
SRS
ENGINEERING
CORPORATION
BIODIESEL TECHNOLOGY

Introduction to Degumming

The soybean, in addition to being our most important source of edible oil and protein, is also the only current commercial source of lecithin. Worldwide consumption of this by-product of soybean processing is estimated at 200,000 tons/year, and it finds uses in variety of food and industrial products. Industrially, lecithin is removed by treating the crude oil with water, inorganic and organic acids, enzyme and neutralization with caustic; the gums precipitate from the oil and are recovered by centrifugation or sedimentation. Some processors refine the crude oil directly, and the gums are removed with the soapstock. Thus, to the processor, the soybean phoshatides may be considered valuable by-products that must be removed in order to render the final product suitable for end uses as salad-cooking oils, margarine's, or shortening stocks.

DEGUMMING

Phospholipids (Pls) are natural components of oil and oilseeds. They are not desirable because they settle out of the oil during shipping and storage. Pls have adverse effects on the color and flavor of oil. The presence of Pls creates problems during oil processing and some food applications, i.e. frying. Pls are removed from oil during the degumming process. There are two types of Pls: hydratable and nonhydatable. In general, crude vegetable oils contain about 10% of nonhydratable Pls. However, the amount may vary significantly depending on the quality of the seed, type of seed and conditions during the oil milling operation. Hydratable Pls can be removed in most part by water-degumming process. Nonhydatable Pls can be removed only during acid degumming or enzymatic degumming processes.

The best alternative to all this degumming processes is our GREEN-D SUPER DEGUMMING process.

WATER DEGUMMING

Hydratable Pls can be removed from the oil by water-degumming. As rule of thumb about 2% hot water at 160-176 F added to oil and mixed 10-15 minutes. During this process, Pls absorb water and lose their lipophilic characteristics, become oil insoluble and agglomerate into a gum phase. Gums are separated by centrifugation and added back to meal. Gums can be further processed to produce lecithin, which is used as emulsifier in food and feed applications. The residual phosphorous level after water degummed oil is about 100 parts per million.

SUPER-DEGUMMING

PL content of the oil can be further decreased to about 30-50 parts per million by adding 1500-2500 parts per million organic acid into the oil at 104-131 F, a process called super-degumming. The oil from the acid degumming is cooled to 90-100F before entering a feed tank for the refining operation.

CHEMICAL REFINING

Commercial crude oils usually contain about 1-3 percent FFAs. High quality oils contain 0.5 percent or less FFA. Although most of the long-chain FFAs do not significantly impair the taste of the oil, the short-chain FFAs may have a soapy and rancid flavor. Soapstock is separated from refined oil by gravity settling, filtration or centrifugation. Furthermore, FFAs accelerate oxidation reactions, consequently, reducing the oxidative stability of the oils. Crude oils are traditionally deacidified or refined by chemical methods. During chemical refining, a heavy soapstock (sodium or potassium salts of fatty acids) is formed.

PHYSICAL REFINING

Physical refining, also known as deacidification by steam distillation, is a process where FFAs and other volatile compounds are distilled off the oil. Physical refining, a viable alternative for caustic/chemical refining process, is based on the higher volatility of FFAs than TAGs at high temperatures and low pressures. The final FFA content in the refined oil can be reduced to 0.005 percent when physical refining is used.

Phospholipid (Pls) content of different oils and fats

Type of Oil	P-Content (ppm)	Phospholipids (Pls) %
Coconut	10 - 20	0.025 - 0.05
Palm	15 - 40	0.04 - 0.01
Sunflower	200 - 500	0.05 - 1.3
Maiz germ (corn)	300 - 800	0.7 - 2.0
Rapeseed	200 - 800	0.5 - 2.0
Cottonseed	400 - 1000	1.0 - 2.5
Soyabean	600 - 1200	1.5 - 3.0

Green D Plus Degumming Unit

Patent Pending Green Process

34,000 gal/day degumming unit

Advantages

- Uses only water and cavitation
- Improved yield
- Lower investment cost
- Less environmental impact
- Less waste water formed
- Mild refining (NO chemicals used)

The process is easier to operate than the chemical process. There is little need for adjustments when the properties of the oil change. Cavitation water degumming is a very stable process and easier to operate than any other processes.

