

INTRODUCTION

Coed Cymru, a partner in CALU, has found that whilst oak timber has a ready market, timber from beech, sycamore and even ash can be difficult to sell. Heat treatment might be a way of raising the value of wood from these species.

Modification of timber properties by high temperature treatment has been explored for over fifty years. During the early 1990s a variety of heat treatment processes were developed in northern Europe to produce timber that is claimed to be more dimensionally stable (less prone to expansion and contraction in changing humidity) and more resistant to rot, a property that is particularly useful for upgrading normally non-durable softwoods without the use of chemicals.

HEAT TREATMENT FOR WALES

Purpose built ovens for heat treating timber are available commercially, but they are large and extremely expensive. Therefore, Coed Cymru sought to source a smaller oven that would be more appropriate to the scale of hardwood timber production and much of the manufacturing in Wales. There was also a need to test the heat treatment process on Welsh hardwoods and to obtain data on the most suitable treatment protocols. This work is being carried out in collaboration with Marcos Gonzales-Pena at the School of Agriculture and Forest Sciences at the University of Wales in Bangor. A detailed study of heat treatment of beech and other timbers is currently being conducted at the University and is providing significant technical input.

THE OVEN

An oven capable of treating up to 1m³ of timber at temperatures up to 250°C was built by Caltherm, a specialist company based in Newcastle under Lyme (01782 563865). It is important to exclude oxygen during the heat treatment process, so ports for steam and nitrogen were included and the interior was made reasonably airtight. Within the oven, air is circulated by a powerful fan. A robust trolley loading and clamping system to secure the timber was provided. The cost of this oven was around £13,000, although it could be made larger without significantly adding to the cost. More detailed information regarding the design of the oven is available on request. The Countryside Council for Wales funded the purchase of the oven.

RESULTS OF HEAT TREATING TIMBER.

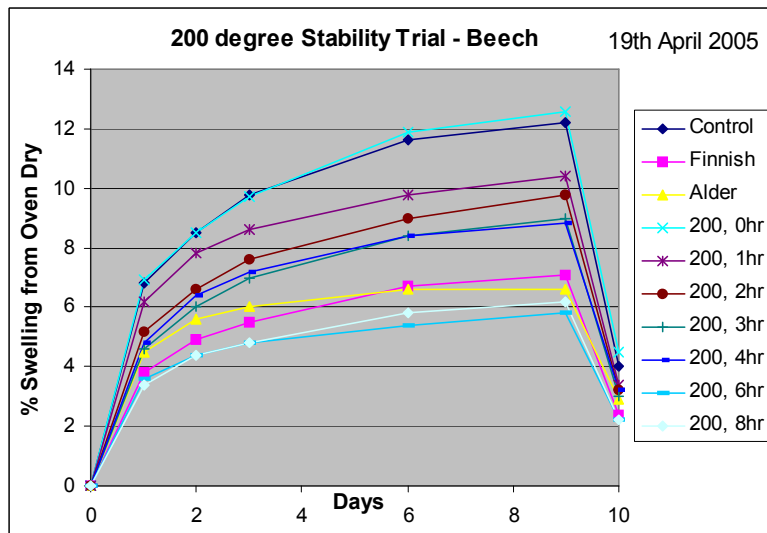
A range of samples of timber species have been treated for different lengths of time. Examples of results are as follows:

- The timber darkens according to the temperature and duration of heating (see Fig 1). It has been mistaken for tropical timber, and we understand that there is an increasing interest in darker timbers. The colour is throughout the timber, representing a big advantage over stained finishes, creating a whole new range of timber products.
- The darkening depends on the duration and temperature of heating. The samples of beech, below, were heated at 200°C for up to 8 hours.

Figure 1: Illustrating changes in colour with duration of heating



- The longer the treatment, the darker the colour, so the required colour can be chosen.
- Heat treatment renders the timber more stable as shown below. Samples of beech treated at 200°C were re-dried and allowed to swell in water saturated air. The movement was reduced by up to 50%, slightly better than a sample that had been treated in Finland. This is particularly useful for beech which has high movement and expands the potential range of products that beech can be used in.



- Treating the timber at lower temperatures for a longer period of time gives a more reliable and uniform product. A slow run up to temperature that includes holding at 120° for initial drying produces a good product.
- Kiln dried timber is used although it is possible that manipulation of the process could be used to partially dry some species to reduce kiln drying times.
- Heat treatment tends to change physical properties of timber. Further research is being conducted into these changes, particularly changes in strength and elasticity, at the University of Wales in Bangor. For many purposes (furniture, flooring) where the timber is not being stressed to its limit, these changes will not be significant.
- The machining properties of the timber appear to be improved.
- Durability of the samples of treated timber has not yet been tested, though this is planned for the future. It should be noted that these tests should be carried out by a competent laboratory who can provide proper certification.

CONCLUSIONS

So far, small loads (up to 5 cubic foot) of timber have been heat treated in the new oven. With small loads such as this, the cost of electricity equates to c.£2.00/cu ft. With larger loads, this should reduce to less than £1.00/cu ft. Capital costs will depend on the oven size and the annual throughput, but could be less than £1.00/cu ft.

Heat treatment of hardwoods has the potential to create a new range of useful products from hardwoods grown locally in Wales. Certain softwoods may be also be amenable to heat treatment, although the reduced strength and increased brittleness may be a problem

Those interested in the technique should discuss the process in more detail with Andy Stewart at Coed Cymru 01686 650777.