

Analysis of Bioproducts from Ultra-Low Cost Biomass Processing



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Abstract:

An ultra-low cost biomass thermal processing unit has been developed to use timber harvest and forest fuels reduction slash. Normally, slash is disposed of by being burned on site. Our process adds a small extra cost compared to pile burning, but can produce “oven dried” wood or pyrolyzed wood (often called biochar). Analysis of the different biomass products uses Thermogravimetric Analysis (TGA) to determine the moisture content, volatiles, percentage of fixed carbon, and ash content.

Background



Our thermal processing unit was developed to create an economical and portable method to process biomass that has in the past gone to waste. This new technology uses a thermal insulating material that captures and evenly distributes heat released from the partially combusting pile.

The samples for this research were collected from the Pack Forest in Eatonville, WA. They were processed over the course of two days on site.

Objectives

- For “oven-dried” wood, use TGA data to find the composition of hemicellulose, cellulose, and lignin in the sample.
- Analyze biochar products from three field trials, each processing 400 lbs of slash, to see the effects of different average temperatures and process times.
- Use these results to understand the sensitivity of biochar product to processing variations.

Methods

- Oven dry biochar at 200°F
- Grind biochar in Wiley Mill Grinder using a 40 mesh
- Run samples of 8 mg in TGA in inert atmosphere

