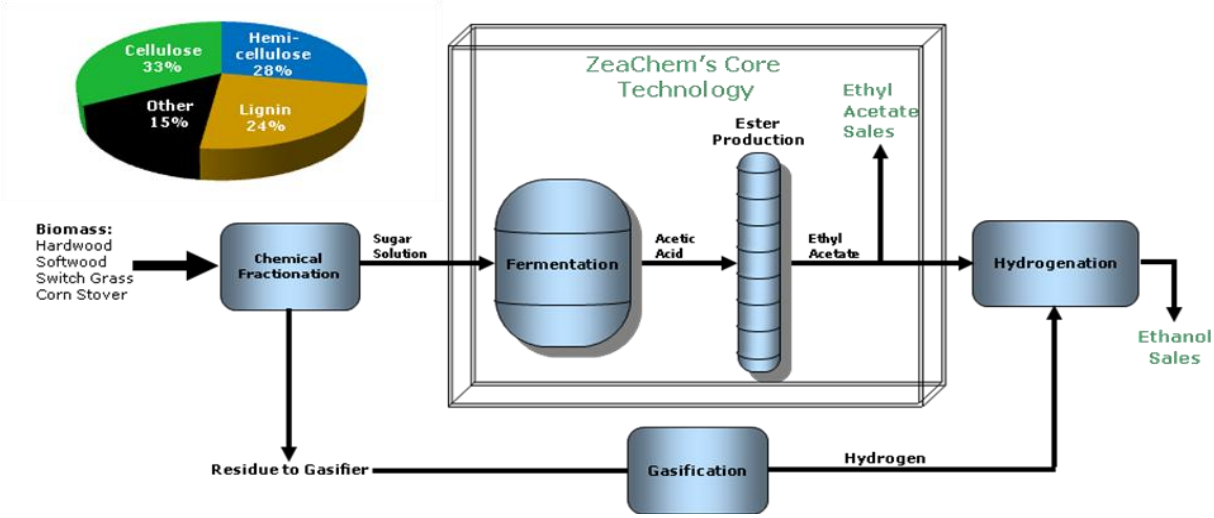
ZeaChem

Technology Overview

ZeaChem is pioneering advanced cellulosic ethanol, fuel and chemical technology using a hybrid combination of biochemical and thermochemical processing steps. ZeaChem uses biomass feedstocks that contain high levels of cellulose, which is the rigid structural compound found in all plants. Cellulosic biomass is an ideal choice for biorefining because it grows abundantly throughout the world and replenishes quickly and easily in poor quality soil. Another significant benefit of using cellulosic biomass is that it effectively ends the "food vs. fuel" debate that has drawn so much negative publicity to corn based ethanol plants.



ZeaChem utilizes a hybrid process of biochemical and thermochemical processing that preserves the best of both approaches from yield and efficiency perspectives. ZeaChem's process, although tightly protected by Intellectual Property (IP), utilizes no new organisms or process.

After fractionating the biomass, the sugar stream (both xylose [C_5] and glucose [C_6]) are sent to fermentation where an acetogenic process is utilized to ferment the sugars to acetic acid without CO_2 as a by-product. In comparison, traditional yeast fermentation creates one molecule of CO_2 for every molecule of ethanol. Thus the carbon efficiency of the ZeaChem fermentation process is nearly 100% vs. 67% for yeast. The acetic acid is converted to an ester which can then be reacted with hydrogen to make ethanol. To get the hydrogen necessary to convert the ester to ethanol, ZeaChem takes the lignin residue from the fractionation process and gasifies it to create a hydrogen-rich syngas stream. The hydrogen is separated from the syngas and used for ester hydrogenation and the remainder of the syngas is burned to create steam and power for the process. The net effect of combining the two processes is that about 2/3 of the energy in the ethanol comes from the sugar stream and 1/3 comes from the lignin steam in the form of hydrogen. At an expected Nth plant yield of 135 gallons per bone dry ton (gal/BDT), the process is nearly balanced with the necessary steam and power generated from the non-hydrogen portion of the syngas stream.

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