

Forestry Commission Project Report 10 - Extended summary
Trial of portable moisture meters for assessing moisture content in wood chips and roundwood

Moisture content (MC) is one of the key parameters used to classify wood fuel, as it directly influences calorific value, and is a critical element when specifying the required quality of fuel for a given end use. Standard BS EN 14961-1:2010 'Solid biofuels - Fuel specifications and classes - General requirements'¹ requires MC to be stated when categorising woodfuel. The standard 'BS EN 14774:2009 - Solid biofuels. Determination of moisture content. Oven dry method'¹ details sampling, preparation and analysis of samples in a laboratory required to implement the oven-dry method.

However there also is a need for fuel producers to be able to assess moisture content of material rapidly and in the field for operational reasons (e.g. to determine if roundwood is ready for chipping).

Investigation into the use of an acoustic hammer to assess MC in roundwood showed a good correlation between readings obtained and MC, but the cost of such equipment places it out of reach of many small and medium scale suppliers.

A number of portable moisture meters are readily available in the UK; this project identified the types of units most likely to be used by woodfuel suppliers and tested their practicality and accuracy against the 'oven dry' method of determining moisture content.

Method

Moisture content was tested in the following materials

- Larch, Chestnut, Corsican Pine and Beech roundwood with a range of moisture contents
- Woodchips from mixed softwood slabwood at two different moisture contents

Two different type of moisture meter systems were tested, the first one using electrode pins or probes to measure electrical resistance between two points, the second using a metal container to measure the dielectric constant within a known weight of material.



Example of a resistance type of meter



Example of a capacitance type of meter

The first type of meter only was assessed for MC measurement accuracy in roundwood, and both systems were assessed for MC measurement accuracy in woodchips.

Results

• Roundwood

Readings obtained from measuring the moisture content of roundwood were extremely variable. This reflects the variability of moisture levels within individual logs, and also highlights the very localised nature of MC readings given by probe type resistance meters. Similar results have been observed in other independent firewood MC measurement trials commissioned by HETAS.

¹ These standards are available from the Biomass Energy Centre website www.biomassenergycentre.org.uk – all standards can be found from www.bsigroup.com

Because of this, a large number of measurements would be required to give a reasonably accurate estimate of the MC of roundwood. In the field, this kind of sampling would be impractical and would not allow quick and simple estimates of MC to be made. It is not advisable to make business decisions based solely on readings taken from this type of equipment.

• Woodchips

Both types of meters gave reasonably accurate MC estimates when assessing woodchips. Results from both types of meter were comparable and both sets of results agreed broadly with those obtained by oven drying and weighing samples to determine moisture content. However, both systems also had some limitations:

Probe type resistance meters

- May be less accurate around wood fibre saturation at MC around 30%, which is likely to be problematic at the small and medium scale as it corresponds to the typical range of target MC for woodchips in small to medium scale applications (25 – 250kW)
- Provided very localised measurements, which would need to be balanced by relatively intensive sampling to obtain a reliable estimate of average MC, there again making this option impractical.

It is also thought, though this point would require further investigation, that accurate calibration of such systems could improve their accuracy. This however would not address the aspect of the very localised measurements.

Capacitance meters

- These systems measure greater quantities of woodchips, and the readings were well correlated to laboratory values. This suggests that this type of system could provide a suitable means of assessing MC relatively quickly.
- The pattern observed when taking repeat readings tends to confirm anecdotal reports that this type of device should be disturbed as little as possible during the measurement process and care should be taken when filling the container with sample material.

The accuracy of such devices would need to be confirmed by more extensive trials, and their cost (c. £1,500 for a typical capacitance meter, £200 to £700 for resistance meters) might be prohibitive for small scale businesses but seem to be a promising option for the assessment of MC in woodchips.²

Conclusions

It is not yet possible to recommend a simple type of system and/or measurement protocol for accurately and practically measuring MC in roundwood.

- For the measurement of MC in woodchips, even if correct calibration of resistance type systems could improve their reliability, the likely number of readings required to achieve an accurate MC estimate and the unreliability of such systems around wood fibre saturation point make them unlikely to be a practical option for fuel suppliers.
- Results from this study suggest that capacitance type systems offer an adequate level of reliability for woodchip supply chain requirements, although the very careful handling needed may limit its usefulness in many production situations.

In light of these findings, weighing and oven-drying samples remains the most reliable method of establishing MC in woodfuel at present.

Other related work

Internal Project Information Note (IPIN) 33/08 - *Acoustic Tool Trial*

Internal Project Information Note (IPIN) 25/06 - *Woodfuel Drying and Storage*

Internal Project Information Note (IPIN) 09/06 - *Small Roundwood – Pilot Drying Trials*

Internal Project Information Note (IPIN) 11/08 - *Evaluation of Methods for Drying Woodchips*

The work summarised here is part of an ongoing programme of research funded by the Forestry Commission aimed at improving the efficiency with which fuel is produced from sustainably managed forests in the UK. For further information on this project and related work:

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² Heating and weighing 'moisture analysers' are also available on the market – they work on the same principle as the oven dry method, calculating moisture content based on the difference between dry and fresh weight. An indicative retail price is c. £2,000.