

Effect of heating rate of torrefaction of sugarcane bagasse on its physical characteristics

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Abstrak

Torrefaction, which is used to improve the properties of sugarcane bagasse as fuel in pulverised fuel combustion and as carbon feed in gasification, is a low heating rate pyrolysis of biomass carried out at a temperature of 200–300oC, at an atmospheric pressure, and in an inert environment. In the present work, sugarcane bagasse was torrefied at heating rates of 3, 6, and 10oC/minute, respectively, to achieve a final temperature of 275oC and after the final temperature was reached, hold times of 0 and 15 minutes, respectively occurred at a constant temperature of 275oC for a heating rate of 6oC/minute. The physical characteristics of torrefied sugarcane bagasse samples to be determined were a particle size distribution accomplished by grinding, hydrophobicity by allowing the samples to absorb moisture from the ambient air, and pellet hardness of the sample pellets. The torrefaction results show that increasing heating rate and hold time reduced the cellulose content of the sugarcane bagasse to as low as between 5.35% to 10.61% by weight composition, respectively. As the lignin content increased, the sample pellets resulted in better hardness in comparison to that measured on raw sugarcane bagasse. As the hemicellulose content increased, the samples, after grinding and stronger hydrophobicity, produced a higher fraction of smaller particle sizes. The maximum weight fraction of particles in these samples with sizes smaller than 105 µm achieved was 83.43% weight in contrast to 0.62% weight in raw sugarcane bagasse. The maximum water absorption by the samples in 3 hours was 1.28% weight in contrast to 8.02% weight by raw sugarcane bagasse. The results indicate that torrefaction is able to improve sugarcane bagasse physical characteristics, which are favourable for biomass pelletization, storage and transportation.