



Detection of Decay using Vapor Analysis – short note

Anonymous, L. Lawson (ed.)
Wood Study Group

Abstract- Detection of methane and possibly other evolved vapors may be useful in detecting decayed wood in enclosed spaces such as behind drywall. Most microorganisms that are responsible for decay evolve methane as does the excrement of many wood consuming insects. Detection of methane might prove useful as a tool for building inspection.

Index Terms- wood, decay, rot, non-destructive testing, insect damage, gas analysis

On Thursday, April 21, 2010, the editor received an anonymous phone call regarding the need for better inspection tools for examining frame buildings for structural decay. The caller was only aware of the screwdriver method, poking the structural member in question with a screwdriver. Closely related to this is the Resistograph® which drills a hole into the wood to be inspected. While the former only makes a hole if the wood is decayed, the latter always makes one. For the caller and the editor, this appeared to be the state of the art. The discussion examined possible acoustic, electromagnetic impedance, microwave reflection and possibly thermal tools for testing. The caller rejected all of these on account of their requirement that the wood to be examined had to be directly accessible to or at least in the line of sight of the examiner. The caller insisted that removing sheetrock for inspection was an onerous task. The conversation compared the analogy with aircraft inspection. X-ray methods did not seem to be appropriate for inspecting dwellings although the style of x-ray backscatter used for inspecting prisoners and

lately air travelers was within the realm of theoretical possibility. The only remaining component of the decay inspection armamentarium was smell. While uncertain, smell is a simple method that has long been used. Wood decay evolves gasses and vapors that can be detected. At about this point the caller rang off.

Reviewing the relevant literature shows that various fungi and bacteria that attack wood do give off gasses and higher molecular weight vapors that can be detected. [1]. Of these perhaps methane is the most universal [2]. Electronic nose methods such as conducting polymer, metal oxide, MOS, and vibrating crystal, have been tried as detectors of decay, but the success appears to have been modest [3]. There is a tradeoff between sensitivity and selectivity in all electronic nose methods that tends to favor high molecular weight compounds over low molecular weight ones. Because methane is a possibly the product shared by decay and insect damage processes, it seems like a good choice as an indicator of decay. It's low molecular weight and presence in the atmosphere are drawbacks. Ideally one would like to detect a methane gradient pointing toward its source. This would require a very high sensitivity detector capable of continuous monitoring. One candidate may be the catalytic carbon nanotube detector [4].

REFERENCES

- [1] O. Schmidt, W. Liese, "Occurrence and Significance of Bacteria in Wood", *Holzforschung* 48 (4) 271-277 (1994).
- [2] V.A. Mukhina, P. Yu. Varonin, "A new source of methane in boreal forests", *Applied Biochemistry and Microbiology* 44 (3) 297-299 (2008).

[3] M. Baietto, A.D. Wilson, D. Bassi, F. Ferrini,
“Evaluation of three electronic noses for detection of
incipient wood decay”, *Sensors 10* (2) 1062-1092 (2010).

[4] L. Yijiang, L. Jing et al., “Room temperature methane
detection using palladium loaded single-walled carbon
nanotube sensors “, *Chemical Physics Letters 391* (4-6) 344-
348 (2004).