Preface

Pretreatment of biomass

The Biorefinery concept is recognized as one important strategy the world can use to wean itself off finite hydrocarbons, using renewable biomass feedstocks to establish a more sustainable global society. The world’s most abundant natural material is cellulose which, like starch, is composed of glucose. However, unlike sugar or starch which nature designed more as a readily biodegradable biomass source and which has been used as the initial feedstock of many pioneering biorefineries, cellulose is a structural material that is much more difficult to deconstruct. This is a result of both its intrinsic, close polymeric alignment and its intimate association with other lignocellulosic components such as hemicellulose and lignin. Although significant advances have been made in enhancing the enzymes that can hydrolyze cellulose, some form of pretreatment is invariably required, to both facilitate the recovery of the associated lignin and hemicellulose components in a higher value form and to enhance accessibility of the enzymes to the cellulose.

As indicated in this special issue there are a wide range of lignocellulosic/biomass materials that can act as the feedstock for a biorefinery. Thus, the type of pretreatment required to fractionate and enhance component recovery and cellulose accessibility will be strongly influenced by the nature of the substrate. These include highly recalcitrant, softwood lignocellulosic materials to the likely more malleable micro/macro algae that have been suggested as possible future feedstocks. As well as a biorefinery approach a parallel, thermorefinery strategy has also been suggested as a possible means of converting biomass to useful products and this topic has also been covered in this special issue.

The most current biomass pretreatment R&D activities in the bio and thermorefinery areas have been profiled in this special issue with the hope with particular emphasis on technology developments, industrialization and commercialization of biofuels and the overall bio- and thermo-refinery processes. This special issue contains 53 selected, peer reviewed papers classified into the four themes of; (1) pretreatment of lignocellulosic materials, (2) pretreatment of algal biomass, (3) pretreatment as it relates to a thermorefinery approach and, (4) others.

- **Pretreatment of lignocellulosic materials for a biorefinery approach:** As the efficient fractionation of the carbohydrate components from the lignocellulosic matrix while increasing accessibility to cellulose is an important component of a biorefinery approach to bioconversion, several different pretreatment technologies are profiles. In the special issue, thirty-six articles cover this topic.
  - Pretreatment of algal biomass: As algal biomass, including macro- and microalgae, has different physicochemical characteristics from lignocellulosic materials, a different pretreatment approach needs to be developed for algae based biorefineries. Seven papers describe the thermochemical and biological pretreatment of algae.
  - Pretreatment for thermorefinery approach: Bio-oil and/or bio-syngas are the starting feedstocks for a thermorefinery approach. Five papers covering pyrolysis and torrefaction, have been included in this theme.
  - Others: Five papers describe where pretreatment has been used as the front-end of a range of processes such as anaerobic digestion, esterification of rubber oil, torrefaction with combustion and nonconventional energy utilization.

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