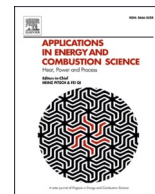




Contents lists available at ScienceDirect

# Applications in Energy and Combustion Science

journal homepage: [www.sciencedirect.com/journal/applications-in-energy-and-combustion-science](http://www.sciencedirect.com/journal/applications-in-energy-and-combustion-science)

## Special issue of thermo-chemical conversion of biomass

The rapid depletion of fossil fuels and the increasing of carbon emissions drive us to exploit the renewable energy. Biomass, the only carbon-contained renewable energy resource, has aroused more and more attentions due to its natural abundance and carbon neutrality. Thermo-chemical processes, such as gasification and pyrolysis, are regarded as a promising technology for the utilization of biomass since it can rapidly convert biomass into liquid fuels, biochar and gases. Those can be directly or further used as energy, fuel, and chemical products, which have already been applied in various industries. However, the thermo-chemical conversion of biomass still remains to be further explored in many aspects, such as deep mechanism, novel processes and catalyst materials, as well as new modeling and analyzing methods, etc. The above-mentioned has been the motivation for the publication of the current special issue “Thermo-chemical Conversion of Biomass”. This Special Issue aims at reporting the latest advances in biomass to biofuel via thermo-chemical conversion technology including original research papers and reviews (mini-reviews).

Many submissions were received for this Special Issue. All submissions have been subjected to the usual screening within the editorial office and/or subsequent rigorous peer-review process. Upon the completion of the whole editorial process, a total of 19 papers (including 7 review articles and 12 research articles) have been finally accepted for publication in this Special Issue, as listed in Table 1.

The Special Issue compiles a list of review and original research articles describing the latest fundamental research and technology development in thermo-chemical conversion of biomass, with the concise synopsis of each paper given below.

**Review article.** Seven review articles are included. Ren et al. [1] reviewed the fabrication strategies of Ni-based catalysts for the reforming of biomass tar/tar model compounds and offered some future direction and challenges to optimize the Ni-based catalysts. Zhang et al. [2] presented a review on the aviation oil production from organic wastes through thermochemical technologies, especially for the methods of conventional pyrolysis, microwave-assisted pyrolysis, and solar-assisted pyrolysis. Song et al. [3] summarized biomass gasification, catalytic gasification, novel gasification technologies for H<sub>2</sub> production and finally provided some prospects for the future research directions. Zheng et al. [4] critically reviewed the latest progress in the development of the effect of feedstock, catalyst, co-pyrolysis, and process design on the bio-aromatics production from biomass. Liu et al. [5] comprehensively reviewed the formation, prevention and application of humins, which summarized significant knowledge for humins

formation, characterization, prevention and further utilization. Caballero et al. [6] critically reviewed the syngas production from biomass and followed by the reforming technologies of the biomass-derived vapors to explain the status, challenges, and prospects for biomass conversion to fuels. Tao et al. [7] elaborated on a state-of-the-art review for the conceptual design and evaluation of the integrated bio-fuel production systems, along with future research perspectives and new development strategies.

**Research article.** Twelve articles are included. Wang et al. [8] studied the component evolution mechanism of biomass pyrolysis vapors by a combined method of bio-oil composition inversion and function fitting. Fawzy et al. [9] conducted a kinetic analysis of the isothermal, non-isothermal, and stepwise heating of a short rotation woody crop by using an advanced kinetics and technology solutions method. Zhang et al. [10] proposed catalytic pyrolysis of the Ca<sup>2+</sup>-loaded lignin coupled with the metal-modified HZSM-5 to produce an enhanced aromatic yield of 46.1 mg/g. Xiao et al. [11] explored the evolution of radicals including stable radicals and active radicals to clarify the coke formation during pyrolysis of bio-oil at 200–500°C. Chen et al. [12] characterized the property variation and energy usage with torrefaction severity for the pretreatment of biomass, with the comparison of electric-heating torrefaction and solar-driven torrefaction method. Li et al. [13] investigated the effect of coal volatiles on the subsequent pyrolysis of biomass on the properties of biochar in a two-stage reactor. Zhang et al. [14] studied the sintering of simulated ashes in a lab-scale auto thermal biomass gasification reactor and pointed out that the degree of ash sintering was restrained at a relative low gasification temperature. Hu et al. [15] explored the role of glycosidic bond in the pyrolysis of cellulose based on the combined methodology of stochastic surface walking and neural network potential. Jiang et al. [16] studied the equilibrium, kinetic and mechanism during phosphate adsorption at a capacity of 97450 mg/kg PO<sub>4</sub><sup>3-</sup> by a novel activated sewage sludge biochar. Chen et al. [17] conducted the experimental and kinetic study on flash pyrolysis of biomass in a micro-fluidized bed reactor via the on-line photoionization mass spectrometry. Zhang et al. [18] analyzed the cost and profitability of a biomass-based combined heat and power generation in China by using the integrated logistic model and geographic information system. Cui et al. [19] used a reactor-integrated electrospray ionization high-resolution mass spectrometry to real-time analyze the lignin depolymerization process.

