LIGNOCELLULOSIC FEEDSTOCK BIOREFINERY—THE FUTURE OF THE CHEMICAL AND ENERGY INDUSTRY

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The sustainable development of the chemical and energy industry is an indispensable component of our sustainable society. However, the traditional chemical and energy industry depends heavily on such non-renewable fossil resources as oil, coal, and natural gas. Its feedstock shortage and the resultant environmental and climatic problems pose a great threat for any type of sustainable development. Lignocellulosic materials are the most abundant renewable resources in the world, and their efficient utilization provides a practical route to address these challenges. The lignocellulosic feedstock bio-refinery is an effective model for the comprehensive utilization of lignocellulosic materials, and it will play vital role in the future development of chemical and energy industry.

Keywords: Lignocellulosic feedstock bio-refinery; Sustainable development; Chemical & energy industry

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Lignocellulosic Materials as Main Feedstock for Chemicals and Energy

A suitable feedstock for the chemical and energy industry is extremely important for the sustainable development of society. Its choice is always influenced by many factors, for example, its availability, technological level, economical considerations, and its environmental and ecological effects. Historically, it has experienced two great changes based on the practical historical conditions and economical considerations. One happened about 200 years ago when coal became the main feedstock in place of renewable biomass. Another happened about 50 years ago when crude oil became the main feedstock instead of coal. These changes have played an important role in the rapid growth of chemical and energy industries in the recent 200 years. It is no doubt that the current prosperity of chemical and industry is based on the cheap and steady feedstock supply, especially of such non-renewable fossil resources as crude oil, coal, and natural gas. However, the limited reservoir of fossil resources and their non-renewable nature will inevitably lead to shortages in the feedstock supply. Moreover, severe environmental and climatic problems have resulted from the use of fossil resources as refinery feedstocks. To deal with these difficulties, it is essential to shift the feedstock from the current non-renewable fossil resources to renewable biomass. It is noteworthy is that this feedstock change is different from the previous ones. The change depends on technical progress, and more considerations are placed on its sustainable development. In consideration of the expected population growth, crops will be mainly used as food and can't

become the main feedstock. It is obvious that lignocellulosic materials, the most abundant renewable resources in the world, will become the main feedstocks of the future chemical and energy industries.

Bio-Refinery — An Effective Model for the Comprehensive Utilization of Lignocellulosic Materials

Lignocellulosic materials have relatively complex composition and structure, which makes their comprehensive utilization rather complicated. However, their effective utilization is the prerequisite that they become the main feedstock of chemical and energy industry, replacing fossil resources. The recent technical progress in chemical technology and biotechnology makes their efficient utilization possible, and the lignocellulosic feedstock bio-refinery is the most effective model for their comprehensive utilization. The lignocellulosic feedstock bio-refinery is analogous to the petroleum refinery. It is a facility that integrates lignocellulosic conversion processes and equipment to produce fuels, power, and chemicals from lignocellulosic materials. By producing multiple products, it can take advantage of the differences in lignocellulosic components and intermediates and maximize the value derived from the lignocellulosic feedstock. It might, for example, produce one or several low-volume, but high-value, chemical products and a low-value, but high-volume liquid transportation fuel, while generating electricity and process heat for its own use and perhaps enough for sale of electricity. The high-value products enhance profitability, the high-volume fuel helps meet national energy needs, and the power production reduces costs and avoids greenhouse-gas emissions. The lignocellulosic feedstock bio-refinery can be built on two different technical platforms: the thermo-chemical platform and the biotechnological platform. The conceptual lignocellulosic feedstock bio-refinery is shown in Fig. 1. Although there are still some technical difficulties for its commercialization, it is certain that the lignocellulosic feedstock re-finery will be the future of the chemical and energy industry.

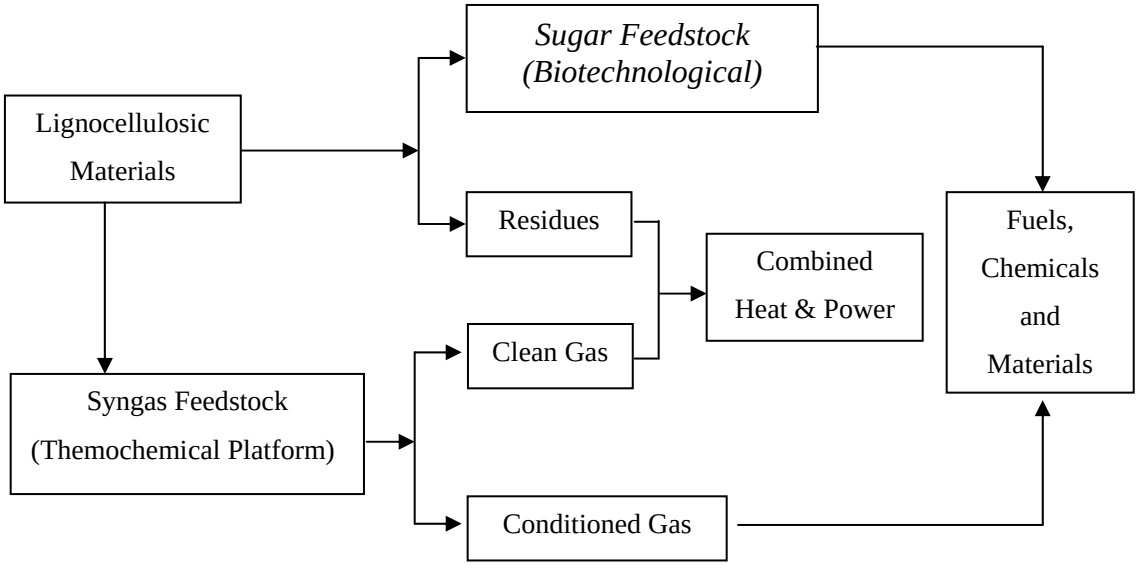

Fig. 1 Conceptual lignocellulosic feedstock bio-refinery