

## Treatment of eucalypt heartwood using supercritical carbon dioxide as a carrier

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### Introduction

Existing treatment methods do not give satisfactory penetration of preservatives into the heartwood of many hardwoods including eucalypts. The result is often a thin envelope treatment that termites might breach, allowing them access to an untreated core. As a consequence, we propose a more efficient method for treating wood with pyrethroids using supercritical fluids such as carbon dioxide as the carrier (Figure 1, also <sup>1</sup>).

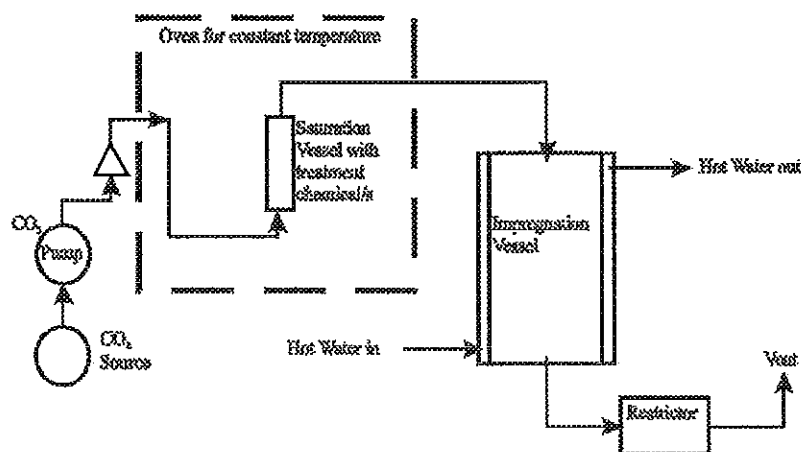


Figure 1: Schematic diagram of the experimental set up for treating timber using supercritical carbon dioxide (scCO<sub>2</sub>)

Broadleaved hardwoods produced some 1,322,000 cubic metres of timber in 1997-98 according to the Australian Forest Products Statistics (1999)<sup>2</sup>. With the greater emphasis in the Building Code of Australia on termite protection, a successful treatment method would improve the marketability of hardwoods for products such as flooring and framing.

In preliminary work with *Eucalyptus oblique* (messmate), heartwood blocks 200×35×35 mm were impregnated with permethrin dissolved in scCO<sub>2</sub> at 200 bar pressure. After treatment, "In" and "Out" stakes, 200×10×10 mm were cut for analyses and trials (Figure 2). Two small blocks, 48×10×10 mm, were cut from the "In" and "Out" stakes for chemical analysis (A position). Two similar blocks were cut for termite bioassay (T position). Another stake 200×10×10 mm was allocated for strength testing. Untreated specimens, and specimens treated with LOSP using conventional vacuum pressure impregnation, were included for comparison.

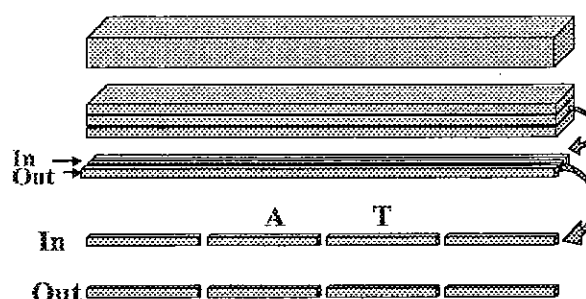


Figure 2: Cutting of specimens for various analyses

## Results

Eucalyptus obliqua heartwood was successfully treated with permethrin using supercritical carbon dioxide as the solvent carrier. The specimen size used was 200×35×35 mm in accordance with the size of the pressure cylinder. Chemical analyses for permethrin using HPLC were conducted on the inner most parts of the treated samples. The mean permethrin retention obtained was 0.035% m/m oven dried wood, which is well above the required levels needed (0.02%) for H2 and H3 hazard classes. The Instron flexural tests conducted on samples cut from the blocks showed no deterioration of strength (MOR and MOE) compared to similar untreated samples or those treated by conventional vacuum-pressure impregnation. A termite bioassay using *Mastotermes darwiniensis* revealed that samples from treated wood were resistant to attack. Preliminary studies on blocks with sealed ends revealed some dimensional deformation due to the high pressure of supercritical fluid, indicating that the entrance of supercritical carbon dioxide is mainly through the end-grain, not the side-grain surfaces. However, the collapse can be prevented or controlled by altering process variables, such as pressure, temperature, rates of pressurisation and depressurisation etc. Further trials are being conducted on boards up to one metre long in a larger pilot plant recently installed at CSIRO.

## References

- <sup>1</sup> Qader, A. and Cookson, L.J., "Solubility of pyrethroids (wood preservatives) in supercritical carbon dioxide with and without co-solvent", 6th World Congress of Chemical Engineering, Melbourne, 23-27 September 2001
- <sup>2</sup> Australian Forest Products Statistics - March quarter 1999, published on 13 July 1999

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