Key Benefits

- Developed to increase oil yield
- Compatible with any refining process
- Low energy consumption
- Substantially reduces cost of degumming process
- Capacities from 10,000 gal/day to 500,000 gal/day
- Instant process - no retention time
- Reduction of hydrated and non-hydrated phosphorus below 25 PPM without any chemicals

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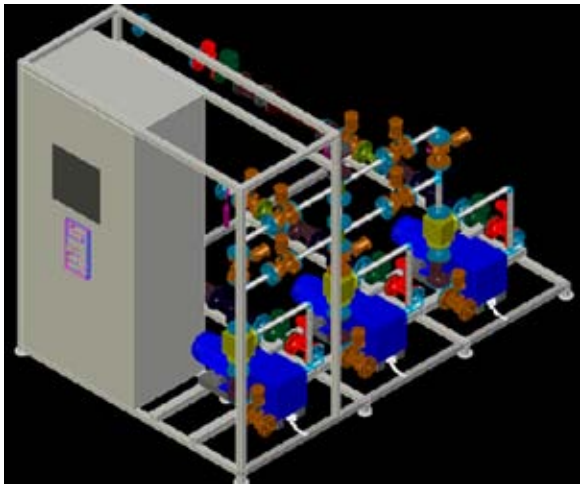
GreenD+Plus chemical injection capability

SRS Engineering has teamed up with Cavitation Technologies, Incorporated to develop this unique Green D system which contains the proprietary, patent pending, continuous flow, hydrodynamic, nano-technology-based reactor. This system has no moving parts and can be held in the palm of your hand. It is fully- automated allowing the user to produce superior quality degumming on demand with the touch of a button.

Simultaneous Metered Blending Advantages



Simultaneous Metered Blending combines the high volume production capacity of the Green D systems. It adapts the flow measuring techniques, but instead of blending in a kettle, the components are sent through the cavitation reactors. This system provides the simplest means of blending in the degumming process, and is most appropriate for less automated plants.

The Green D is designed to simultaneously measure liquids with a flow meter and moves these known quantities, in the correct ratio, through a cavitator.

- Mass flow measurement
- Efficient for any blend size
- Accuracy not limited to batch
- Short set-up time
- Simultaneous product loading speed blends
- Can be operated and controlled by PLC

Partners in Creating a Greener Tomorrow!

SRS ENGINEERING CORPORATION
BIODIESEL TECHNOLOGY

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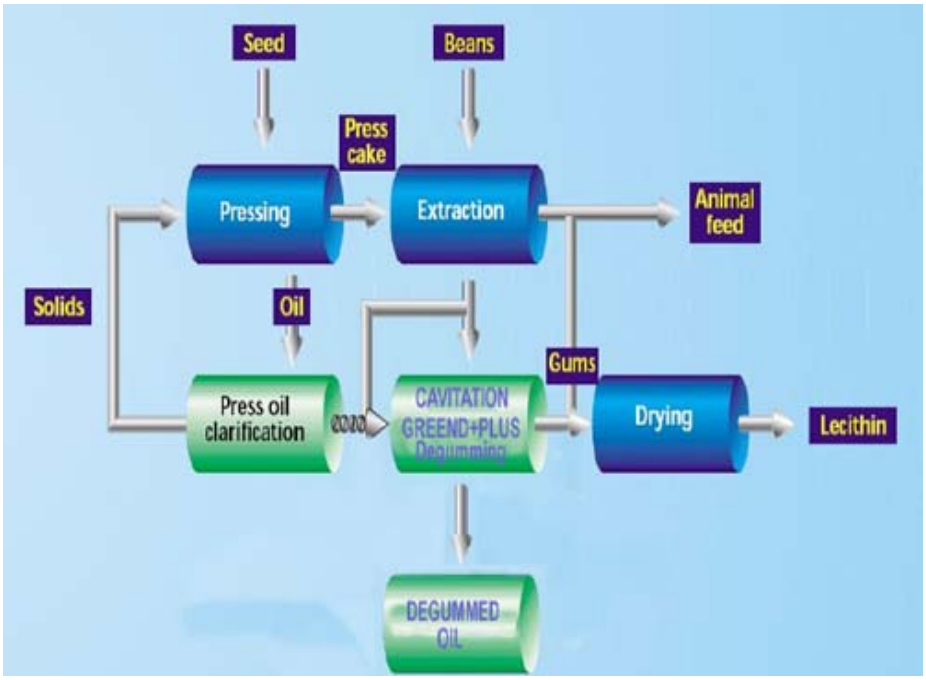
Recommended quality of oils for biodiesel production

