

Vikane® Fumigant vs. Orange Oil

Laboratory Study of Orange Oil (XT-2000) Use to Control Drywood Termites in Wood

Orange oil is extracted from orange fruit peels and is available as XT-2000 for treating drywood termites.

The laboratory study used wood boards naturally infested with drywood termites.¹ Prior to treatment, the wood boards were confirmed to be infested with drywood termites by using X-rays and sensors that detect termite feeding and movement, which are methods that do not injure termites. One set of boards was treated with orange oil, a second set was treated with water only and a third set served as an untreated control group. The boards treated with orange oil were injected about 2 inches apart with the maximum amount of orange oil the wood could absorb.

Three months after the treatment, all boards were cut into small fragments to extract and count live and dead drywood termites. Live termites were found in all the boards. Termite survival was high in both control treatments, while an average of 19% of the termites survived the orange oil treatment (see table below).

19% of termites survived treatment with orange oil

Figure 1



Figure 2



Treatment	Total Number Drywood Termites (Three Boards per Treatment)				Average Survival ^b
	Live	Dead	Casualties ^a	Total	
Orange Oil	336	1,105	9	1,450	18.7%
Water Control	1,090	35	1	1,126	94.2%
Untreated Control	961	38	30	1,029	96.4%

^aCasualties include termites destroyed in the extraction process, and were not included in the % Survival calculations.

^b% Survival = Sum of % survival [(# Live / (# Live + # Dead)) for each board divided by 3 (number of boards tested)]

These results showed that orange oil (XT-2000) eliminated only 81% of drywood termites, even in a best case scenario with complete access to infested wood and thorough application of the maximum amount of orange oil. Whole-home fumigation is the most effective method documented to eliminate drywood termite infestations in structures, including termite colonies in areas like attics, walls and crawlspaces that might be unreachable for localized treatment.²

¹Dr. Vernard Lewis, University of California, Berkeley, CA. 2008

²Scheffrahn et al. 1997. J. Econ. Entomol. 90: 492-502; Lewis and Haverty. 1996. J. Econ. Entomol. 89: 922-934.

Comparing Methods to Eliminate Drywood Termites

	Vikane® fumigant	Orange oil (d-limonene, citrus oil)
Methodology	Whole-structure treatment: The entire structure is tarped and fumigated with Vikane® fumigant, killing all drywood termites inside, no matter where they are hiding.	Spot treatment: Only colonies that can be found and are accessible may be treated. Requires drilling holes into wood and injecting orange oil.
Third-party validation of efficacy	Fumigation with Vikane is the most thorough, consistent and effective treatment of infested structures in more than 20 years of university research and 55 years of commercial use. ^{1,2,3} Researchers and pest control operators acknowledge that whole-structure fumigation, compared to spot treatments, penetrates better into concealed areas, and large volumes of wood are treated more efficiently. ⁴	Laboratory research (front page) revealed that revealed that in a best case scenario with complete access to infested wood and orange oil injected at 2-inch intervals, orange oil eliminated only 81% of drywood termites. Up to hundreds of termites survived treatment. ⁵ This termite survival is important because research has shown drywood termite colonies can reproduce and increase with as few as 20 worker termites. ⁶
Treatment limits based on termite location in structure	There are no limitations: Vikane penetrates into all wood within the tarped structure to kill termites. ^{1,2}	Termite colonies must be accessible to the person performing the orange oil treatment.
Treatment limits based on applicator ability to detect termites	There are no limitations: Vikane penetrates all wood within the tarped structure to kill termites. ^{1,2}	Detecting live termites is critical for orange oil treatment: Undetected colonies will not be treated or controlled. Besides visual inspection, other detection methods for termites are infrequently used and produce uncertain results. There is always doubt as to the location and extent of drywood termites in buildings with restricted accessibility. ⁷
Possibility for damage by treatment application	The possibility of damage is low when Vikane is used according to the label. Improper tarping may cause damage.	Many injection holes in wood and walls for orange oil treatment may need to be repaired. Orange oil is an oily liquid which is used as a solvent and a degreaser. Its effect on paint and surface finishes is unknown.
Flammability	Vikane is not flammable.	Orange oil is flammable with a flashpoint of 115°F.
Indoor air quality	The licensed professional who treats a structure with Vikane must follow specific aeration procedures, including air testing using sensitive equipment to confirm federal label requirements have been met. Procedures and equipment have been extensively researched to validate their performance.	Orange oil has a pungent citrus odor. No air testing is conducted after application.
References	¹ Lewis, V.R. and M.I. Haverty. 1996. Evaluation of six techniques for control of the Western drywood termite (Isoptera: Kalotermitidae) in structures. <i>Journal of Economic Entomology</i> 89(4): 922-934. ² Scheffrahn, R.H., N.-Y. Su, and P. Busey. 1997. Laboratory and field evaluations of selected chemical treatments for control of drywood termites (Isoptera: Kalotermitidae). <i>Journal of Economic Entomology</i> 90(2): 492-502. ³ Su, N.-Y. and R.H. Scheffrahn. 1986. Field comparison of sulfuryl fluoride susceptibility among three termite species (Isoptera: Kalotermitidae, Rhinotermitidae), during structural fumigation. <i>Journal of Economic Entomology</i> 79(4): 903-908. ⁴ Lewis, V.R. 2003. IPM for Drywood Termites (Isoptera: Kalotermitidae). <i>Journal of Entomological Science</i> 38(2): 181-199. ⁵ Lewis, V. R. 2009. Unpublished research. University of California Berkeley. ⁶ Unpublished data, T. Atkinson, formerly University of California, Riverside (personal communication). ⁷ Lewis, V.R. 2002. Drywood Termites, Pest Notes, University of California Agriculture and Natural Resources. Publication 7440.	



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