CHEMICAL REVIEWS

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Carbon Dioxide in Biomass Processing: Contributions to the Green Biorefinery Concept

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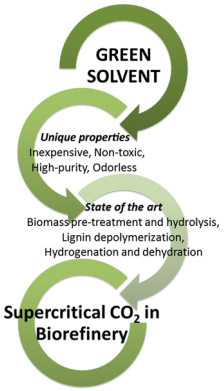

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1. INTRODUCTION

The 21st century is witnessing a huge demand of fossil reserves coupled with a rapid reduction in readily and economically reachable oil feedstocks.[1,2] The present energy demand is not fulfilled from fossil fuel sources, making the world exposed to geopolitical risk. Furthermore, concerns regarding the security of the supply chain and the environmental impacts have resulted in an ever-increasing shift of global energy policies to seek alternative technologies and sustainable sources of energy, materials, chemicals, and value-added products.[1] Recently, the need for development of an economy based on renewable resources has been recognized by society, and diverse R&D activities have started to be funded to accomplish this aim.[3] However, generation of bioproducts based on sustainable supply chains poses vast challenges for an eco-based economy. The simplest way to provide a supportable supply chain is through the employment of renewable biomass feedstocks, which is the only sustainable option to substitute for fossil fuel resources, as sources of organic compounds over a relatively short time scale and with limitless supply. All these factors have reinforced the need for research on production of biomass-derived commodities produced in a sustainable manner.[4] The biorefinery concept considers the use of biomass as a low-cost feedstock for the chemical and biological industries. The most widely used description of biorefinery is a definition adopted by International Energy Agency Bioenergy Task 42. It states that biorefining is the sustainable processing of biomass into a spectrum of marketable products and energy.[5] In other words, the biorefinery is a term used to define industrial facilities that cover an extensive range of combined technologies in which biomass is transformed and converted, in a sustainable manner, into a wide range of value-added products, leading to direct similarities to today's petrorefineries. Following this idea, the aim of future biorefineries is the extraction of high-value chemicals present in biomass, such as flavoring agents, fragrances, and nutraceuticals and, in the next step, processing of biomass-derived polysaccharides, lignin, and proteins toward bioderived materials, fuels, and other commodities.[6]

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