- Oil must be degummed
- Phosphorus (Gums) must be <20 PPM
- Low levels of heavy metals: Iron, Copper, Calcium and Magnesium

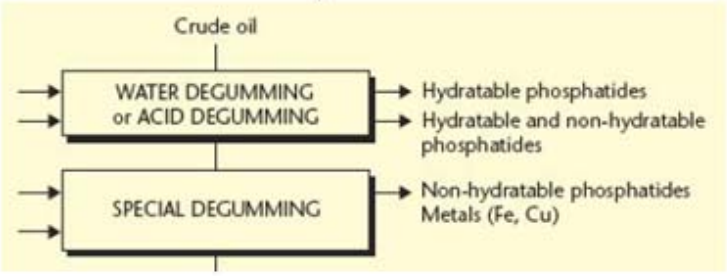
Average composition of crude and refined soybean oil*

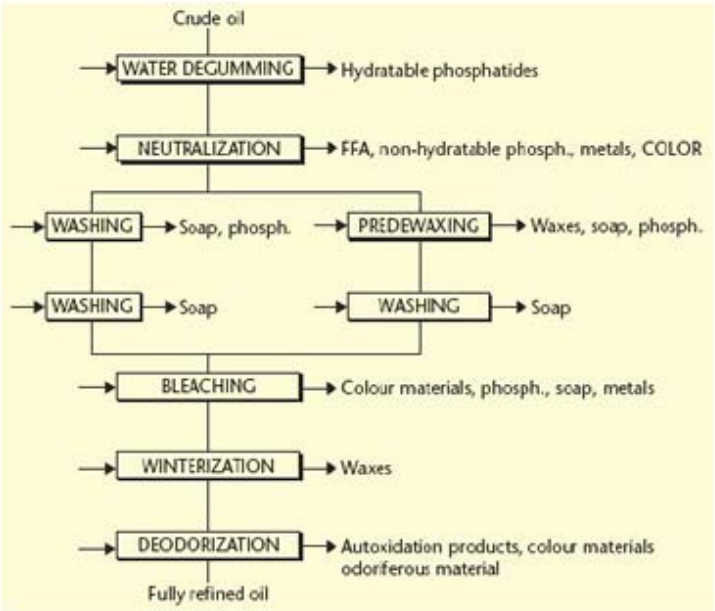
	Crude Oil Composition	Conventional Process Water Degumming	Acid Super Degumming	Green + Plus Degumming Water + Cavitation
Phosophorus (ppm)	400-1300	80-200	12-20	15-35
Iron (ppm)	1-3	<1	0.1 - 0.3	N.D.
Copper (ppm)	0.03-0.05	<0.05	0.02	N.D.
Calcium (ppm)	50-150	30	1 - 5	3-15
Magnesium (ppm)	50-150	20	1 - 5	1-12

**The values for (ppm) total are average values for crude oils with the corresponding phosphorus numbers. Actual (ppm) may vary with crude oil quality and process conditions.*



INDUSTRY DEGUMMING PROCESS





CAVITATION PROCESS

ONE STEP PROCESS

Water + Cavitation

- ✔ Hydratable phosphatides
- ✔ Non-hydratable phosphatides
- ✔ Metals: iron, copper and magnesium

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Diagram of Water Degumming Cold Process

