Production of Cardboard Waste-Based Biochar Using Double-Barrel Carbonization Technique.

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ABSTRACT

With rising population and urbanization, cardboard use has also expanded significantly over the years, resulting in an increase in cardboard waste generation. According to the Environmental Protection Agency, paper goods and corrugated cardboard (CCB) account for 25% of municipal solid waste (MSW) [1]. A practical answer to the waste management issue is the thermal conversion of MSW, particularly the paper and packaging materials; CCB. The primary output from this thermochemical decomposition is bio char which has a number of uses, including improving soil fertility, cleaning up water and soil contaminants. CCB is a better agent for this thermal conversion process because of its high percentage of lignocellulose [2]. The project's main goal is to use the double-barrel pyrolysis technology as a thermo conversion process that is easily applicable to Sri Lankan households to convert cardboard waste into biochar and to investigate the impact of the operating temperature on the yield of produced biochar. The double barrel was designed by considering the several factors including the ease of use, durability, safety, material cost, and the efficiency of the production of biochar. As shown in Figure 1, two mild steel double barrels which had outer barrel dimensions of 280 mm in height and 190 mm in diameter and an inner barrel of 90 mm diameter and 250 mm. height was developed. Inner barrel was filled with 75g of 80mm*40mm (area) cut pieces of CCB and mounted with a thermoscope. Outer barrel was filled with charcoal and burned for 50 min in 400^{0}C. Following that yield was calculated and tea test was used to assess the biochar's absorption process. our study was carried out in two trials. Trial 01 was done in the temperature range of 380- 400^{0}C for 30 min and the yield was 40% and trial 02 was done at the 380-410^{0}C for 50 min and obtained 26.77%. The results of our experiment have deviations from the literature because the literature had used an auger reactor, which can control temperature and feeding rate over time and the temperature was constantly maintained. However, when it comes to our experiment, the main objective was to introduce a household simple setup, so that the supplied temperature, heat and the federates were varying. The average temperature of each trial shown in figure 2. Hence in our study at average heating rate of 8.5186 ^{0}C /min, an average of 33.4 % of yield was produced, Further research should be carried out to improve the double barrel design such as more air intake holes for facilitate the burning process inside the barrel and to keep the set up on a stand that is opened to the atmosphere and a web made of a metal that can withstand temperatures of 400 ^{0}C or higher can be placed beneath the inner barrel to avoid difficulties in separating the yield.

Figure I: Manufactured inner and outer barrels

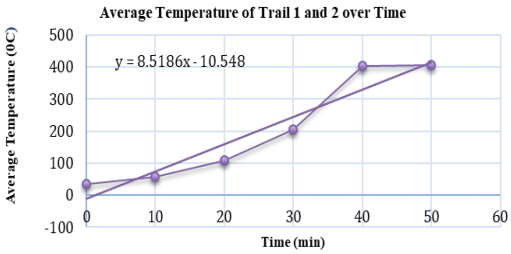

Figure II: Average temperature fluctuation along with the time in trails 01 and 02

Figure II - yield of cardboard waste-based biochar.

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Keywords— Biochar, Carbonization, Double-barrel technic, Municipal solid waste (MSW), Pyrolysis, cardboard waste

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