CARBONYL SULPHIDE AND ETHYL FORMATE UPDATE

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The Fate of ^{35}S-labelled carbonyl sulfide on grains and their fractions

The amount of sorbed fumigant residues and converted fumigant residues on grains and cereals was measured using ^{35}S-labelled carbonyl sulphide (COS). Hard wheat, soft wheat, paddy rice, brown rice, polished rice, sorghum, maize, canola, barley, oats and peas were exposed for 4 days to 50 mg L^{-1} of $CO^{35}S$ with a total radioactivity of 20 mCi. After exposure, the samples were split and ventilated with either air or COS for 2 days.

The results showed samples aerated with air contained higher levels of ^{35}S residues than those aerated with COS. This indicates an interchange between S and ^{35}S. Therefore, the levels of objective COS residues were lower than the levels of residue indicated by ^{35}S sorption alone. The levels of $CO^{35}S$ and converted fumigant residues measured varied with commodity, eg. 3-20 ng g^{-1} (grain) was present in lipid extractions and 95-380 ng g^{-1} in water extractions.

More than 90% of (COS equivalents)^{35}S residues were in the water extractions. Total uptake of radioactivity was below 350ng g^{-1} or 0.35mg kg^{-1} (ppm) for all 11 tested commodities. The total radioactivity determined by phosphorus imaging of sectioned commodities ranged from 200-400ng g^{-1}.

The radiation image from the phosphorus imaging shows that more than 90% of ^{35}S residues was located or distributed in the embryo, testa, pericarp and husk, and the ^{35}S was still slowly desorbing from grains after 2 days aeration.

VAPORMATE – A formulation of Ethyl Formate in Carbon Dioxide

VAPORMATE is a non-flammable formulation that contains 16.7 wt% ethyl formate (EtF) in liquid carbon dioxide (CO_2), a dilution of 1:6. In addition to eliminating flammability, the CO_2 enhances the fumigation efficacy of the ethyl formate.

This formulation at 11 vol% EtF in gaseous CO_2 is conservatively below the determined 15 vol% EtF in gaseous CO_2, which when vaporised will remain non-flammable in all proportions of air. Thus it can be safely applied in grain silos and other fumigation enclosures as an aerosol. It is anticipated that VAPORMATE will be granted pesticide registration status in Australia & New Zealand before Year 2004 end.

Behaviour of Ethyl Formate Blended with Natural Plant Products

Work was undertaken to assess the toxicity of ethyl formate alone and mixtures with natural products such as monoterpenes against the internal stages of *Sitophilus* oryzae (the most difficult stages to kill with ethyl formate alone).

Some monoterpenes showed enhancement of ethyl formate toxicity to mixed age cultures of *S.* oryzae when exposed for 6 hours or longer. For example, ethyl formate plus carvone and ethyl formate plus thujone were slightly more toxic over a 6 hours exposure at 67.5 mg L^{-1} and significantly more toxic for a 24 hour exposure at 33.8 mg L^{-1} to the pupal stage of *S. oryzae* at 25°C. It is considered that ethyl formate blended with some natural products could have potential for long term exposures (>24 hours) not solely as a fumigant but also due to its residual short term effects.

Phytotoxicity of Ethyl Formate

The germination and plumule vigour of wheat, barley, paddy, sorghum, maize, mungbean, soya bean, safflower and cotton seeds treated with ethyl formate (EF), was investigated. Unlike methyl bromide, at high doses EF showed no effect on germination and plumule length, eg. 120mg L^{-1} of EF for 72 hours exposure.