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Valorization of native sugarcane bagasse lignin to bio-aromatic esters/monomers via one pot oxidation-hydrogenation process

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PURPOSE OF THE ABSTRACT

The development of viable biorefinery routes for the valorization of lignocellulosics into usable products remains a challenge. Here we propose a highly effective ?oxidation-hydrogenation? process for full utilization of sugarcane bagasse by using molecular O2 at atmospheric pressure in the presence of Pd/C and methanol. The oxygen covered on catalyst surface enhanced the in situ hydrogenolysis of native lignin via solvent dissociation and formation of H radicals. Alcohol solvent is not only acted as hydrogen-donor but also an effective capping agent for stabilizing the noncanonical subunits in sugarcane bagasse. Under optimal condition ferulic acid (FA) and p-coumaric acid (pCA) derived bio-aromatic esters were obtained from native bagasse lignin with 31.7 wt% yield, which accounts for 55% of total oil fraction. Another feature of this process is the formation of methylated mono sugar derivatives in oil fraction and the carbohydrate-rich solid residue is readily fermentable. The yield of bio-aromatic esters highly depands on the content of FA and pCA unit in biomass and whether the lignin is in the native or technical form. Two main reaction pathways for the in-situ valorization of lignin are proposed and the multi-facet roles of molecular O2 to facilitate fractionation and lignin depolymerization are explained, based on the XPS, FTIR and 2D NMR results.

FIGURES

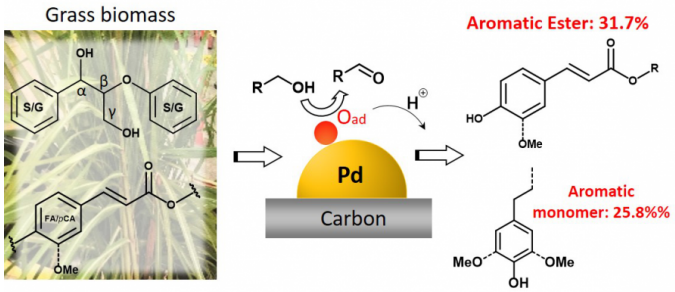

FIGURE 1

Valorization of native sugarcane bagasse lignin to bio-aromatic esters/monomers via one pot oxidation-hydrogenation process

Bagasse conversion to bio-aromatics esters and chemicals via one pot oxidation-hydrogenation process

FIGURE 2

KEYWORDS

sugarcane bagasse | aromatic esters | oxidation-hydrogenation | oxygen

BIBLIOGRAPHY