The pelletization and combustion properties of terrified Camellia shell via dry and hydrothermal torrefaction: A comparative evaluation

Tu Ren, Jiang Enchen, Sun Yan, Xu Xiwei, Rao Shu

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Corresponding author: Xu Xiwei

Email: xuxiwei200801@hotmail.com

The pelletization and combustion properties of terrified Camellia shell via dry and hydrothermal torrefaction: A comparative evaluation

Tu Ren, Jiang Enchen, Sun Yan, Xu Xiwei*, Rao Shu

1. College of Materials and Energy in South China Agricultural University, Guangzhou 510640

Abstract: The torrefaction performance and properties of torrefied CS (Camellia shell) bio-char obtained via dry and hydrothermal torrefaction have been compared as well as pyrolysis and combustion properties. And making of torrefied pellets and their properties such as pellet density, Meyer hardness, and energy consumption are also investigated. The results showed that dry torrefied bio-char had higher energy and density at 220℃ and decreased significantly with temperature, while hydrothermally prepared bio-char had stable energy and mass yield with temperature. The coalification status of hydrothermally bio-char is similar to that of sub-bituminous coal. The pellet formed from dry terrified bio-char via quart tube in 220℃ with high pellet density (1048kg/m^3) and low energy consumption (17.6KJ/kg) in spite of low the Meyer hardness (6.8N/mm^2). As for the process kinetics, the activation energy via dry torrefection with auger showed lower activation energy 43.26KJ/mol as well as lowest ignition temperature (290℃), compared to hydrothermal torrefaction.

Keywords: dry and hydrothermal torrefaction; pelletization; fuel properties; combustion properties; combustion kinetic analysis

1 Introduction

The development of renewable energy and alternative fuels has been widely explored in both academia and bioenergy industry field in order to diminish fossil fuel reserves, serious environmental pollution and high greenhouse gas (GHG) emissions (Chen et al., 2015). CS was widely planted in China for producing tea-seed oil. And the yield is 5,600,000t/year. However, the shell of CS was threw out in the field,