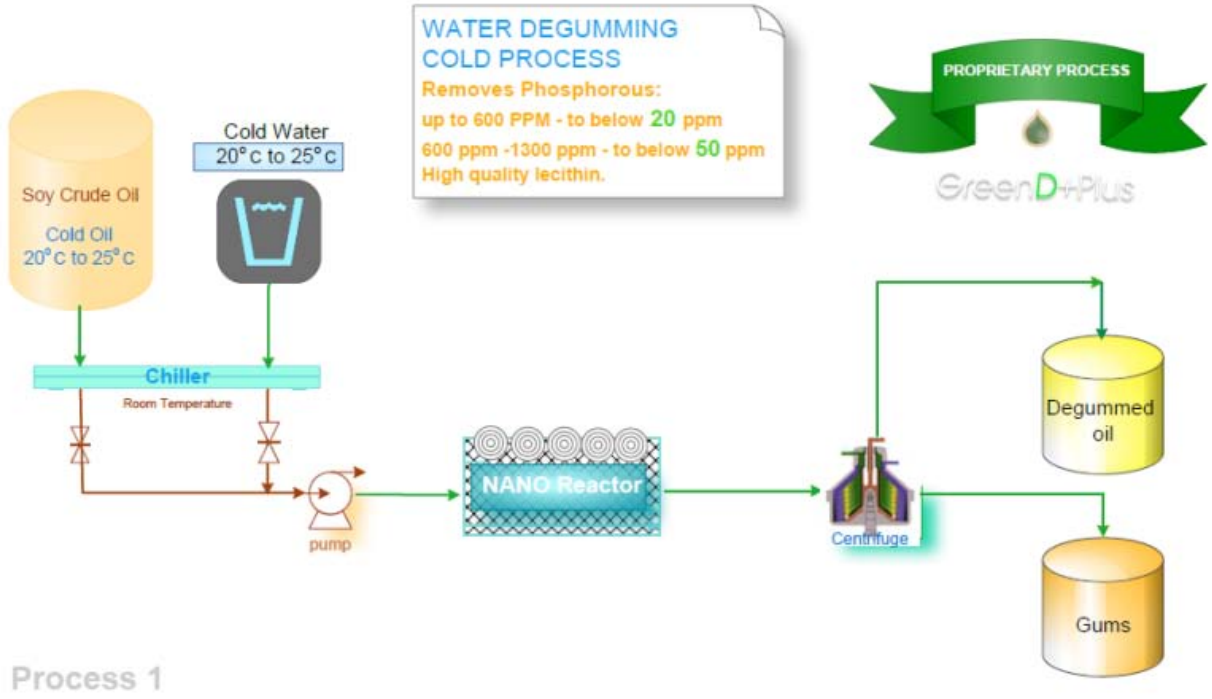
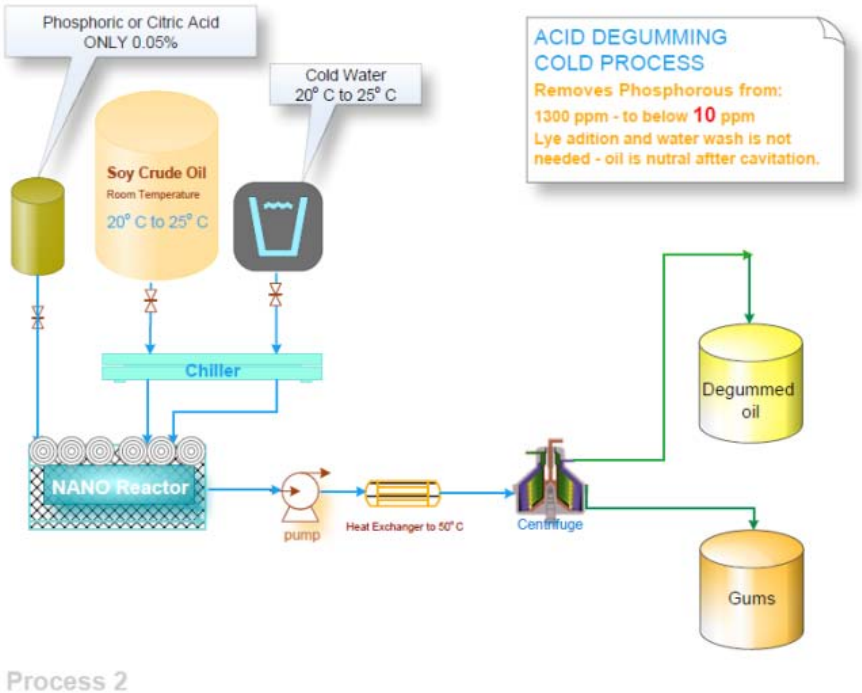


