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Section B3: Bio-Energy

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Section Editor-in-Chief
Prof. Dr. Fernando Rubiera González
Institute of Carbon Science and Technology, INCAR-CSIC, 26 Francisco Pintado Fe, 33011 Oviedo, Spain

About the section *B2: Wind, Wave and Tidal Energy*

In recent decades, there has been a constant growth in the world's energy demands, mostly supported by fossil fuels. This has resulted in an associated increase in CO_2 emissions and a growing concern about the consequences of climate change and global warming, which represent a major threat to the wellbeing not only of humankind but also of our planet. Thus, there is an increasing interest in developing new technologies to produce energy from renewable sources, such as biomass, in a high-energy efficient, cost-competitive, and environmentally friendly manner. The production of bio-energy from biofuels offers several advantages, as it will reduce the energy production impact of the greenhouse effect and global warming due to its CO_2 life-cycle neutrality; likewise, unlike most other renewable energy sources, bio-energy can generate both heat and electricity with high efficiency in combined heat and power (CHP) plants.

Transport is the third-largest source of CO_2 emissions after the power and industrial sectors, with road transport being the biggest contributor followed by aviation and shipping. Reducing the emissions of the transport sector is likely to be more challenging than for other sectors; thus, key developments in the transport sector will have to include higher use of biofuels produced in a sustainable manner, including biojet fuels suitable for aircrafts, in accordance with the sustainable development scenario of the IEA.

The Bio-Energy Section is primarily focused on regular and review papers related to all aspects of bio-energy production and use, including treatment of feedstocks, biomass conversion technologies, all range of biofuels for vehicles, and new trends and latest discoveries for promoting the use of aviation biofuels.

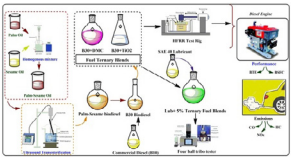
Section B3: Bio-Energy

Content Highlights

DOI:10.3390/en13133375

Effect of Additivized Biodiesel Blends on Diesel Engine Performance, Emission, Tribological Characteristics, and Lubricant Tribology

Authors: M. A. Mujtaba, H. H. Masjuki, M. A. Kalam, Fahad Noor, Muhammad Farooq, Hwai Chyuan Ong, M. Gul, Manzoore Elahi M. Soudagar, Shahid Bashir, I. M. Rizwanul Fattah and L. Razzaq

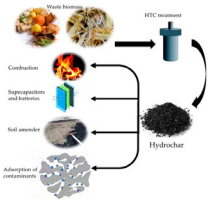


Abstract: This research work focuses on investigating the lubricity and analyzing the engine characteristics of diesel–biodiesel blends with fuel additives (titanium dioxide (TiO_2) and dimethyl carbonate (DMC)) and their effect on the tribological properties of a mineral lubricant. A blend of palm–sesame oil was used to produce biodiesel using ultrasound-assisted transesterification. B30 (30% biodiesel + 70% diesel) fuel was selected as the base fuel. The additives used in the current study to prepare ternary fuel blends were TiO_2 and DMC. B30 + TiO_2 showed a significant reduction of 6.72% in the coefficient of friction (COF) compared to B30. B10 (Malaysian commercial diesel) exhibited very poor lubricity and COF among all tested fuels. Both ternary fuel blends showed a promising reduction in wear rate. All contaminated lubricant samples showed an increment in COF due to the dilution of combustible fuels. Lub + B10 (lubricant + B10) showed the highest increment of 42.29% in COF among all contaminated lubricant samples. B30 + TiO_2 showed the maximum reduction (6.76%) in brake-specific fuel consumption (BSFC). B30 + DMC showed the maximum increment (8.01%) in brake thermal efficiency (BTE). B30 + DMC exhibited a considerable decline of 32.09% and 25.4% in CO and HC emissions, respectively. The B30 + TiO_2 fuel blend showed better lubricity and a significant improvement in engine characteristics.

DOI:10.3390/en13164098

Hydrothermal Carbonization as a Valuable Tool for Energy and Environmental Applications: A Review

Authors: Manfredi Picciotto Maniscalco, Maurizio Volpe and Antonio Messineo

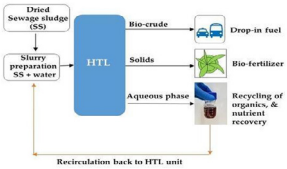


Abstract: Hydrothermal carbonization (HTC) represents an efficient and valuable pre-treatment technology to convert waste biomass into highly dense carbonaceous materials that could be used in a wide range of applications between energy, environment, soil improvement and nutrients recovery fields. HTC converts residual organic materials into a solid high energy dense material (hydrochar) and a liquid residue where the most volatile and oxygenated compounds (mainly furans and organic acids) concentrate during reaction. Pristine hydrochar is mainly used for direct combustion, to generate heat or electricity, but highly porous carbonaceous media for energy storage or for adsorption of pollutants applications can be also obtained through a further activation stage. HTC process can be used to enhance recovery of nutrients as nitrogen and phosphorous in particular and can be used as soil conditioner, to favor plant growth and mitigate desertification of soils. The present review proposes an outlook of the several possible applications of hydrochar produced from any sort of waste biomass sources. For each of the applications proposed, the main operative parameters that mostly affect the hydrochar properties and characteristics are highlighted, in order to match the needs for the specific application.