<https://doi.org/10.1016/j.jaecs.2022.100075>

Available online 16 June 2022

2666-352X/© 2022 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**Table 1**

A list of papers that are published in this special issue.

Article type	The first author and corresponding author	Corresponding author's institution	Title (DOI)
Review article	Ren & Cao	China University of Mining & Technology	Fabrication strategies of Ni-based catalysts in reforming of biomass tar/tar model compounds (10.1016/j.jaecs.2021.100053)
	Zhang & Xiong	Harbin Institute of Technology; South China University of Technology	A review of aviation oil production from organic wastes through thermochemical technologies (10.1016/j.jaecs.2022.100058)
	Song & Yang, Wang	Huazhong University of Science and Technology; Zhejiang University	Recent development of biomass gasification for H <sub>2</sub> rich gas production (10.1016/j.jaecs.2022.100059)
	Zheng & Wang, Zheng	Xiamen University; Innovation Laboratory for Sciences and Technologies of Energy Materials of Fujian Province	Advanced catalytic upgrading of biomass pyrolysis vapor to bio-aromatics hydrocarbon: A review (10.1016/j.jaecs.2022.100061)
	Liu & Wang	Chinese Academy of Sciences; Guangdong Key Laboratory of New and Renewable Energy Research and Development	Advances in understanding the humins: Formation, prevention and application (10.1016/j.jaecs.2022.100062)
	Caballero & Zaini	KTH Royal Institute of Technology	Reforming processes for syngas production: A mini-review on the current status, challenges, and prospects for biomass conversion to fuels (10.1016/j.jaecs.2022.100064)
	Tao & Chen	Tianjin University of Commerce; Tibet University	Technologies integration towards bio-fuels production: A state-of-the-art review (10.1016/j.jaecs.2022.100070)
Research article	Wang & Zhu	University of Science and Technology of China	Study on the influence of residence time on the componential evolution of biomass pyrolysis vapors during indirect heat exchange process through a combining method of bio-oil composition inversion and function fitting (10.1016/j.jaecs.2021.100047)
	Fawzy & Osman	Queen's University Belfast; South Valley University	Kinetic modelling for pyrolytic conversion of dedicated short rotation woody crop with predictions for isothermal, non-isothermal and stepwise heating regimes (10.1016/j.jaecs.2021.100048)
	Zhang	Southeast University	Enhancing aromatic yield from catalytic pyrolysis of Ca <sup>2+</sup> -loaded lignin coupled with metal-modified HZSM-5 (10.1016/j.jaecs.2021.100049)
	Xiao, Xiong & Wang	Huazhong University of Science and Technology	Coke formation during the pyrolysis of bio-oil: Further understanding on the evolution of radicals (10.1016/j.jaecs.2021.100050)
	Chen	Nanjing Forestry University	Comparative study of electric-heating torrefaction and solar-driven torrefaction of biomass: Characterization of property variation and energy usage with torrefaction severity (10.1016/j.jaecs.2021.100051)
	Li & Hu	University of Jinan	Sequential pyrolysis of coal and biomass: Influence of coal-derived volatiles on property of biochar (10.1016/j.jaecs.2021.100052)
	Zhang & Gao, Wu	Queen's University Belfast; Xi'an Jiaotong University	Effect of auto thermal biomass gasification on the sintering of simulated ashes (10.1016/j.jaecs.2021.100054)
	Hu & Wang, Lu	North China Electric Power University; Zhejiang University	Role of glycosidic bond in initial cellulose pyrolysis: Investigation by machine learning simulation (10.1016/j.jaecs.2021.100055)
	Jiang, Yang & Li	Hunan Academy of Forestry	Removal of phosphate by a novel activated sewage sludge biochar: Equilibrium, kinetic and mechanism studies (10.1016/j.jaecs.2022.100056)
	Chen & Qi, Jia	Hefei University of Technology	Experimental and kinetic study on flash pyrolysis of biomass via on-line photoionization mass spectrometry (10.1016/j.jaecs.2022.100057)
	Zhang & Li	University of Strathclyde	Optimisation of Logistic Model Using Geographic Information Systems: A Case Study of Biomass-based Combined Heat & Power Generation in China (10.1016/j.jaecs.2022.100060)
	Cui & Zhou	Shanghai Jiao Tong University	Online investigation of lignin depolymerization via reactor-integrated electrospray ionization high-resolution mass spectrometry (10.1016/j.jaecs.2022.100069)

