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David Serrano
IMDEA Energy, Spain

Recent progress in the thermocatalytic processing of biomass into advanced fuels

A high interest has arisen in recent years in novel processes for the transformation of different types of biomass into advanced biofuels. The use of non-edible biomass sources and the overall sustainability of the process are very important factors to be considered in the development of new routes for the production of second-generation biofuels. In this way, lignocellulosic biomass appears as a very interesting source of biomass due to its independency with the food market, its low cost and high availability in the form of agriculture and forest residues or as energy crops. Three main pathways are being explored for the thermochemical conversion of lignocellulose: Gasification, pyrolysis and liquefaction. Biomass pyrolysis, depending on the temperature and the heating rate, yields gases, liquid and solid fractions with different proportions. The maximum yield in the liquid fraction (bio-oil) is attained when working at temperatures of about 500ºC and high heating rates (fast and flash pyrolysis). This is a relatively simple process that it is being implemented now at commercial scale in different countries. However, one of the unsolved problems is related to the complex composition of the bio-oil, which limits its use as fuel mainly in not very demanding applications, such as heating fuel. Bio-oil presents both high oxygen content and low calorific value. Moreover, it has an acidic pH, which provides it with undesirable properties. Accordingly, a variety of routes are being investigated for bio-oil upgrading into advanced biofuels, showing properties suitable for the transportation sector. These routes include a number of chemical transformations, such as catalytic pyrolysis, hydrodeoxygenation, ketonization, esterification, aldol condensation, alkylation, etc. In most cases, the catalysts to be developed should combine bifunctional properties, for removing a large part of the oxygen contained in the bio-oil and to modify the chemical structure of the compounds for its use as transportation fuels, with a high accessibility to the active sites.

Biography

David Serrano is the Director of the IMDEA Energy Institute and Full Professor of Chemical Engineering at Rey Juan Carlos University. He is also Head of the Thermochemical Processes Unit at IMDEA Energy. He received his PhD from Complutense University of Madrid (1990) awarded with the Extraordinary Mention. He was appointed as Associate Professor at Complutense University of Madrid (1990-1999), and subsequently at Rey Juan Carlos University. Later he was appointed as Full Professor (2002). His teaching activity has been focused on subjects related to chemical engineering, environmental engineering and energy engineering in a number of degrees, masters and PhD courses. Currently, he is Coordinator of the FP7 EU CASCATBEL project, aimed to the conversion of lignocellulosic biomass into advanced biofuels through catalytic routes. He has been author of about 150 publications in scientific journals, author of more than 200 communications to congresses and scientific meetings, of 5 patents and of 4 books. He is member of the Scientific Committee of CIESOL (Almería, Spain) and of the German Biomass Research Centre (Leipzig, Germany), as well as of different scientific associations. He has been member of the scientific committee of several journals and of a number of scientific workshops and congresses.

david.serrano@imdea.org

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