

Fabrication of a Vertical Charcoal Kiln Using Local Materials as Heat Insulator for High Quality Charcoal

Kuljira Onakul¹, Chayapat Thitisak¹, Sukrita Tattinaphanich¹

Natthakan Doungporn², Buppha Tawaboot², Siri Doungporn³, Parinya Panphrom³

¹*Udon Pittayanukul School's students, E-mail:maimaii9688@gmail.com*

²*Udon Pittayanukul School, ³Udon Thani Rajabhat University*

Abstract

The objectives of this project are to 1) design, build and study the efficiency of a charcoal kiln 2) study and compare the heat content of charcoal and 3) study and compare the properties of charcoal. A charcoal kiln was designed by using the SketchUp program and built into 2 layers; the outer layer was a 150 liter steel tank and the inner layer was 60 liter fuel tank connected to a 30 liter tank. A hole was drilled at the bottom of the inner kiln to allow air to enter the kiln throughout the process. The space between the inner and outer furnaces was where the insulation is placed. The materials for this study were dried durian shells and dried coconut shells. Thermal insulation were soil mixed with rice husks and sand mixed with rice husks in a ratio of 1 to 5. Burning 4 kilograms of the material in the inner tank. Put the insulator in the space between the inner and the outer kiln. The temperature was recorded at each position in the kiln and at the insulation. After burning the charcoal, recorded the weight of the charcoal, analyze the efficiency of the charcoal kiln by determining the percentage of charcoal production. Analyzed the heating content of charcoal with an Auto Bomb Calorimeter and analyzed the properties of charcoal by burning in a high temperature kiln to find the percentage of moisture content, percentage of volatile substances content, percentage of ash content and the percentage of fixed carbon content. Compared the heating content and the properties of charcoal using a two-way analysis of variance and comparing pairwise mean differences using Duncan's multiple range test method. The results of this study found that:

1. Maximum temperature in the charcoal kiln was between 360.5 - 529.8 degrees Celsius and charcoal kiln that use insulator could produce higher charcoal than not used insulator. The percentage of charcoal production using sand mixed with rice husk as insulator was higher than soil mixed with rice husk and without insulator. The duration of burning was about 13.5 to 14 hours.

2. Burning materials and insulator had no influence on heat content. However when considering each variable, it was found that: charcoal from coconut shells had a higher heat content than charcoal from durian shells. Moreover, charcoal burned using soil insulator mixed with rice husks and sand mixed with rice husks provided a higher heat content than without insulator.

3. Burning materials and insulator had an influence on the percentage of moisture content. That was charcoal from durian shells that are burned without insulator had the highest percentage of moisture content, followed by charcoal from durian shells burned using sand mixed with rice husks. In addition, charcoal from coconut shells that were burned using soil mixed with rice husks has the lowest percentage of moisture content. Moreover, it was also found that burning materials and insulators had no influence on the percentage of ash content, the percentage of volatile substances content and the percentage fixed carbon content. When considering each variance, it was found that the percentage of ash content, the percentage of volatile substances content and the percentage of fixed carbon content were not different.

Keywords : Vertical charcoal kiln , biomass charcoal, high quality charcoal