PENETRATION OF FUMIGANTS INTO LOGS FOR PEST ERADICATION AND STAIN PREVENTION

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Fumigants have been used around the world to reduce the threat of pest transmission in raw wood products such as logs. Though primarily directed at. insects, certain fumigant chemicals have also been successfully to kill fungi and nematodes even in wood with very high moisture contents. For example, red oak logs with intact bark require fumigation with high levels of methyl bromide for export to the EU to assure the death of the oak wilt fungus in the sapwood. In the course of development of the concentration x time product (CT) required for oak log treatment, it was discovered that the death of wood parenchyma cells (as measured by a simple dehydrogenase assay) was correlated to the treatment level effective against the oak wilt fungus (4). More recently, this correlation between parenchyma and fungal death in sapwood was shown to exist for red oak log treatment with sulfuryl fluoride (8).

This ability to kill parenchyma in logs by fumigation has resulted in a new application for chemicals such as methyl bromide, surfuryl fluoride, and methyl iodide in the prevention of non-microbial sapwood stains which cause substantial loss to the hardwood lumber industry (1,5,6). Killing parenchyma cells in freshly felled logs apparently prevents the accumulation of these oxidative, enzyme-mediated stains in a variety of hardwood species including red oak, sugar hackberry, hickory, maple, and white ash. The cost of such treatment under simple outdoor tarp fumigation can be as low as $1-3 per thousand board feet (2) with savings of $500-800 per M Bd-ft in reduction of lumber downgrading.

Substantially higher treatment levels of fumigants are required for fungal kill or stain prevention than are used for insect control, but use of the parenchyma assay using the triphenyl tetrazolium chloride can provide a measure of effective fumigant penetration. Parenchyma cells continue living for several months after log harvest even during warm weather seasons and can provide direct evidence of fumigant ingress which may be difficult to assess by other means (fungal culturing or chemical analyses).

Few data are available documenting penetration of fumigants into logs (particularly with intact bark). Work with red oak (3) has shown that methyl bromide can effectively penetrate at least 50mm of sapwood (normally the maximum encountered in commercial logs), and more recently, naturally, infected red oak logs were successfully treated in an outdoor tarp fumigation using sulfuryl fluoride (9). The oak wilt fungus was killed at the maximum sapwood depth of 50mm. Study of parenchyma death in radiata pine logs has shown that methyl bromide is limited to a kill depth of approximately 70mm into sapwood but sulfuryl fluoride can kill to at least a depth of 115mm (7).

Methyl iodide has been cited as a potential replacement for methyl bromide in several

agricultural applications. In laboratory studies using small red oak log sections, it was able to effect parenchyma cell death even better than methyl bromide (8). However, when tested outdoors under tarp on larger logs of commercial size (thicker bark and sapwood), it was less effective than methyl bromide in prevention of stain (and in killing all parenchyma) in red oak at similar CT values (6).

In summary, there do seem to be fumigants (such as sulfuryl fluoride) which -may effectively be used in place of methyl bromide for biocidal treatment of logs. Given the report that steaming of logs is approximately 35 times more costly than current gas fumigation and the potential damaging aspects of heating to wood quality for some species, fumigation may remain a desirable option for treatment of raw wood products.

References

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