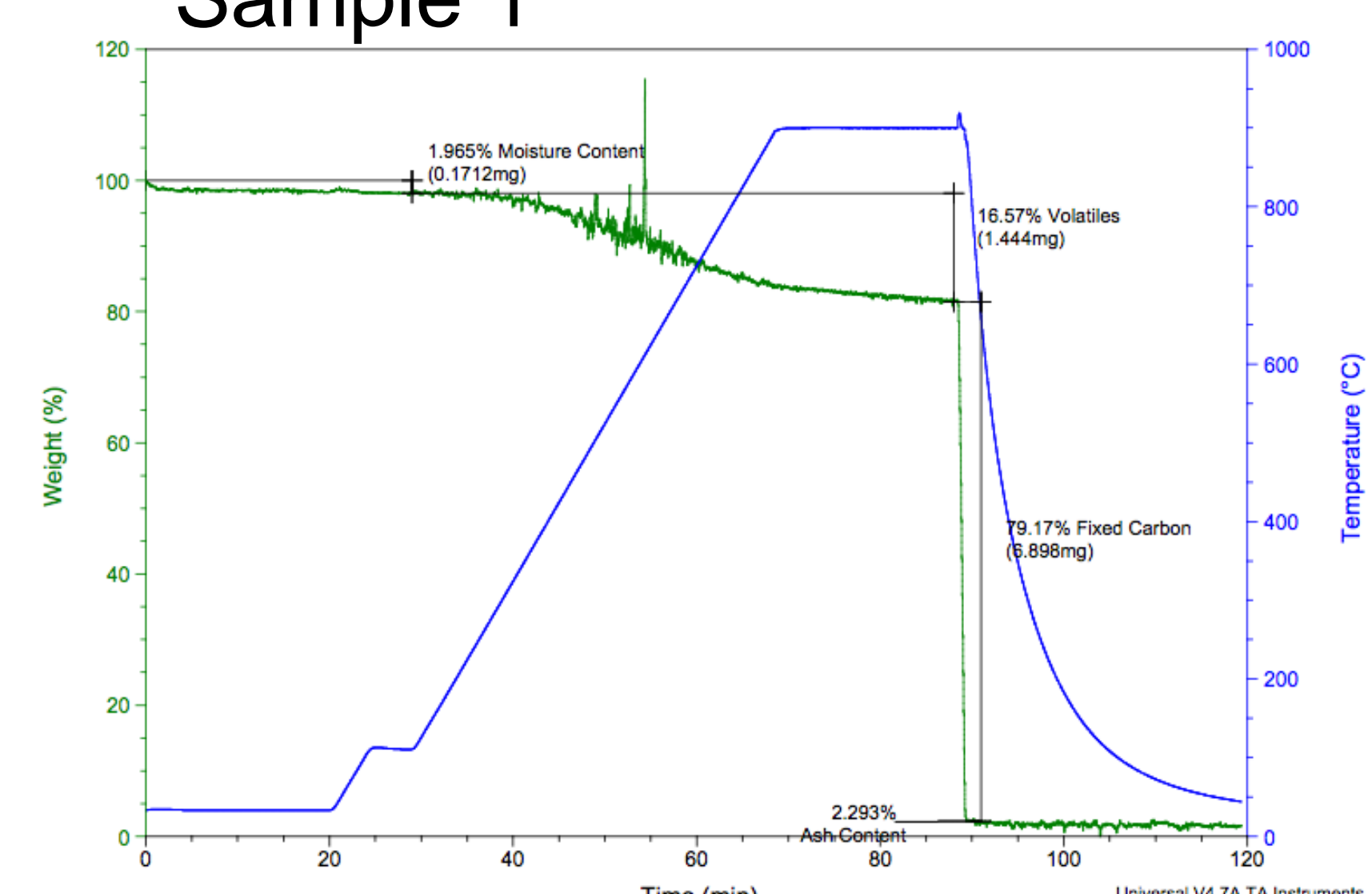


- Ramp at 20°C/min to 110°C and hold for 5 min to determine moisture content
- Ramp at 20°C/min to 900°C and hold for 20 min to determine percentage of volatiles in the sample

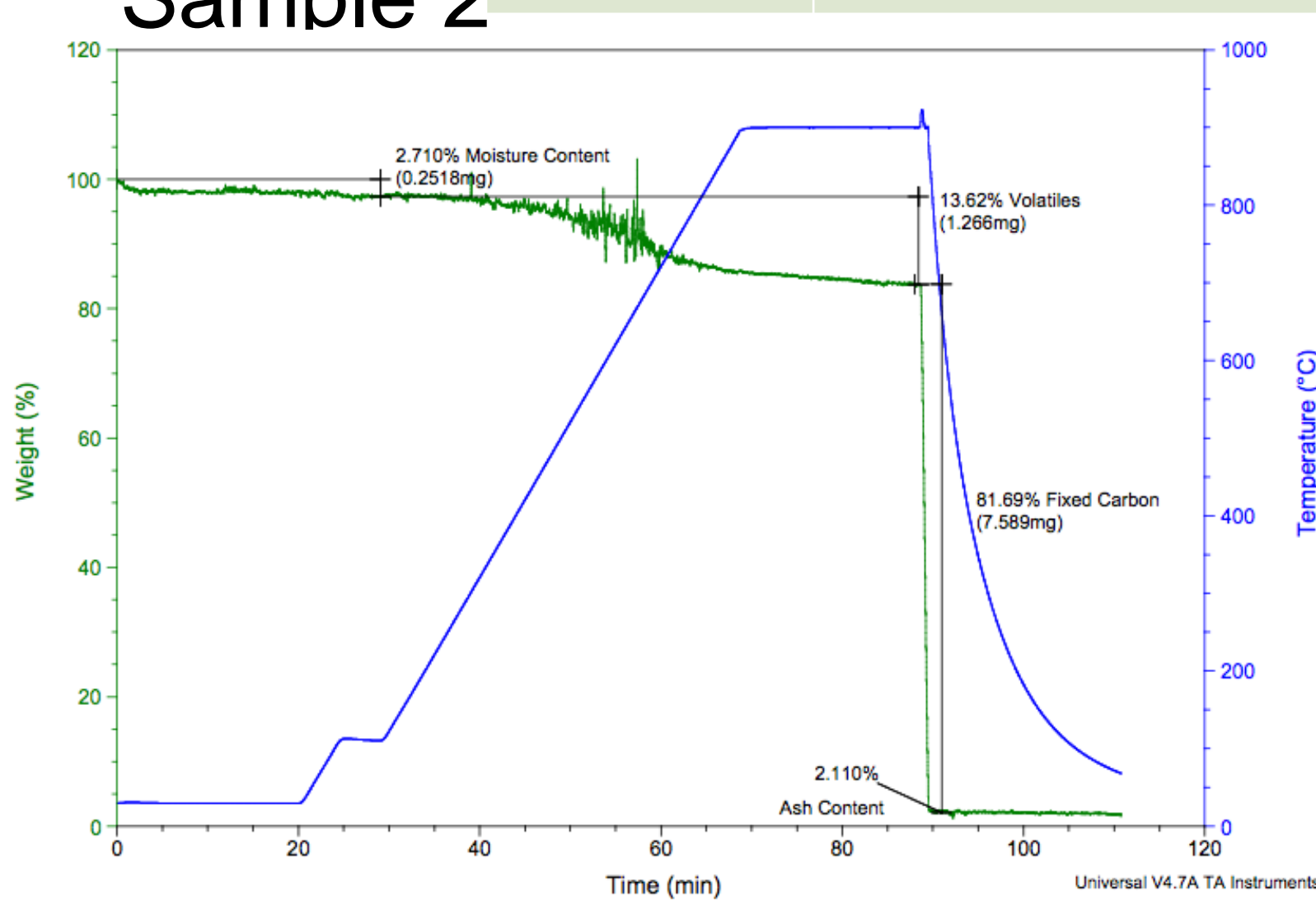
- Introduce oxygen to combust char and determine ash content

