Briquette Experiment

1/16/2010, Zan Smith

Revised 6/15/2010

The Briquette Press

This was my first attempt at making fuel briquettes using an industrial caulk gun. This was the beginning of a biofuel briquette study to determine if banana waste could be used for fuel in Muhororo, Rwanda where the Greater Cincinnati Professionals Chapter of Engineers without Borders works. The caulk gun used was a COX 51001-2T. It has a solid barrel and is designed for bulk loading. This model has a 26:1 load magnification. This ratio was chosen as it was expected that a normal grip would be around 40 pounds. This would put about 1000 pounds on the area of Pi square inches. The typical 3rd world press puts about 2000 pounds on typical 3 inch diameter briquette that has an area of 2Pi square inches. Thus, I expected this to be equivalent. Later I consulted a human factors reference and learned that the grip for capability ranges from 50 pounds for a small woman to 150 pounds for a strong man. Thus, I could have saved a lot of money buying a cheaper model caulk gun with a 12:1 or 18:1 ratio.

12 2 inch and 12 4 inch plastic disks were donated by Ticona for the project. The 4 inch disks were used on the large press built by Lee Hite. I drilled a 2 inch disk to use inside the end cap so that water could escape when a briquette load was compressed. This way, I could load the tube and make one briquette at a time. I also trimmed down 3 of the 2 inch disk to fit inside the tube. Later, the tube was drilled to make several briquettes at once. The picture shows the gun with the drilled disk inside the end cap.

Raw Materials

For raw materials, I used aged banana skins, shredded tax records (what fun), leaves from my compost bin, pine needles, and a handful of long decorative grass shown below.

To make paper mush I poured boiling water over handfuls of shredded paper in a blender. BIG MISTAKE, blender did not contain the boiling water and I got burned. Do not repeat that mistake. However, it did make excellent paper mush.

I put warm water in the blender and fed in the banana skins one at a time. It made an ugly looking mess that poured easily into a plastic container. However it seemed to jell after about an hour. The paper mush on the left and banana skin gel on the right in the picture

Pruning shear was use to cut the grass into about 1 inch pieces.

Making Briquettes

1 - The 1st attempt was with leaves and paper mush. The leaf mulch was not very fine and I used too much and not enough paper in my first attempt. The mixing bowl is shown in the picture. The result was an overlong briquette that was loose.

2 – The 2nd attempt was with the leaf mulch and banana gel. Closer to the right amount but again loose.

3 – The 3rd test was with grass pieces and paper. The charge was too big again but better bound by paper.

4 – The 4th was grass and banana. Still too large and banana gel does not appear to be a good binder.

5 – The 5th try used pine needles and paper mush. This time, the result was the desired size and the paper seems to have been in about the right portion.

6 – The 6th and last try was with pine needles and banana gel. About the right size again but again, the banana gel does not seem to be a good binder.

The picture shows the 6 samples. 1-4 are right to left in front, 5 and 6 are right to left in back.

Conclusions

- The caulk gun works but do not over squeeze the trigger. It simply makes it difficult to release the plunger, and very little additional water comes out.
- Do not use boiling water in a blender to make paper mush, too dangerous. Better to let it soak for an extended time, probably a week.
- Leaves and grass were too coarse to get a tight puck.
- Best result was with the pine needles and paper mush.
- Paper mush appears to be a better binder than banana gel although further evaluation of banana binder is needed.
- Banana gel might be satisfactory with finer material.
- The leaves, pine needles and grass should be much finer.

June Comments

After the above summary, the caulk gun was drilled so multiple briquettes could be produced. The modified gun has successfully produced 3 briquettes at a time about one inch thick. Three batches of briquettes were made using one cup water blended with one cup banana skins as a binder in each case:

1. 2 cups sawdust
2. 2 cups dry banana leaves
3. One cup sawdust with one cup banana leaves.

The modified caulk gun is shown below.