## Acknowledgments

The guest editors of this Applications in Energy and Combustion Science Special Issue are grateful to all the authors and reviewers for their great contributions that have made this Special Issue possible. We also greatly acknowledge the editorial office of Applications in Energy and Combustion Science for providing the professional assistance to ensure the success of this Special Issue.

## References

- Ren J, Cao J-P, Zhao X-Y. Fabrication strategies of Ni-based catalysts in reforming of biomass tar/tar model compounds. *Appl Energy Combust Sci* 2022;9:100053. <https://doi.org/10.1016/j.jaecs.2021.100053>.
- Zhang Y, Fan S, Liu T, Xiong Q. A review of aviation oil production from organic wastes through thermochemical technologies. *Appl Energy Combust Sci* 2022;9:100058. <https://doi.org/10.1016/j.jaecs.2022.100058>.
- Song H, Yang G, Xue P, Li Y, Zou J, Wang S, Yang H, Chen H. Recent development of biomass gasification for H<sub>2</sub> rich gas production. *Appl Energy Combust Sci* 2022;10:100059. <https://doi.org/10.1016/j.jaecs.2022.100059>.
- Zheng Y, Wang J, Wang D, Zheng Z. Advanced catalytic upgrading of biomass pyrolysis vapor to bio-aromatics hydrocarbon: A review. *Appl Energy Combust Sci* 2022;10:100061. <https://doi.org/10.1016/j.jaecs.2022.100061>.
- Liu S, Zhu Y, Liao Y, Wang H, Liu Q, Ma L, Wang C. Advances in understanding the humins: formation, prevention and application. *Appl Energy Combust Sci* 2022;10:100062. <https://doi.org/10.1016/j.jaecs.2022.100062>.
- Bolívar Caballero JJ, Zaini IN, Yang W. Reforming processes for syngas production: A mini-review on the current status, challenges, and prospects for biomass conversion to fuels. *Appl Energy Combust Sci* 2022;10:100064. <https://doi.org/10.1016/j.jaecs.2022.100064>.
- Tao J, Ge Y, Liang R, Sun Y, Cheng Z, Yan B, Chen G. Technologies integration towards bio-fuels production: a state-of-the-art review. *Appl Energy Combust Sci* 2022;10:100070. <https://doi.org/10.1016/j.jaecs.2022.100070>.
- Wang C, Diao R, Luo Z, Zhu X. Study on the influence of residence time on the componential evolution of biomass pyrolysis vapors during indirect heat exchange process through a combining method of bio-oil composition inversion and function fitting. *Appl Energy Combust Sci* 2022;9:100047. <https://doi.org/10.1016/j.jaecs.2021.100047>.
- Fawzy S, Osman AI, Farrell C, Al-Muhtaseb AaH, Harrison J, Al-Fatesh AS, Fakeeha AH, Rooney DW. Kinetic modelling for pyrolytic conversion of dedicated short rotation woody crop with predictions for isothermal, non-isothermal and stepwise heating regimes. *Appl Energy Combust Sci* 2022;9:100048. <https://doi.org/10.1016/j.jaecs.2021.100048>.
- Zhang H, Luo B, Wu K, Wu H, Yu J, Wang S. Enhancing aromatic yield from catalytic pyrolysis of Ca<sup>2+</sup>-loaded lignin coupled with metal-modified HZSM-5. *Appl Energy Combust Sci* 2022;9:100049. <https://doi.org/10.1016/j.jaecs.2021.100049>.
- Xiao G, Xiong Z, Syed-Hassan SSA, Ma L, Xu J, Jiang L, Su S, Hu S, Wang Y, Xiang J. Coke formation during the pyrolysis of bio-oil: Further understanding on