Results

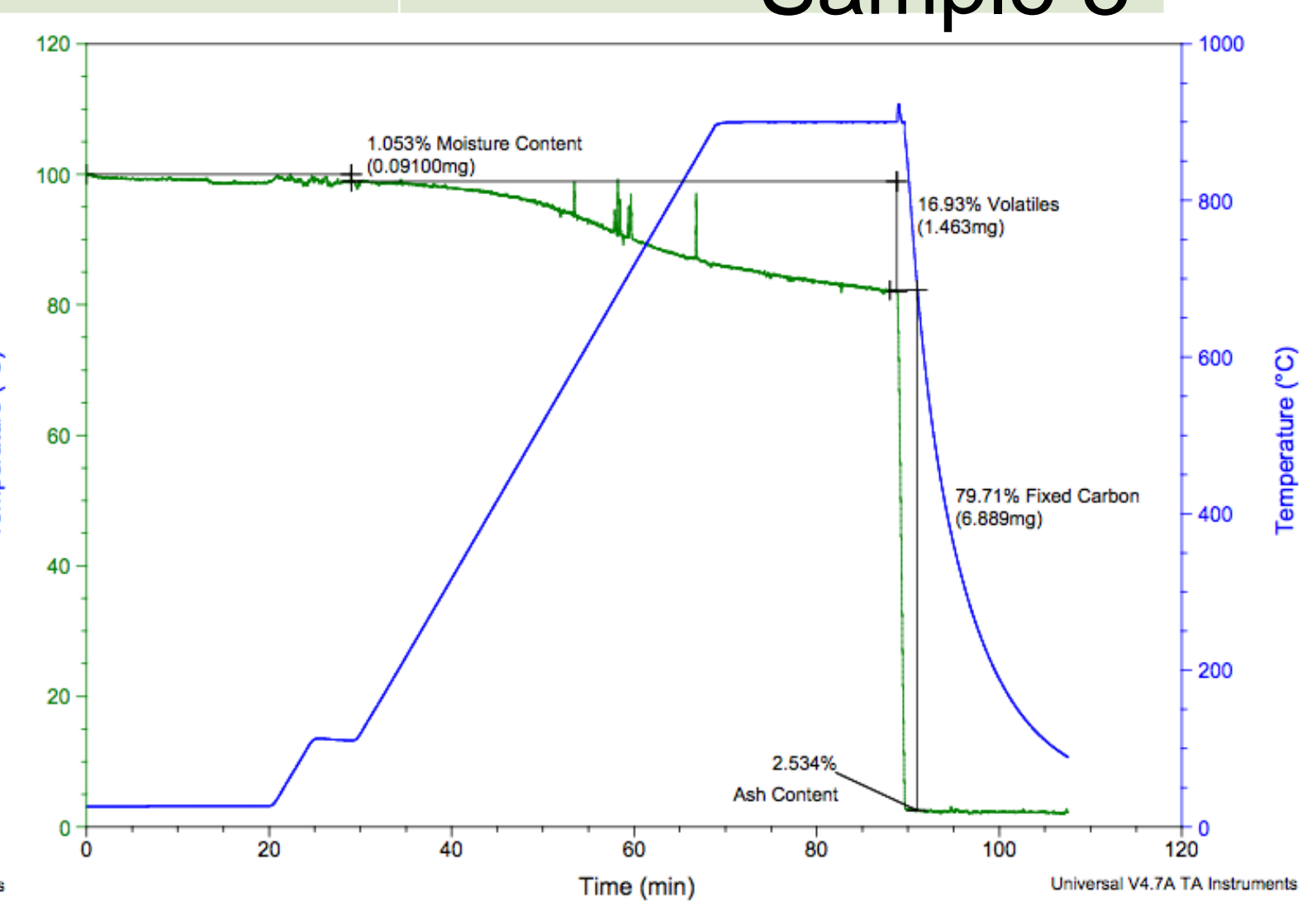
TGA Analysis of Alder Biochar:
Sample 1



Sample 2

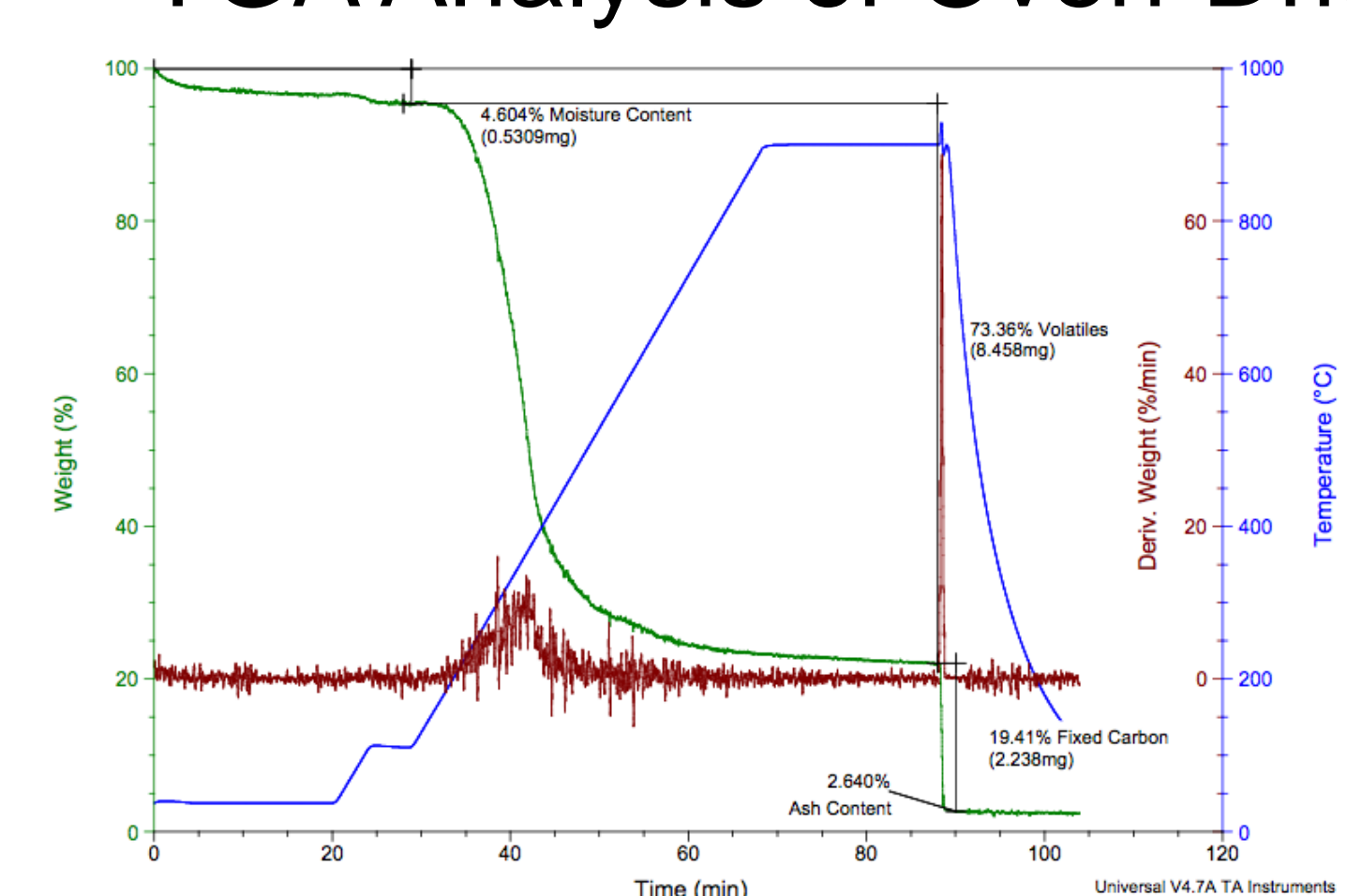


Sample 3



Sample	Moisture Content (%)	Volatiles (%)	Fixed Carbon (%)	Ash Content (%)
1	1.965	16.57	79.17	2.293
2	2.710	13.62	81.69	2.110
3	1.053	16.93	79.71	2.534

TGA Analysis of Oven-Dried Alder



M.C. (%)	4.604
Volatiles (%)	73.36
F.C. (%)	19.41
Ash (%)	2.640

Discussion

The sample with the shortest burn time had the highest fixed carbon percentage. Average temperature did not display a noticeable pattern in our data, as wood burned at the highest and lowest average temperatures had very similar compositions. Based on the TGA data of the biochar, it is difficult to conclude precisely what processing variations impact the composition of the biochar. Further research can be done to determine the operating conditions that produce different characteristics in the biochar.

Future Directions

Possible uses for biochar:

- Natural coal replacement
- Soil amendment to improve drainage, reduce fertilizer use, and sequester carbon
- Cooking fuel in developing countries

Using the process to oven-dry wood would reduce transportation costs needed to haul the biomass to processing plants.

We are in the process of upgrading our blanket to one that is larger, more lightweight, easier to handle, and more air tight. For more information on the new blanket, see Burdette Birdinground’s poster.

Acknowledgements

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