

## LIGNIN RICH RESIDUES FROM BIOMASS TO CHEMICALS AND FUELS

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Chemtex is completing the construction of a 20MM gallon per year bioethanol plant in Crescentino, Italy utilizing the PROESA™ technology developed by Chemtex Italia. The PROESA™ process is both a **well-developed and simple process** that economically produces bioethanol and lignin-rich residues (LRR). PROESA™ has been demonstrated on a variety of perennial grasses and hardwood feedstocks, and can directly reduce capital costs, increase ethanol yield, and allow for the utilization of a series of low-cost feedstocks. Currently LRR is used for cogeneration for the plant. However it can be used as a feedstock for production of higher value chemicals and fuels.

With PROESA™ as the base technology, Chemtex is developing complementary technologies for the conversion of LRR to value-added hydrocarbons. A deoxygenation process for production of value-added hydrocarbons is undergoing development in the Chemtex pilot plant in Sharon Center, Ohio.

The usual routes for lignin conversion into chemically attractive products are gasification and reforming or pyrolysis and refining, both of which have issues. The Chemtex process uses LRR from lignocellulosic ethanol plant, but at the same time is flexible enough to use lignin-containing raw materials from other processes. The raw materials used in our technology are derived from naturally occurring lignocellulosic biomass, after the majority of the carbohydrate fraction has been biologically converted to ethanol. These include LRR from various crop residues (wheat and rice straw) and dedicated energy crops such as *Arundo donax*. The sulfur content of our feedstock is very low, and consequently no desulfurization is required to obtain hydrocarbon fuels (as opposed to a fossil fuel).

In our technology center in Ohio we have gone from batch laboratory scale reactions to continuous laboratory scale and then to continuous pilot scale process. So far Chemtex has converted various LRR from PROESA™ process into hydrocarbons highly rich in aromatics both in laboratory scale and pilot scale equipment.