

Moisture Content of Locally-Sourced Fuelwoods

Research conducted by Haines High School Physical Science Students in November 2009 as part of the Haines Borough's study of the feasibility of municipal heating using local wood source.

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Purpose: to determine the moisture content of wood chip samples obtained from several species and allowed to air-dry for different times.

Apparatus:

- Samples of woodchips from Sitka Spruce, Western Hemlock, Cottonwood and Alder, "green" as they came immediately after harvest, and "decked" as they come after the source logs were stacked for one month.
- Three microwave ovens of power greater than 600W.
- Paper Towels.
- Three Ohaus Quadruple Beam Analytical Balances.

Procedure: Three separate student teams independently followed ASTM protocol E 1358-97: Standard Test Method for Determination of Moisture Content of Particulate Wood Fuels Using a Microwave Oven. This method involves finding the mass of three paper towels (in data table as MT), weighing out 50.00g of the sample wood chips and placing them on the towels (total mass of sample on towels=MSTI), then heating the chips using full power in a series of intervals according to a schedule in the ASTM protocol. The mass is measured with the balance and the samples are stirred between each of the heatings, which are continued until the mass changes by less than 0.50g. The final, dried mass of the sample and towels is recorded as MSTF. The loss of mass of the samples is the mass of the moisture driven-off, and this quantity is divided by the original sample mass to give the percent moisture content. The independent results obtained by the three teams are shown on the data table as are the average values for each sample.

Green Spruce data:

Group	MT	MSTI	2 min.	1 min.	1 min.	30 sec.	MSTF	% moisture content
A	6.61g	56.61g	41.885g	38.500g	37.900g		37.900g	37.42%
B	6.57g	56.57g	44.327g	40.285g	38.855g		38.770g	35.60%
C	8.80g	58.80g	47.460g	43.968g	42.200g	41.112g	40.580g	36.44%
Average moisture content: 36.49%								

Green Hemlock data:

Group	MT	MSTI	2 min.	1 min.	1 min.	30 sec.	30 sec.	30 sec.	MSTF	% moisture content
A	6.595g	56.595g	38.525g	34.985g	33.900g				33.900g	45.39%
B	6.600g	56.600g	43.400g	39.300g	36.300	35.680			35.680g	41.84%
C	6.635g	56.635g	45.210g	40.000g	36.690g	35.290g	34.745g	34.233g	34.050g	45.17%
Average moisture content: 44.13%										

Background on chip sample collection (collected by DOF)

One gallon “zip lock” plastic bags were nearly filled on 10/29/09 with samples from two green standing trees that were felled for the collection of saw chips. The Spruce tree was 14” DBH (diameter at breast height) and the Hemlock was 16” DBH. These samples represent a high ratio of sap wood to heart wood per tree. The trees were cut to produce chips with a chainsaw in several cross section cuts. The cuts were distributed from four feet to 16’ from the butt of the logs. The chips were collected immediately after cutting and piling under the cut location. The air from within the bag was removed as much as possible prior to closing the bag. Two 50 gram samples were removed from the Spruce bag and one 50 gram sample was removed from the Hemlock bag prior to delivery to the Haines Physical science class.

Decked Spruce data:

Group	MT	MSTI	2 min.	1 min.	1 min.	30 sec.	MSTF	% moisture content
A	6.620g	56.620g	39.050g	35.581g	34.933g	34.953g	34.933g	43.37%
B	6.630g	56.630g	40.180g	35.967g	35.085g		35.085g	43.09%
C	6.650g	56.650	39.830g	36.540g	35.652g		35.652g	42.00%
Average moisture content: 42.82 %								

Decked Hemlock data:

Group	MT	MSTI	2 min.	1 min.	1 min.	30 sec.	MSTF	% moisture content
A	6.680g	56.680g	45.560g	39.050g	35.510g	33.350g	32.040g	49.28%
B	6.672g	56.672g	40.921g	35.085g	32.410g	32.180g	32.180g	48.98%
C	6.600g	56.600g	43.760g	38.600g	34.250g	32.750g	32.200g	48.80%
Average moisture content: 49.02%								

Background on chip sample collection (collected by DOF)

One gallon “zip lock” plastic bags were nearly filled on 11/05/2009 with samples from two decked trees that were felled, yarded and decked in early September. The Spruce tree was approximately 18” in diameter at the location of the chainsaw cut to collect the chips. The Hemlock tree was approximately 16” in diameter at the location of the chainsaw cut to collect the chips. Again, these samples represent a relatively high ratio of sap wood to heart wood per tree. The cuts were within four feet of the ends of the logs. The chips were collected immediately while the saw cut was being made as the bag was held in position to the rear of the saw. The air from within the bag was removed as much as possible prior to closing the bag.