CYANOGEN: A NEW FUMIGANT WITH POTENTIAL FOR TIMBER

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Physical and chemical behaviour of cyanogen on timber

Cyanogen is a colorless gas with an almond-like odor; its chemical and physical properties are listed in Table 1. Cyanogen has been patented by the CSIRO as a new fumigant effective against insects and micro-organisms. In comparison with methyl bromide and phosphine, cyanogen is highly toxic to stored product insects and is fast acting. It has a threshold limit value (TLV) of 10 ppm, which compares favourably with 5 ppm for methyl bromide and 0.3 ppm for phosphine.

Table 1. Chemical and physical properties of cyanogen compared to other fumigants

	Methyl bromide	Phosphine	Sulfuryl fluoride	Cyanogen
Formula	CH_3Br	PH_3	SO_2F_2	C_2N_2
Molecular weight	95	34	102	52
Boiling point @1 atm	3.6°C	-87.74°C	-55.2	-21.17°C
Specific gravity (gas), air=1.0	3.3	1.2	3.72	1.82
Flammability limits in air, v/v %	13.5-14.5	>1.7	non	6-32
Solubility in water, v/v %	3.4	0.2	Slight	Highly soluble
Conversion factor mg/L to ppm, v/v @ 1 atm	260	730	245	480

Cyanogen was more rapidly sorbed by softwood than by hardwood, similar to methyl bromide. For both hardwood and softwood, cyanogen penetrated timber faster than methyl bromide and the vapour concentration was higher.

Laboratory bioassays on insect, nematodes and fungi

Termites: 100% mortality for *Cryptotermes brevis, C. cyanocephalos and C. domesticus* was obtained after 24 hours fumigation with a cyanogen dose of 0.43mg/L compared to a methyl bromide dose of 1.74mg/L., showing the higher toxicity of cyanogen compared to methyl bromide for at least three species of drywood termites.

Nematodes died quickly after exposure to cyanogen. For example, an application of 3.48 mg/L for 3 hours exposure killed 404/404 nematodes of *Steinernema carpocapsae,* as against a control mortality of only 5/462. The same level of kill was obtained by methyl bromide at 10mg/L for 5 hours exposure.

Timber microorganisms: Cyanogen was effective against a range of important timber micro-organisms such as *Phytophthora nicotianae, Fomes lignosus, Phytophthora palmivora* and *Trichaptum* sp. at a dose of 5-20mg/L for 6-24 hours fumigation.

International collaboration

An important outcome of the 2001 MBAO conference was the establishment of research collaboration between Australia (SGRL), China (CIQ) and the USA (USDA, PPQ) on quarantine fumigation of timber for control of the Asian long-horned beetle. The first trials have already taken place. Cyanogen will be tested in March 2003 in China.

In addition, collaborative research and trials on alternative fumigants (including cyanogen) on timber will be conducted in late 2002 in Malaysia, with funding from the UNDP.