
How to Find Hidden Microbial Growth with a Mold Dog

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ABSTRACT

Microorganisms grow frequently in hidden places, e.g., behind wall linings, in floors, or behind installations. They are often not visible from the outside. Often, health complaints occur even after the moisture damage has dried, sometimes even only then. In these cases, moisture measurements are not suitable to localize the microorganisms. Besides spores and other particles, microorganisms emit gaseous substances (microbial volatile organic compounds = MVOC). The MVOCs are still emitted from the contaminated material long after the microorganism has died. Dogs can be trained to search for microbial odor and to detect the source. This is a very successful method for locating hidden microbial damage. The mold dog, however, must be correctly trained, led, and interpreted. In some cases, it is the only applicable method to find spots damaged by microorganisms. During a building inspection, the dog is accompanied by a professional dog handler and an experienced consultant. At places where the dog marks a microbial odor, samples must be taken for microbiological analysis. By this well directed procedure, destruction of material is unnecessary and additional costs can be avoided.

INTRODUCTION

The use of rescue dogs after earthquakes or other catastrophes and the use of tracker dogs to find hidden drugs or explosives is well known (Wegmann and Heines 1989). Swedish dog handlers were the first who had the idea to use dogs to find hidden microbial damage. Originally, this method was applied following fears that fungi had damaged wooden construction materials. Rather than health hazards, the original fear was that wood-destroying fungi would destroy their

houses undetected. If the damages were not detected in time, the costs for sanitation would have been higher.

Nowadays, microbial growth in buildings is recognized as a cause of human disease. Its localization, which can often not be performed optically, becomes necessary. Microorganisms often grow in hidden places, behind wall linings, in floors, or behind installations. The places where they grow are not usually located by measurements of moisture or physical examinations. Measurements of moisture without destruction can only be applied in the presence of solid materials. Otherwise, there is the risk of not finding the moisture damage. Indications of microbial sources are often given by MVOC measurements (Lorenz and Diederich 2001) or sometimes only by the health complaints of the people concerned.

The examination of a building with the mold dog, which has a more sensitive sense of smell than humans, is often the only way to locate hidden microbial damages with justifiable expense.

Education of a Mold Dog

A dog that is trained to be a mold dog must have special qualities and abilities. This means that an expert experienced in training dogs has to decide whether a dog is able to work as a mold dog and the amount that is worth to be invested in it. Qualities that distinguish such a dog are a strong character and a prey instinct.

The dog must be trained and led by professional, experienced dog trainers and handlers. The education of a dog until the first use in field work takes several months. During the education, the dog is accompanied by its handler. The handler of the dog should accompany the education. He is the person of reference. It is necessary to train the dog with samples of

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different species of microorganisms. They should be species that grow often in buildings where there is microbial damage.

Sample materials for the training of a mould dog are

- a. culture medium with certain species of microorganism,
- b. material samples from microbial damage with a known composition of microorganism,
- c. culture medium and material samples without a microorganism, and
- d. samples from materials that emit compounds with a chemical structure like the MVOC. The dog should not notice materials like this.

It is important to cooperate with a microbiological laboratory that provides the required samples.

The dog's training is updated periodically with samples to ensure that the dog is still able to fulfill its task.

METHOD

During the investigation of a building by a dog, the professional handler gives special orders to instruct the dog where to go once the dog has familiarized itself with the rooms. It is important that the walls and the known critical places of moisture in a building be accessible (e.g., in rooms with dense floor coverings, the mold dog can only smell the microbial odor at the joint-edge of the floor). The team of dog and handler must be accompanied by a consultant. The dog handler has to interpret the marks and the behavior of the dog. To avoid misinterpretation, the consultant needs to have the knowledge of moisture damage in buildings and its causes. At the places where the dog marks a microbial odor, samples must be taken for microbiological analysis.

Advantages of the Use of a Mold Dog

Due to field work, the marks of the mold dog are reliable indications to take samples at the right places. The correct interpretation by the consultant is very important in order to avoid unnecessary material destruction.

- If several areas hidden microbial damage exist in one structure, the localization is more difficult without the mold dog and, in some cases, even impossible (see the examples).
- The use of a mold dog is the most effective method to examine big structures, such as office buildings or schools with several floors, in order to obtain an overview in a short time where hidden microbial growth can be expected (e.g., an office building with 200 rooms was examined within 8 hours). To use only measurements of moisture, it would have lasted several days, probably without any result.

Due to this well-directed procedure, time and expenses are reduced.

- Health complaints often occur after drying phases of

moisture damage—sometimes even only then. The moisture measurements are not suitable to localize where the microbial growth occurred. The MVOCs are still emitted from the contaminated material even after the microorganism has been dead for a long time.