Diagram of Acid Degumming Cold Process



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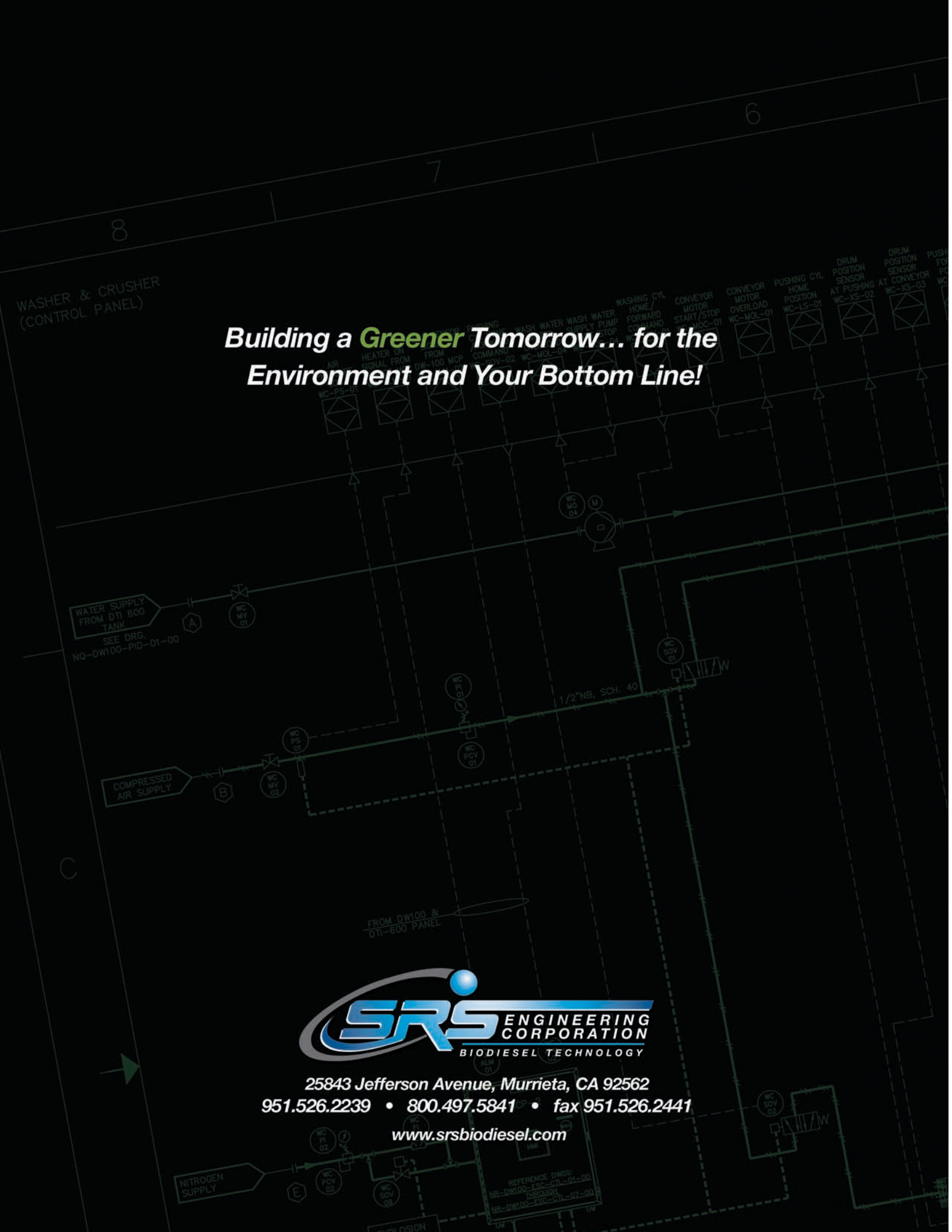

Building a Greener Tomorrow… for the Environment and Your Bottom Line!

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