- the evolution of radicals. *Appl Energy Combust Sci* 2022;9:100050. <https://doi.org/10.1016/j.jaecs.2021.100050>.
- [12] Chen D, Cen K, Gan Z, Zhuang X, Ba Y. Comparative study of electric-heating torrefaction and solar-driven torrefaction of biomass: Characterization of property variation and energy usage with torrefaction severity. *Appl Energy Combust Sci* 2022;9:100051. <https://doi.org/10.1016/j.jaecs.2021.100051>.
- [13] Li C, Sun Y, Zhang L, Li Q, Zhang S, Hu X. Sequential pyrolysis of coal and biomass: Influence of coal-derived volatiles on property of biochar. *Appl Energy Combust Sci* 2022;9:100052. <https://doi.org/10.1016/j.jaecs.2021.100052>.
- [14] Zhang S, Sun S, Gao N, Quan C, Wu C. Effect of auto thermal biomass gasification on the sintering of simulated ashes. *Appl Energy Combust Sci* 2022;9:100054. <https://doi.org/10.1016/j.jaecs.2021.100054>.
- [15] Hu B, Zhang W-m, Zhang B, Wang X-g, Yang Y, Ma S-w, Liu J, Wang S-r, Lu Q. Role of glycosidic bond in initial cellulose pyrolysis: Investigation by machine learning simulation. *Appl Energy Combust Sci* 2022;9:100055. <https://doi.org/10.1016/j.jaecs.2021.100055>.
- [16] Jiang M, Yang Y, Lei T, Ye Z, Huang S, Fu X, Liu P, Li H. Removal of phosphate by a novel activated sewage sludge biochar: equilibrium, kinetic and mechanism studies. *Appl Energy Combust Sci* 2022;9:100056. <https://doi.org/10.1016/j.jaecs.2022.100056>.
- [17] Chen L, Yang K, Huang J, Liu P, Yang J, Pan Y, Qi F, Jia L. Experimental and kinetic study on flash pyrolysis of biomass via on-line photoionization mass spectrometry. *Appl Energy Combust Sci* 2022;9:100057. <https://doi.org/10.1016/j.jaecs.2022.100057>.
- [18] Zhang J, Zhang X, Rentizelas A, Dong C, Li J. Optimisation of logistic model using geographic information systems: a case study of biomass-based combined heat & power generation in China. *Appl Energy Combust Sci* 2022;10:100060. <https://doi.org/10.1016/j.jaecs.2022.100060>.
- [19] Cui C, Zhu L, Ouyang J, Shen Y, Ren H, Yuan W, Zhou Z, Qi F. Online investigation of lignin depolymerization via reactor-integrated electrospray ionization high-resolution mass spectrometry. *Appl Energy Combust Sci* 2022;10:100069. <https://doi.org/10.1016/j.jaecs.2022.100069>.

Shurong Wang<sup>a,\*</sup>, Tiziano Faravelli<sup>b</sup>, Haiping Yang<sup>c</sup>

<sup>a</sup> State Key Laboratory of Clean Energy Utilization, Zhejiang University, Hangzhou 310027, China

<sup>b</sup> Department of Chemistry, Materials and Chemical Engineering, Politecnico di Milano, Milano 20133, Italy

<sup>c</sup> State Key Laboratory of Coal Combustion, Huazhong University of Science and Technology, Wuhan 430074, China

\* Corresponding author.

E-mail addresses: [srwang@zju.edu.cn](mailto:srwang@zju.edu.cn) (S. Wang), [tiziano.faravelli@polimi.it](mailto:tiziano.faravelli@polimi.it) (T. Faravelli), [yanghaiping@hust.edu.cn](mailto:yanghaiping@hust.edu.cn) (H. Yang).