Restrictions of the Method

- The mold dog marks the places where it can smell microbial odor. It doesn't show why there is an odor and, only within limits, if there is small or extensive damage. Hence, the results of the mold dog inspection cannot be evaluated immediately. In every case, it is necessary to take samples for the examination in a microbiological laboratory.
- Microbial damage in ceilings:
 1. If there is microbial damage in the floor and in the ceiling of a room, the dog may ignore the damage in the ceiling. In most cases, however, the ceiling is also the floor upstairs and the inspection can proceed.
 2. In other cases, such as a structure with a flat roof, much experience is required to interpret the marks or the behavior of the mold dog when it indicates microbial damage in the ceiling.
- Sometimes the microbial source is not at the place where the dog marks.

For example, microbial odor from damage in the insulation level of a floor with a tight covering can only be smelled at the surrounding splice of the floor.

Often, the mold dog marks power sockets or heating pipes that come from the cellar through the floor. This indicates microbial sources in the cellar.

Practical Examples

Case 1—Fire Station: Mold in Interior Walls. Health hazards and visible mold were the reasons for the examination of an entire fire station. It is a building with more than 50 rooms. Moisture could not be measured (Lorenz and Richardson 2000).

In several rooms in the upper floors, the mold dog marked the inside walls and the floor. At the places on the inside walls where the dog marked, microbial infection was noticed on the paper fiber gypsum boards behind the wallpapers. Without the use of the mold dog, the inside walls would not have been examined for microbial damages.

In areas where no mold was seen, especially in the floor, a serious infection in the materials with *Chaetomium spp.*, *Aspergillus versicolor*, and *Actinomyceten* was detected by the microbiological analysis.

Case 2—Office Building: Mold in Adhesive Under a Cupboard. The reason for an examination in an office building was health problems and the measurement of typical MVOC in the indoor air. Moisture could not have been measured and microbial damage could not have been localized during the intensive inspections.

The mold dog especially marked at the bottom of the built-in cupboards. The pasted carpet under these built-in cupboards was examined and a microbial infection was discovered in the adhesive. The built-in cupboards were probably placed before the adhesive was fully dry; hence, microorganisms could grow.

Case 3—Former Army Quarters: Health Complaints.

Following the arrival of many families in a large building (ex-army quarters), there were many complaints of bad health. Twenty-eight inhabitants of the examined flats complained of tiredness, headache, skin problems, breathing problems, and painful joints. MVOC measurements indicated microbial growth. However, it was possible to find small damage only in a few flats, e.g., near bathroom windows or in one case behind a cupboard on the outer wall.

In the majority of the flats, the source of the high MVOC concentrations (between 1.5 and 5.7 $\mu\text{g}/\text{m}^3$) could not be localized. Moisture measurements also gave no indication.

Following the inspection with the mold dog the, wall and floor materials were analyzed. In the floor, a growth of *Penicillium spp.*, *Bacillus sp.*, and *Actinomyceten* were proven. In the wall plaster, there was no special growth measured. However, as the mold dog had marked the wall, the surface paint (a special material) was analyzed. It was discovered that the growth of microorganisms (*Aspergillus versicolor*; *Aspergillus spp.*, *Geotrichium*, *Cladosporium spp.*, *Penicillium spp.*, *Actinomyceten*) was present.

DISCUSSION

Several hundreds of examinations by Dr. Lorenz, Institute of Indoor Diagnostics, with the mold dog have shown that it is a reliable method to find hidden microbial growth. The success of this method is based on the following points:

- the quality and the talent of the dog,
- the education and the training of the dog during the whole time as a mold dog,
- the experiences that are collected during the field work by the dog handler and the consultants.

To continually improve the method, it is very important to include new awareness of the field work into the training of the dog.

The single compounds of the MVOC the dog smells when he localized a microbial source are not known and not decisive for solving the problem. Microorganisms produce and emit different microbial volatile organic compounds (MVOC) during the metabolism (Fischer 2000; Lorenz and Richardson 2000).

A sufficiently known association of single compounds of MVOC to the different species of microorganism does not exist. Some compounds, such as 1-Octen-3-ol and Geosmin, emitted by microorganisms have a characteristic odor. These compounds are olfactory perceptible at very low concentrations for human beings and probably, but in lower concentrations, for dogs. It is not known if there is a detection limit.

The dog is trained to find the microorganism but not the single compounds of the MVOC. The dog searches the typical MVOC pattern, which it knows from its education and which is emitted from microorganisms.

A good education and training with samples representing “real life” situations is important. The dog handler and the accompanying consultant should know the peculiarities of the dog in order to make the right interpretation.

REFERENCES

- Fischer, G. 2000. Comparison of microbiological and chemical methods for assessing the exposure to air-borne fungi in composting plants, Diss. 2000 RWTH Aachen, Akademische Edition Umweltforschung, Bd. 2000, 10.
- Lorenz, W., and N. Richardson. 2000. Versteckter Schimmelpilz – Möglichkeiten zur Erkennung und Bewertung. BbauBl 9 (2000) 32-35.
- Lorenz, W., and T. Diederich. 2001. Practical experiences with MVOC as an indicator for microbial growth (This conference).
- Wegmann, A., and W. Heines. 1989. Such und Hilf – Ein Handbuch für die Ausbildung und den Einsatz des Rettungshundes, 1. Aufl. Mürlenbach/Eifel: Kynos Verlag.