DOI:10.3390/en13020493

Bio-Crude Production through Aqueous Phase Recycling of Hydrothermal Liquefaction of Sewage Sludge

Authors: Ayaz A. Shah, Saqib S. Toor, Tahir H. Seehar, Rasmus S. Nielsen, Asbjørn H. Nielsen, Thomas H. Pedersen and Lasse A. Rosendahl

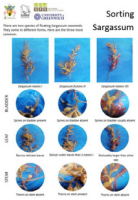


Abstract: Hydrothermal liquefaction (HTL) is a promising technology for the production of bio-crude. However, some unresolved issues still exist within HTL, which need to be resolved before its promotion on a commercial scale. The management of the aqueous phase is one of the leading challenges related to HTL. In this study, the sewage sludge has been liquefied at 350 °C with and without catalyst (K_2CO_3). Subsequently, aqueous phase recycling was applied to investigate the effect of recycling on bio-crude properties. Obtained results showed that the energy recovery in the form of bio-crude increased by 50% via aqueous phase recirculation, whereas nitrogen content in the bio-crude was approximately doubled after eight rounds of recycling. GCMS characterization of the aqueous phase indicated acetic acid as a major water-soluble compound, which employed as a catalyst (0.56 M), and resulted in a negligible increase in bio-crude yield. ICP-AES highlighted that the majority of the inorganics were transferred to the solid phase, while the higher accumulation of potassium and sodium was found in the aqueous phase via successive rounds of recycling.

DOI:10.3390/en13061523

Sargassum Inundations in Turks and Caicos: Methane Potential and Proximate, Ultimate, Lipid, Amino Acid, Metal and Metalloid Analyses

Authors: John James Milledge, Supattra Maneein, Elena Arribas López and Debbie Bartlett



Abstract: The Caribbean has been experiencing beach inundations of pelagic Sargassum, causing environmental, health and financial issues. This study showed variations in the composition and methane potential (MP) between the species of Sargassum. The MPs for *S. natans VIII, S. natans I* and *S. fluitans* (145, 66 and 113 mL CH_4 g^{-1} Volatile Solids) were considerably below theoretical potentials, possibly due to the high levels of indigestible fibre and inhibitors. The mixed mats Sargassum composition was substantially different from the individual species, being higher in ash, calcium, iron, arsenic and phenolics. The mixed mats produced no methane, perhaps due to the high levels of phenolics. There was a strong correlation between MP and phenolic content. Heavy metals and metalloids were at levels that should not cause concern, except for arsenic (21–124 mg kg^{-1} dry weight). Further work on the speciation of arsenic in Sargassum is required to fully determine the risk to health and agriculture. Both protein and lipid levels were low. The 'indispensable amino acid' profile compares favourably with that recommended by the World Health Organisation. Lipids had a high proportion of Polyunsaturated Fatty Acids. The use of Sargassum for biogas production could be challenging, and further work is required.

Special Issues Open for Submission

Innovative Biodegradation Processes for Environmental Contaminants Removal
Guest Editor: Prof. Dr. Annabelle Couvert
Deadline: **31 March 2022**

Biodiesel Fuel Combustion
Guest Editor: 4 April 2022
Deadline: **Dr. Mansour Al Qubeissi**

Residual Biomass Conversion to Bioenergy
Guest Editor: Prof. Dr. Biagio Morrone
Deadline: **25 April 2022**

Biomass Energy for Environmental Sustainability
Guest Editor: Dr. Hwai Chyuan Ong
Deadline: **25 May 2022**

Lignocellulosic Biomass Conversion
Guest Editor: Dr. Mamata Singhvi
Deadline: **31 May 2022**

Advances in Biomass for Energy Technologies
Guest Editors: Prof. Dr. Jacek Dach, Prof. Dr. Maciej Zaborowicz and Prof. Dr. Wei Qiao
Deadline: **20 June 2022**

Technologies for Biomaterial and Energy Production from Dedicated Crops and Residues
Guest Editor: Dr. Luigi Pari
Deadline: **30 June 2022**

Waste Biorefineries
Guest Editor: Dr. Md Mofijur Rahman, Dr. Syed Awais Ali Shah Bokhari,
Dr. Shams Forruque Ahmed and Prof. Dr. Pau Loke Show
Deadline: **30 June 2022**

Valorisation of Wastes: Environmental Sustainability and Production of Biofuels by Advanced Technologies II
Guest Editor: Dr. Alessandro Alberto Casazza
Deadline: **25 August 2022**

Biomass and Municipal Solid Waste Thermal Conversion Technologies
Guest Editor: Dr. Xiaohan Ren, Prof. Dr. Fei Sun and Prof. Dr. Juan Chen
Deadline: **31 October 2022**

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Basel, February 2022