Manuscript BMSE-D-21-02037 for review

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Dear Dr. Barwari,  
  
In view of your expertise, we would be very grateful if you could review a manuscript, that should be of some interest to you, to help us evaluate its suitability for publication in Journal of the Brazilian Society of Mechanical Sciences and Engineering.  
  
If you accept this invitation, we would appreciate receiving your review within 28 days.  
  
Manuscript Number:  BMSE-D-21-02037  
  
Title:  Numerical CFD Simulation of a Horizontal Cyclonic Combustion Chamber for Burning Pulverized Biomass Solid Fuels  
  
Abstract: Growing energy demand and environmental concern have constantly pressured the energy industry to apply increasingly efficient combustion methods. Knowing this, and in order to take advantage of the great availability of biomass energy resources from agro-industrial processes in Brazil, the US company Brayton Energy designed a cyclonic combustion chamber as a component of an externally fired gas turbine for power generation using pulverized solid biomass fuels. In this study, numerical simulations were performed using Computational Fluid Dynamics (CFD) to evaluate the fluid dynamic design and the combustion process of biomass particles in this horizontal cyclonic combustion chamber. The simulations were performed in ANSYS FLUENT using the turbulence models RNG k-ε and SST k-ω. For the combustion simulations were used the Species Transport model and the combined method finite rate/eddy dissipation for the turbulence and the chemical reaction interactions. The  
Discrete Phase Model (DPM) was used for the biomass particles tracking and the Discrete Ordinates model (DO) for the radiation representation. Sugarcane bagasse particles were used as fuel with a medium diameter of 63 . The results of the cold-flow simulations show the profile of axial and tangential velocities within the cyclonic chamber and the formation of the recirculation zones. The recirculation zones, in the simulations with the RNG model, show average velocities of -35 m/s and -20 m/s that indicate the possibility of flame formation inside the combustor. In the analysis of combustion, the results show that the temperatures of fuel particles at the outlet of the biomass feed pipe reach approximately 470 K, which is a temperature above the water vaporization temperature and below the bagasse devolatilization temperature, so that the particles are ready to devolatilize inside the combustor. Additionally, combustion parameters of the bagasse particles such as mass,  
percentage of burning and residence time along their trajectory inside the combustion chamber were also analyzed. Thus, based on the contours of axial velocities inside the combustor, temperature and the release region of the volatile species, it is concluded that the design of the cyclonic chamber allows the formation of the flame inside the combustor and also the complete combustion of the biomass particles, but it needs slightly adjustments in the geometry of combustor (diameter or length) to allow the flame to stabilize.  
  
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Thank you very much.  
  
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Mario Eduardo Santos Martins, Ph.D.  
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