

SUMMARY REPORT—CONTRACT R-023-032
APPLICATION OF AGRICULTURAL BYPRODUCTS
FOR THE PERIOD JULY 1, 2015, THROUGH DECEMBER 30, 2015

The project consists of feedstock supply estimation, cost estimation, product marketing, material characterization, and product formulation, testing, and certification activities.

FEEDSTOCK SUPPLY: Locations of primary and secondary feedstocks and physical supplies have been identified.

NEW PRODUCT MARKETING: Targeted products and channels have been identified from the preliminary list assembled in the previous period.

WASTE WOOD AND COPRODUCT SUPPLY SCHEDULE: Physical and economic supply schedule data sources have been identified. Data collection has begun.

COST MODEL: The cost model was updated with current and forecast values. Returns are currently (December 2015) small given a slow start to the winter heating season.

MATERIAL CHARACTERIZATION/ PRODUCT FORMULATION:

A graduate student Jamileh Shojaeiarani was hired to work on this project. In the past 6 months most of the work focused on the characterization of material and evaluating some of the physical properties. There were four experiments that were conducted in the laboratory. A new laboratory scale pellet mill was also purchased to conduct the future experiments.

The materials that were tested included: Sunflower flower, Soy Stover, Culled Beans and Wood Flour.

Experiment. 1

Title: effect of moisture content and temperature on particle size distribution:

The particle size was determined according to ANSI/ASAE standard S319.3. In order to classified material based on particle size distribution, 100 g of ground samples was placed in a set of sieves (opening size 10, 20, 40, 60, 80, 100 and pan) placed on the Ro-Tap sieve shaker for 10 min was used. Different fractions obtained by the screening were collected and weighed.

In general 61.46% of material with MC equal to 10% were in the range of 0.250 and 0.425; while it was 59.77% for MC equal to 20%.

Experiment. 2

Title: effect of moisture content and temperature on bulk density:

Bulk density measurement of the chopped material was performed according to the method of ASTM D1895B. The weight and volume of material were measured to calculate the bulk density. For measuring weight a laboratory balance was used; the volume was determined by a 1 L container. The results show an increase in bulk density as the moisture content of material increases. Bulk density increase for two different level of moisture content and humidity (10% and 20%) has shown in table below:

Material	Beans	Wheat	Sunflower	Wood	Soy Stover
Bulk density increase%	2.889715%	8.848657%	16.24225%	32.12996%	24.74674%

Experiment. 3

Title: effect of moisture content, temperature and different fraction of raw material in solid bio fuels ash content:

Ash content is determined according to the method of ASTM E1534 – 93. The weight loss of the sample when heated under rigidly controlled conditions of temperature, time and sample weight was measured. According to observed results replacing wood flour by agricultural by-products in pellets increases the amount of gathered ash content. Increasing Sunflower, Bean and soy Stover percentage in making pellet from 20% to 40 % led to an increase in ash content equal to 25.47%, 32.45% and 40.77% respectively.

Experiment. 4

Title: effect of moisture content, temperature and different fraction of raw material in solid bio fuels heat value:

Heating value of any fuel is the energy released per unit mass or per unit volume of the fuel when the fuel is completely burned. Heat value of different pellets were determined by using Parr 6200 Isoperibol Calorimeter. In this case the weight, height and sulfur contents of each pellet were measured. Burning each pellet in Calorimeter generated gross heat values of the materials. According to the results gross heat value of pellets showed a decrease of 1.88%, 4.63% and 0.33% as the amount of Sunflower, Culled Beans and Soy Stover flour increase from 20% to 40% in each pellet, respectively.

Next we will be making pellets by blending different materials in different formulations and evaluating the physical and thermal properties as per PFI standard.