Editorial: Building a bridge in bioenergy between Asia and Europe

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1 Introduction

The present special issue includes a number of scientific articles initially selected among more than 200 contributions during the IBSCE 2015 – Asian Bioenergy Conference 2015, held in Shanghai in October 2015. Authors of these papers were invited to prepare and submit a full journal article for peer review: this issue is the result of the scientific work carried out by scientist from Europe and Asia to address scientific innovation and deployment of biomass, bioenergy and bioproducts.

Asia represents a key area for sustainable bioenergy and bioproducts. In fact, its impressive economic and industrial growth is associated with increased global and local pollution, especially in urban areas, while the development of rural regions requires a new and sustainable supply of energy: thus, renewable energy is a fundamental component of sustainable development. Asian companies have clearly understood it as an opportunity for economic development, and thus have invested in the fast growing renewable energy sector, such as photovoltaics, where China has rapidly become the dominating country. On the other hand, the EU has also invested large human and financial resources in the renewable energy field, developing innovative technologies, processes, systems and value chains.

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The joint conference aimed at favouring the direct dialogue between these two regions of the world, promoting the sharing of scientific and technical information in the field of bioenergy, presenting the most recent research results and contributing to strengthening the links between Europe and Asia.

This action is today more and more welcome, as the implementation of the COP21 Paris Agreement, already endorsed by the USA, the EU and China, will require a tremendous effort and very focused and concrete actions, where innovative systems, processes and technologies will play the key role.

2 The special issue

Eight scientific articles comprise this special issue. The topics presented range from GHG/bioenergy policy analysis, to thermochemical and biochemical processing of biomass, upgrading and use of liquid fuels, and production of biochemicals.

Seungwoo Kang et al. examined whether GHG mitigation policy could be sufficient to deploy bioenergy in Asia. Due to the tremendous economic growth and the associated steep rise in energy demand, the Asian region represents a top emitter of CO_2 and a large importer of energy. Authors carried out a study on the evolution of bioenergy deployment through current energy and climate policies using a bottom-up energy system optimisation model, TIAM-FR, elaborating a long-term analysis. Carbon tax resulted as the most favourable means to stimulate the largest bioenergy contribution by 2030, while current intended nationally determined contribution (INDC) GHG emission pledges are not sufficient to drive bioenergy development unless accompanied by specific bioenergy targets.

Michael Kraussler et al. investigated the water gas shift process in a pilot unit connected to a dual fluidised bed reactor operated at part load. The work thus operated the water gas shift unit at high tar load conditions, and demonstrated that using a commercially available Fe/Cr-based catalyst a 92% CO conversion and 30% tar reduction can be obtained with this system. The pilot water gas shift installation is composed of three reactors placed in series, filled with the catalyst.

Ying Ying Tye and Cheu Peng Leh performed aqueous pretreatments of kenaf with oxygen-alkali extraction for the enhancement of core fibre hydrolysability, with the aim of producing fermentable lignocellulosic sugars. Chemical structure and fibre morphology were analysed through FTIR and SEM to examine the performances of the chosen pretreatment method. The effect of an oxygen-alkali extraction step following pretreatment on sugars extracted was assessed. The work concluded that the combination of oxygen-alkali extraction with water and acid pretreatments could increase the kenaf fibres saccharification due to large removal of hemicellulose as well as lignin, and severe structural modifications of fibre. On the contrary, combining alkali pretreatment with oxygen-alkali extraction was found to be ineffective.

Elena De Luca et al. investigated the removal of H_2S from biogas streams in view of downstream biomethane production. The approach proposed by the authors involves the use of a microorganism, the bacterium *Chlorobium limicola*, in a novel photobiorector where hydrogen sulfide is converted with 90% efficiency into elemental sulphur through an anoxigenic photosyntethic step. The work proved the stability of the process under non-sterile conditions.

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Qiong Wang et al. examined sugarcane bagasse and its conversion into furfural and other chemicals in a phosphoric acid-tetrahydrofuran (THF) system. The goal of obtaining furfural while preserving cellulose residue from degradation was obtained through pretreatment by phosphoric acid THF system. The following two-step rising temperature processing achieved 66.59 mol% furfural yield, and cellulose depolymerisation into glucooligosaccharides, which further conversion into formic and levulinic acids in the residual was also investigated.

Buffi et al. addressed the use of vegetable oils as bioliquids for decentralised heat and power generation in rural areas. Based on cultivation of oil crops such as sunflower and rape in the Italian region of Tuscany, centrally located in the country, the work discussed both the main product (i.e., the vegetable oil) and the co-product, the press-cake. It particularly focused the attention on the physical and chemical characteristics of this bioliquid when produced in a decentralised and cold-pressing scheme, in light of the German norm DIN 51623. This standard specifies major properties of the vegetable oil in order to be used in modern engine-based CHP unit. The work also tested and verified a method, based on the use of additives developed by third parties, aimed at reducing P content in vegetable oils. P, together with Ca and Mg, is a major contaminant which can create deposits in the lubricated parts of the engine, and thus reduce the operational performances of the system, therefore increasing costs and risks of failure. Very positive results were obtained with 2% w/w additive.

Eric Billig et al. examined the standardisation, production and utilisation of biomethane in Europe and China. The work focuses attention on the standardisation process in place or planned in both regions, and possible uses of biomethane. Crucial biomethane parameters are presented and discussed, and a SWOT analysis for standardisation presented. The need for a coherent market development is analysed, and recommendations given.

Dimitrios Sidiras et al. addressed acid hydrolysis of wheat straw in a batch reactor in the presence of maleic acid as a catalyst and modelling the hydrolysis kinetics of cellulose and hemicellulose. A new modified severity factor was defined: temperature, acid concentration and pH were modelled, estimating optimum conditions.

3 Conclusions

Bioenergy represents a great economic opportunity and a fundamental component of GHG mitigation in Asia and EU. The work of researchers from both regions will be more effective, with better and faster results achieved, through cooperation in science and technology. This special issue includes some of the information shared during the conference and further elaborated in the form of peer reviewed articles. The topics here presented cover a wide range of applications, from bioenergy conversion to gaseous and liquid biofuels/bioliquids to their utilisation. It aims at providing a small, first, qualified contribution to the scientific dialogue between Asia and Europe on that matter.

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