INTERNATIONAL COLLABORATION ON THE USE OF ALTERNATIVE FUMIGANT TO TREAT TIMBER FOR REPLACEMENT OF METHYL BROMIDE IN MALAYSIA – RESULT FROM EDN (C2N2) TRIAL

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Background. Researchers from CSIRO and FRIM (Forest Research Institute Malaysia) and officials from MDA (Malaysian Department of Agriculture) had worked together in 1) to develop a protocol for the project MAL/99/G68/A/ZG/99-Alternative to the use of methyl bromide on Malaysian timber and 2) to conduct field trials and demonstrate use of alternative fumigants. This project will help Malaysian researchers to establish or build up a capacity in R&D in timber protection without the use of methyl bromide. Knowledge gained is also transferable to the fumigation of other materials such as soil, fruit and vegetables.

Achievements to date

The protocol was generated. The protocol aims to develop practical methods and procedures to demonstrate the efficacy of nominated alternative procedures compared to methyl bromide which is currently used for the disinfestation of timber in storage. Two alternative procedures were proposed:

- Chemical treatment – fumigation with three fumigants (phosphine, carbonyl sulfide and cyanogen) compared with methyl bromide
- Physical treatment – heat with dry air and steam

Technical training of MDA and FRIM staff in CSIRO Entomology Australia. A training program was conducted at CSIRO Entomology, Canberra, Australia. The 5 day training course was designed to impart knowledge required for the completion of the protocol. The course covered the following topics:

- The chemical and physical behaviour of fumigants
- Fumigant handling and measurement
- Analytical methods for analysis of fumigants
- Timber research methods and fumigant behaviour
- Bioassay of insects and pathogens
- Management of fumigant field trials
- Research methodology on heat response of insects and pathogens

Establishment of Fumigation Laboratory. A fumigation and fumigant analytical laboratory was established at FRIM. It contained a fume hood for the safe handling of gas samples and a GC for sample analysis. The new gas chromatography (GC) was successfully commissioned by CSIRO and FRIM staff with two detectors; flame photometric detector (FPD) for analysis of phosphine, carbonyl sulfide and sulfuryl fluoride, and a flame ionisation detector (FID) for analysis of methyl bromide and cyanogen. The GC detected 4 of the 5 fumigants very well, with working ranges from environmental levels to fumigation concentrations, eg, 0.5 ppm to 150g/m^3. FRIM researchers were sufficiently trained in the CSIRO and FRIM use of the GC and its software to operate independently in future laboratory work and trials. The new

laboratory means that FRIM researchers can now conduct laboratory scale evaluations of sorption, desorption and residues of fumigants on timber before moving onto large scale commercial trials.

Demonstation fumigations undertaken at PEQ station using methyl bromide and cyanogen. To test the field fumigation set-up two fumigation trials were conducted with methyl bromide and cyanogen both at a dose of 80g/m^3. Tempratures during the trial ranged between 23-32°C and the chamber was filled to a 15% loading ratio. The timber samples used were rubber wood 300 X 100X 100mm. Bioassays were undertaken with two insect species (*Rhyzopertha dominica* and *Coptotermes spp.*) and two pathogen species (*Schizophyllum communz and Ganoderma applanaium*). The results are shown in Table 1.

Table 1. Summary of trial results

fumigant	Dose (g/m^3)	Time of exposure (hours)	Fumigant emission after fumigation (%)	Kill (%)	
				Insects	Pathogens
MB	80	21	55	100	100
Cyanogen (C_2N_2)	80	17	8	100	100

During the trials, the following activities were jointly undertaken by Australian and Malaysian staff:

- Safe use of cylinder gases
- Set up for fumigant application and gas regulation system
- The procedures for pressure testing of fumigation chambers
- Preparation of timber samples containing target organisms
- Collection and handling of gas samples using syringes and Tedlar gas bags
- Calculation of dosage of fumigant
- Fumigant application skills
- Monitoring fumigant concentration in the chamber
- Monitoring fumigant concentration in the workspace and nearby environment
- Handling of bioassays before and after fumigation