4C Kiln Long units for bamboo

This file is correspondence with two person with interest in making charcoal for bamboo. A long version of the 4C Kiln is appropriate. (The old name of C4 has been edited here to become 4C.
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On 10/17/2015 7:03 PM, D C wrote, with some embedded replies by Paul Anderson PSA:

2) Regarding the fuel ,There is enough Bamboo for the project. Regarding size of the pieces of Bamboo for the stove We have discussed here the best size for the pieces which will be introduced in the Stoves. Not longer than 2 meters. Regarding diameters we feel a 2-1/2 inch could be a choice.

A 2-1/2 and 2 meter would weigh 9-10# at 12 to 14% humidity.

PSA:Regarding diameter, what do you do with the bamboo that is less than 2 inch (5 cm) in diameter? It will become char just like the larger diameter pieces. Please tell me about the small diameter material.

Using your numbers (but please check my calculations), I find the following.

1. About 2 m long weighing about 4 kg, means that 1 meter length weighs 2 kg.

2. five pieces of 1 m equal 10 kg. That is an acceptable weight for a worker to handle.

3. I think that 5 pieces (of one meter) would occupy a space of about 10 x 10 cm., and weigh 10 kg., and this should yield charcoal that is between 15% and 20% of the weight of the dry biomass. This means about 1.5 to 2 kg of char.

4. The 4C kiln that is ONE-barrel long (just less than a meter in length) would take in about 2 to 3 of the 5-piece bundles each hour on a continuous basis. That would be about 4 to 5 kg of char produced per hour.

5. We should make a single-barrel 4C kiln first. Something like what is shown in that video that you can view. We can discuss the details.

6. LATER we can make a longer 4C kiln, but no need for that until you are comfortable with the much more simple single-barrel unit.

Are either of you about ready to start making 4C kiln?

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Message from Paul Anderson,

I need to share with you some information about the pyrolyzer, that is called 4C. I am starting my trip to Africa (untol 16 Nov.), and I do not want to delay our efforts because of my travels.

I will send a separate message with some files from when I was considering trying to get a patent. I have decided to NOT seek a patent, so disregard statements about patents.

But the best way to get to know the C4 kiln is with the video of 7 minutes that shows operational aspects of a C4 kiln in the barrel size. Here is the "unlisted" link of the video at my YouTube account:

http://youtu.be/xzhKD1Zap3c

About the "4C" name:
4C stands for some combination of 4 words that start with C. The current configuration is:

Controlled Continuous Covered Cavity kiln because there are 3 enhancements to the Cone Kiln, which is a cavity process.

Also the words oven or char-maker or pyrolyzer or technology can be used instead of kiln.

For the 4C kiln for long pieces of bamboo, the kiln can be made longer. But first would be to make a simple unit and gain some experience with using it. Then I can assist you with refinements in a variety of ways.

Paul

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From Paul Anderson

Dear Friends, 5 October 2015

I introduce you to each other. You BOTH have the same topic with me, which concerns turning bamboo into charcoal. (Doug McCarty is with me in America and assisting.)

Concerning the discussion below, I request similar information from both of you.

Please tell me: Is the 10 tons per month the charcoal output or is it the weight of the bamboo input to make the char. I suspect that it is the char output.

For calculations, I will assume that the bamboo has arrived at the char-making site and is in a horizontal stack.

Is the bamboo dry when we are going to pyrolyze it?

How many people are working at the char-making site? And what are they doing? such as cutting the culms (bamboo stems) into lengths? loading kilns? unloading the char? other duties?

10 T / month= 25 days of 0.4 T per day of work. Which is 400 kg por dia. At a 20% yield of char from dry biomass, that means 5 x 400 kg = 2000 kg (which is 2 Tons). Assuming production work of 10 hrs per day, that is 200 kg per hour.

My prototype unit will handle over 20 kg per hour, so it will need to be about 10 times larger. That should be manageable. Consider this calculation. My current unit is 0.75 m in length. Make it 4 times longer (becoming 3 m in length). We will call that a "4C-3m kiln" with the 3m indicating the length. 4 x 20 kg = 80 kg input per hour. 3 of those "4C-3m kiln" installations would produce 3 x 80 = 240 kg of biomass input per hour, and have a char yield of almost 50 kg per hour, with 10 hour total of 500 kg per 10 hr workday (or about 400 kg of char for 8 hrs of work of the units.

How many workers are needed for this production with my equipment, as stated above? Answer:

a. Biomass preparation: Depending on equipment for cutting and some bamboo characteristics, you could need one worker for that job of size preparation, or maybe two. The bamboo pieces need to be 3 meters or shorter (unless the units get bigger). If the average length is 8 meters, that means that each culm needs to be cut twice, into 3 pieces each slightly shorter than 3 meters.

b. Two workers are involved with loading and unloading the three kilns during 8 to 10 hours per day.

One worker would be placing the bamboo onto the loading shelf for each of the 3 of "C4-3m kilns". The same worker pushes the bamboo into the kiln.

A second worker removes the char. These two men could be working together, making the workload more evenly distributed and easier.

Note: There are many variables about the site configuration and equipment and what the owner wants to build to make things easier or to use inexpensive labor. But lifting 200 kg per hour for short distances is manageable.

All of the above can be made larger or smaller.

If you desire that the char-maker is to be easily portable (such as being on a trailer with wheels), we must consider the issue of overall length. Instead of 3 of 4C-3m, there could be 4 of 4C-2m or 4C-2.5m.

I am sure that I have your interest. And it is about time for me to send you some diagrams of what is to be built and used. I will have that to you later this week, after I hear back from each of you about current labor and desired portability and dryness of the bamboo and about having it cut into 3 m lengths.

Paul