

Impact of Bio-additives on Quality of Oat Hull Fuel Pellets[†]

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Abstract: Fuel pellet production from low-value agricultural waste material is a promising technique. This fuel pellet can be used for combustion, co-combustion in boilers and furnaces to generate heat and power for both industrial and industrial residential purposes. Bio-based additives such as mustard meal and pyrolysis oil have been used to bind oat hull pellets. The oat hull feedstock was characterized using different methods, including Fourier transform infrared analysis (FTIR), x-ray diffraction (XRD), thermogravimetric analysis (TGA). The central composite design was used to find the different formulation conditions and optimize the formulation for a high-quality pellet. Three parameters, including the concentration of mustard meal (10-20 wt/wt%), bio-oil (5-15 wt/wt%), and moisture content (8-12 wt/wt%), were used as input factors. In contrast, the response factors were durability, relaxed density, and energy density of the fuel pellet. Moisture content acts as a natural binder to bind the biomass particle together. The highest durability, density, and energy content were found for pellets produced from 15% bio-oil, 10% mustard meal, and 8% water. Computed tomography (CT) analysis was performed in the Canadian Light Source Inc. to visualize the internal structure of the pellets. CT analysis showed that the porosity of the pellets increased with a decrease in additives content, pelletization temperature, and compression force.

Keywords: agricultural wastes; bio-fuel; fuel pellet.

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Conflicts of Interest

The authors declare no conflict of interest.