DOES ETHANDINITRILE DECOMPOSE TO HYDROGEN CYANIDE DURING A PINE LOG FUNIGATION?

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Methyl bromide (MB) is currently the most effective fumigant used for quarantine and pre-shipment (QPS) purposes internationally. However, because of its ozone-depleting nature, its use has primarily been restricted to QPS treatments. The search for alternative fumigants to MB identified a relatively new fumigant, ethanedinitrile (EDN), as a potential chemical treatment of pine (*Pinus radiata* D. Don) logs.

Brash et al. (2013) concluded that EDN had potential as a chemical treatment, but that the decomposition pathway of EDN to HCN was unresolved because the patent (O'Brien et al., 1999) states that HCN is produced in water and high humidity environments. High humidity is prevalent when recently harvested logs are covered with a tarpaulin and fumigated. Consequently, it was hypothesised that these circumstances would facilitate the decomposition of EDN to HCN. The fate of EDN must be considered by the New Zealand Environmental Protection Authority (EPA) during the registration process that will permit the use of EDN in New Zealand.

The concentrations of EDN and HCN were measured in the treated space during simulated commercial fumigations of pine logs at 10 or 20 °C in 28 L chambers. The registered dose of EDN Fumigas™ for the treatment of logs and timber in Australia is 50 g m^{-3} for a treatment period of 10 h, which were replicated in this current study. At each sampling occasion, two separate samples were simultaneously collected from each chamber: (i) a 3 mL sample that was analysed on a gas chromatograph (GC) to determine the concentration of EDN; and (ii) a 1 mL sample that was analysed by direct injection on a gas chromatograph-mass spectrometer (GC–MS) to determine the concentration of HCN.

During fumigation, HCN was detected in the treated space at relatively low concentrations which did not significantly change over time. This indicates that HCN is not significantly produced during fumigation and that as a result, insect efficacy is unlikely to be affected by low unchanging ($P = 0.055$) concentrations of this compound in the treated space. On average, the cylinder of EDN tested contained 34.6 g m^{-3} HCN (or 3.1%), which corresponds to a concentration of

0.8 g m^{-3} (or 0.07%) in the treated space for a 50 g m^{-3} EDN dose. This level of HCN is likely a result of the manufacturing process, whereby HCN is oxidised to produce EDN.

Our study, for the first time, demonstrates that fumigation of pine logs with EDN either does not result in the production of HCN or that the concentration of HCN produced is not detectable as it is masked by the HCN that is endogenous to the EDN. Impacts on chemical efficacy, environmental emissions and worker safety due to the presence of HCN are therefore likely to be negligible.

References

Brash, D. W., Armstrong, J. W., & Waddell, B. C. (2013). Ethanedinitrile (EDN) as a potential quarantine disinfestation treatment for New Zealand export logs and sawn timber. Plant & Food Research, Palmerston North, New Zealand.

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