Biomass gasification evaluation among one and a two-stage reactor using numeric simulation with CFD tools.

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Abstract

Due to environmental effects involving fossil fuels, encouraging the development of clean and renewable energy technologies. One of these technologies is biomass gasification. However, the adoption of new technologies implies high costs that could make the total integration of these technologies within the energy matrix of a country infeasible. In contrast, different computational tools, have emerged with the aim of expanding the frontier of knowledge, studying new technologies safely and economically. This is the case of using computational fluid dynamics, especially for this work Ansys MESH®, Ansys FLUENT®, and SolidWorks®, which were used to modeling the geometry and the process of biomass gasification. Two types of fixed bed downdraft reactors were tested, with one and two oxidizing stages. These reactors were simulated with unconventional biomasses as solid fuel in order to establish their future applicability based on experiences with other materials already used at pilot scale.

Unconventional biomasses, like coconut shell, cottonseed, and orange waste, were chosen to reduce the overall waste and also because of their location, like coconut shell, that is abundant in non-interconnected areas of Brazil.

The results show that two stages gasifier can produce syngas with lower tar ratio and greater Lower Heating Value, and demonstrates that unconventional biomass, whose previously would not be considered for gasification, today can be used for the future generation of electricity.

Figures

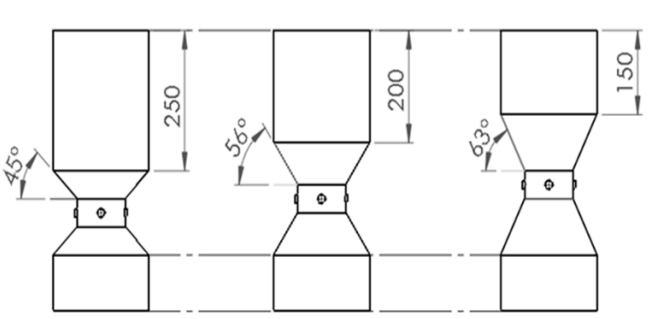


Figure 1 - Changes of Hs in the simulated model.

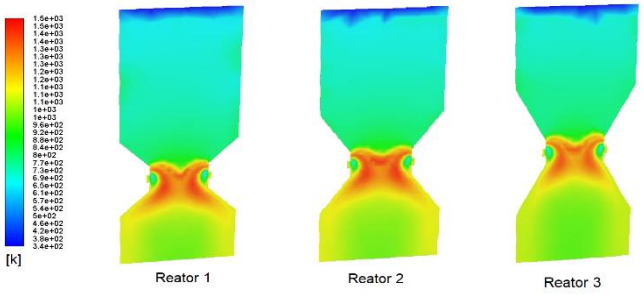


Figure 2 - Temperature contours in the reactors

Recent Publications

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Yepes Maya, D.M., Silva Lora, E.E., Vieira, R., Ratner, A., Espinosa SArmiento, A.L., de Mello e Pinto, L.R., Mendes, L., 2017. BIOMASS GASIFICATION IN DOWNDRAFT DUAL STAGE REACTOR BY EXPERIMENTAL ANALYSIS AND SIMULATION WITH CFD TOOLS, in: European Biomass Conference and Exhibition Proceedings. Stockholm, pp. 808–816. https://doi.org/10.5071/25thEUBCE2017-2CV.3.33



Biography

Professor Diego M. Yepes Maya is a PhD in mechanical engineering and acts at the Institute of Mechanical Engineering of the Federal University of Itajuba, MG, Brazil. Currently works in biomass gasification at both experimental and numerical simulation and CFD, analyzing basically small reactor projects, alternating also with exploratory studies in poor and rural development from non-conventional sources and renewable energies.

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Notes/Comments: