

A Feasibility Study of Producing Biofuels from Textile Sludge by Torrefaction Technology

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Abstract : In modern and industrial society, enormous amounts of sludge from various of industries are constantly produced; currently, most of the sludge are treated by landfill and incineration. However, both treatments are not ideal because of the limited land for landfill and the secondary pollution caused by incineration. Consequently, treating industrial sludge appropriately has become an urgent issue of environmental protection. In order to solve the problem of the massive sludge, this study uses textile sludge which is the major source of waste sludge in Taiwan as raw material for torrefaction treatments. To investigate the feasibility of producing biofuels from textile sludge by torrefaction, the experiments were conducted with temperatures at 150, 200, 250, 300, and 350°C, with heating rates of 15, 20, 25 and 30°C/min, and with residence time of 30 and 60 minutes. The results revealed that the mass yields after torrefaction were approximately in the range of 54.9 to 93.4%. The energy densification ratios were approximately in the range of 0.84 to 1.10, and the energy yields were approximately in the range of 45.9 to 98.3%. The volumetric densities were approximately in the range of 0.78 to 1.14, and the volumetric energy densities were approximately in the range of 0.65 to 1.18. To sum up, the optimum energy yield (98.3%) can be reached with terminal temperature at 150 °C, heating rate of 20°C/min, and residence time of 30 minutes, and the mass yield, energy densification ratio as well as volumetric energy density were 92.2%, 1.07, and 1.15, respectively. These results indicated that the solid products after torrefaction are easy to preserve, which not only enhance the quality of the product, but also achieve the purpose of developing the material into fuel.

Keywords : biofuel, biomass energy, textile sludge, torrefaction

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