly soluble proteins, and increasing soluble ammonia. These changes enable facile separation of the hydrothermally treated stillage into DCO, an aqueous fraction ("stickwater") containing less than half the suspended solids of traditional thin stillage and a high protein solids fraction (refer to **FIGURE 1**). With significantly less suspended solids, stickwater reduces fouling when evaporated, and as an enhanced backset, stickwater permits greater fresh ground corn addition while providing a nutritionally enriched media component.

The high protein fraction isolated after hydrothermal treatment has unique attributes which make it particularly attractive as an animal feed material. The protein agglomerates are hydrophobic and therefore dewater well, thus reducing solubles such as glycerol and minerals which would be residual in the dried protein product. As a result, the Valicor protein product is slow to adsorb atmospheric moisture and retains superior handling properties throughout normal storage.

The addition of a Valicor Protein Recovery Module (PRM) to the base VFrac® system allows the facility owner to produce a dried high protein animal feed containing greater than 50 wt % protein. High protein meals command significantly higher prices than DDGS (28 – 30 wt% protein content) and thus compete with soybean meal (48 – 50 wt% protein content). Key process equipment supplied with the Valicor PRM include a whole stillage filtration and wash system, a protein dewatering centrifuge and a protein dryer. The PRM integrates with the base VFrac® system as shown in **FIGURE 2**.

Beyond DCO

Moving beyond stillage, Valicor has successfully piloted a process to further fractionate DCO into higher value lipid streams, including a low free fatty acid triglyceride stream and a stream enriched in beneficial non-glyceride compounds ("BNGs") such as phytosterols, tocopherols and carotenoids. High purity oil containing greater than 98% TAGs and less than 2% FFA is highly valued by biodiesel producers and will command a significantly higher price than conventional DCO which has FFA levels of more than 10 wt%. A stream enriched in BNGs and FFAs has promise in specialty poultry feeds and even cosmetic preparations. We envision several logical siting options for the Valicor oil fractionation process. Oil fractionation will integrate well within existing ethanol or biodiesel production facilities or could exist as a stand-alone fractionation plant.

Strong IP = Investment Confidence

As important as operationally robust, value-adding bolt-on technologies are to the ethanol facility owner, of equal importance is assurance that the purchased coproduct technologies are backed by a strong, defensible intellectual property position. Valicor's hydrothermal treatment and separation technology for producing protein, oil and stickwater are protected under several issued and pending patents. US Patent 8,772,911 discloses the hydrothermal treatment of stillage in the range of 250 – 350 °F, separating the treated whole, thin or thick stillage into a protein and fat containing fraction and stickwater, and further recovering oil and a high protein fraction. In January 2015, Valicor received a notice of allowance for US application 13/922,497 which further discloses removal of dissolved solids from hydrothermally treated stillage and utilizing a portion of the treated stillage as media in a fermentation process. This recently allowed patent further extends the low end of hydrothermal treatment to a temperature of 200 °F. A pending unpublished US continuation application builds upon the allowed 13/922,497 patent and further claims means of treating stillage prior to heating to improve coproduct recovery, removal of oil and protein from a heat treated stillage concentrate, and other means of removing dissolved solids. In February 2015, Valicor announced the acquisition of US Patent 7,829,680 from ProGold Plus Inc., a protein-focused patent which perfectly complements our IP portfolio around VFrac® hydrothermal treatment and coproducts. The '680 patent reflects the work by ProGold during the mid-2000's to demonstrate the recovery of protein from corn fermentation stillage at a process rate equivalent to 600 gallons whole stillage/hr. The '680 patent discloses an efficient process for fractionating whole stillage by sieves, and then by centrifugation, to obtain a protein fraction containing up to 30% dry solids. The isolated protein fraction can be dried to produce a high protein meal. In pending Valicor application US 2014/0343259 more specific claims to the protein product and methods to recover the product are presented and bolster Valicor's overall protein position. In addition to protein composition claims, notable process enhancements are disclosed in the '259 application including removal of additional solubles from the protein paste and the optional isolation of a second protein product from the stickwater phase.

