Quality Irish Wood Fuel The chemical composition

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Objectives

- Determine the chemical composition of four different assortments of various species of wood chip from Irish forests in the context of utilizing this material as a solid biofuel.
- Establish any statistical differences across geographical locations, within assortments and species for the parameters studies.
- To produce valuable information for the development of a sustainable, renewable and quality energy source.

Parameters measured:

- Percentage ash content
- Gross calorific values
- Major elements: Potassium, Phosphorus, Iron & Sodium.
- Minor elements: Cadmium, Chromium, Copper & Lead.
- Hydrogen content (to convert to net calorific values)
- Water soluble chloride
- Total chlorine

All results were calculated to a dry basis (d.b.) and statistical analysis was carried out using two-away ANOVA on all results.

Experimental

Analysis carried out in accordance with CEN technical specifications:

- CEN/TS 14780: Methods for sample preparation
- CEN/TS 14774-3: Methods for the determination of moisture content-Oven dry method-Part 3: Moisture in general analysis sample
- CEN/TS 14775: Method for the determination of ash content
- CEN/TS 14918: Method for the determination of calorific value
- CEN/TS 15290: Solid Biofuels Determination of major elements
- CEN/TS 15297: Solid Biofuels Determination of minor elements
- CEN/TS 15105: Methods for determination of the water soluble content of chloride, sodium and potassium
- CEN/TS 15289: Solid Biofuels Determination of total content of sulphur and chlorine

Locations of Study Sites

- Toormakeady Co.Mayo
- Abbeyfeale Co.Limerick
- Ballybofey Co. Donegal
- Bweeng Co. Cork
- Dovea Co. Tipperary
- Stradbally Co. Loais

Assortments studied

- Whole tree WT
- Energy wood EW
- Fire wood FW
- Round wood RW

Species studied

- □ Sitka spruce
- Larch

Sycamore

Due to time restrictions, only SS data is presented here. Details of all results achieved so far will be published in the interim report (Dec 2007).

Percentage Ash Content



Percentage Ash Content

- There was statistical significant difference in mean Ash content between Assortments (p<0.001)</p>
- No statistical significant difference in mean Ash content between sites (p=0.331)
- Ballybofey highest levels of ash found in all assortments.

Gross Calorific Values



Gross Calorific Values

- There was no statistically significant differences in mean gross calorific values for both site and assortment.
- Whole tree assortment was found to have highest calorific values (20.93-19.96 MJ/kg) throughout sites.
- Ballybofey whole tree assortment had the highest energy content.

Cadmium Concentration



Cadmium Concentration

- There was no statistically significant differences in mean Cadmium concentrations for both site and assortment.
- Whole tree and round wood assortments had the highest cadmium levels (0.050-0.150 mg/kg)
- Ballybofey round wood had the highest levels of Cadmium detected.

Chromium Concentration



Chromium Concentration

- There was no statistically significant differences in mean Chromium concentration for both site and assortment.
- Whole tree in Ballybofey was found to have the highest levels of Cr.

Copper Concentration



Copper Concentration

- There was statistically significant difference in mean Copper concentration for both site and assortment, (p=0.003 and p=0.037, respectively)
- Whole tree assortment had the highest Cu concentration (2.72-1.5mg/kg) throughout sites.

Iron Concentration



Iron Concentration

- There was no statistically significant differences in mean Iron concentration for both site and assortment.
- Highest concentrations of Fe found in whole tree assortments throughout sites (130-5 mg/kg)

Potassium Concentration



Potassium Concentrations

- There was statistical significant difference in mean Potassium concentration for both site and assortment, (p=0.034 and p=0.002, respectively)
- Highest concentrations of K in whole tree assortment (1174-1965 mg/kg) throughout sites.

Sodium Concentration



Sodium Concentration

- There was statistically significant differences in mean sodium concentration between sites (p=0.041)
- There was no statistically significant differences in mean sodium concentration for assortment.
- Whole tree assortments had the highest Na concentration (328-192 mg/kg) throughout sites.

Phosphorus Concentration



Phosphorus Concentration

- There was no statistically significant differences in mean Phosphorus concentration for both site and assortment.
- Highest P concentrations detected (1171-825 mg/kg) in whole tree assortments throughout sites.

Work in progress

- Seasonal variation analysis currently in progress.
- **Comparison of:**
 - Freshly felled wood
 - Seasonally dried wood

Statistical Analysis of all results.

Conclusions

Ash Content

- Highest values found in whole tree assortment at all sites – Ballybofey highest
- Gross Calorific Values
 - Highest values found in whole tree assortment at all sites – Ballybofey highest

Metal Analysis

- All heavy metal concentrations were within the expected range.
- No lead was detected in any site studied

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