In summary, through a combination of internally developed technologies and strategic acquisition and licensing, Valicor has established a portfolio of intellectual property which allows us and our customers to confidently implement these valuable back-end coproduct technologies.

Access to Markets with Reduced Risk

Freedom-to-operate and robust technology must be buttressed by profitable and reliable channels to market. The two major markets for DCO, biodiesel feedstock and poultry feed, are mature and ethanol plants have been able to easily establish DCO off-take agreements. Similarly, establishing off-take agreements for distillers grains (DWG and DDGS) is a relatively straight-forward process. However, distillers high-protein meal, as a new product, presents a marketing challenge to the independent ethanol producer seeking to secure maximum return with minimal risk. Recognizing both an opportunity and a risk-return challenge, Valicor and Purina Corp. announced on February 17, 2015 that they have teamed up to develop programs that support the commercialization of distillers high protein coproduct. The joining of two industry leaders creates a protein program that includes equipment and process integration, protected intellectual property, comprehensive service programs, market development, and market leadership, all designed to maximize returns to the ethanol plant. The Purina commitment adds:

- Brand recognition and protein brand development
- Product evaluation, including field trials and formulation expertise
- Product placement, including channel and global markets
- Logistics and handling expertise

Looking forward, Valicor is exploring strategic partnerships to facilitate commercialization and market development for DCO fractionation and the high value lipid fractions derived thereof.

In summary, the Valicor VFrac® stillage fractionation system provides the ethanol producer with a one-stop platform for backend coproduct recovery, supported by robust technology and a strong, defensible intellectual property position. Backed by the Valicor-Purina partnership, the VFrac® equipped ethanol producer can move quickly and confidently into markets for high protein meal. Valicor continues to innovate and a bright future is anticipated in biodiesel, specialty nutrition and cosmetic markets for high value lipids isolated from DCO.

Figure 1

VFrac® stillage fractionation coproducts.

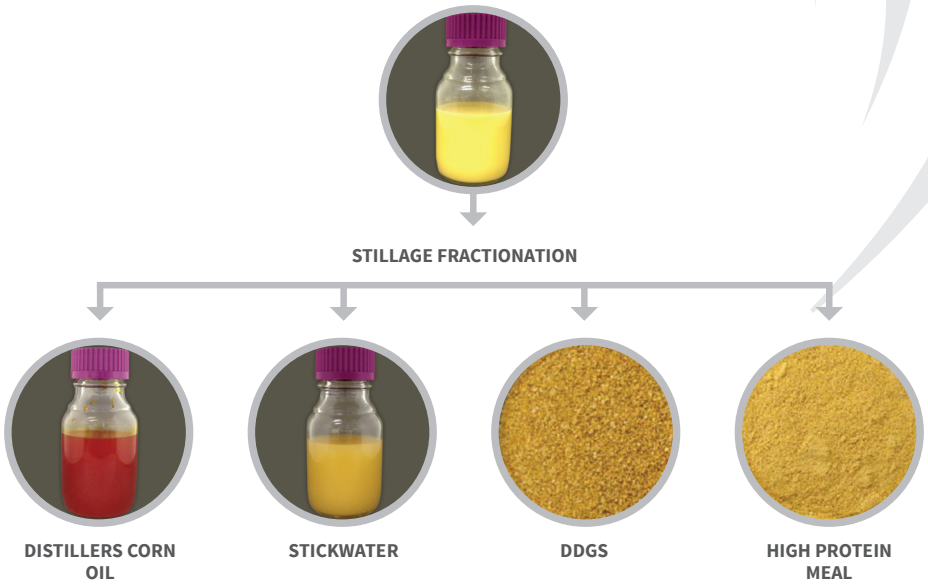


Figure 2

Valicor Protein Module integrated with a base VFrac® Hydrothermal Treatment System.