

Identifying Patterns of Lumberyard Mold

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Picture courtesy of Forintek. Canada's wood products research institute.

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Science behind identifying Sap Stain Fungi

About Molds and Mold Growth Conditions – Mold grows on organic building products including drywall and wood framing. Under ideal conditions mold can even grow on the surface of carpet, glass, enamel, plastic and paint. However, molds that grow because of water damage are different than mold that came with the building at the time of construction.

Characteristics of Heartwood and Sapwood – Lumber from pine trees consist of two types of wood, heartwood and sapwood, named as such because of the different inside layers found in trees. As the lumber cutting process continues, planks of wood bleed causing sugars, starches, proteins, and fats to come to the surface where they form sap. Mold spores in air settle on freshly cut wood where newly produced sap nutrients create surface mold growth.

- Heartwood is located in the center of the tree:
 - Heartwood is noticed by its darker color;
 - It's denser than sapwood and it is not as porous;
 - Sap does not easily bleed-out of heartwood.
- Sapwood is located on the outermost part of the tree:
 - Sapwood is noticed by its blonde and yellow light color;
 - It's not as dense as heartwood and it's more porous;
 - Sap does bleed-out easily from the softer and more porous sapwood.

Types of Surface and Wood Decaying Molds (Fungi) – Molds that use wood as a food source for growth are grouped into three types: surface fungi, decay fungi, and sap-stain fungi.

- Surface moisture supports a variety of molds that can easily be removed.
 - Surface fungi cause discoloration of wood surfaces due to presence of spores, hyphae and mycelia. Growth is mostly confined to the surface and generally does not penetrate or damage wood framing materials.
- Decaying fungi (wood rot fungi) grows primarily inside the heartwood and sapwood, degrading all structural components:
 - Wood rot fungi uses the wood's cellulose, hemicellulose and lignin to decay wood.
 - Wood rot fungi requires a constant high moisture source to begin the wood's decaying process.
- Sap-stain fungi are only found on sapwood and utilize stored nutrients to supports its growth.
 - Sap stain fungi cause staining in the sapwood of living trees as well as processed lumber.
 - Since they are common in lumberyards, they are often called "lumberyard mold."
 - Sap stain is also known as blue stain due to bluish or grayish black discolorations of the sapwood which develops due to fungal growth.
 - Sap-stain fungi often thrive in wood processing mills where a variety of tree species and a variety of trees at different ages are mixed together.

Identifying Patterns of Lumberyard Mold

Types of Sap-Stain Fungi Groups – Fungi that are associated with sap-stain are placed into three groups: Ophiostomatoid fungi include species of *Ceratocystis*, *Ophiostoma* and other related fungi; black yeasts such as *Aureobasidium* and *Rhinocladiella* and; dematiaceous molds such as *Alternaria* and *Cladosporium*.

- *Ceratocystis* and *Ophiostoma* (C/O) group are the most common example of sap-stain fungi because they are usually the first to colonize freshly cut wood.
- The “C/O group” belongs to the division/phylum called ascomycetes that comprise only a few fungal genera.
- Morphologically, ascomycetes are similar to one another and this is why they’re grouped together.
- The fruiting bodies (ascomata) of *Ceratocystis* and *Ophiostoma* are perithecia.
 - These structures are dark globs with elongated necks that produce spores in a sticky mass at their apex.

Sap Stain Sampling and Laboratory Analysis – It is nearly impossible to identify C/O spores from spore trap air samples.

- *Ophiostoma* grows in culture on media that contains cycloheximides, an agricultural fungicide that inhibits protein synthesis.
- *Ceratocystis* is sensitive to cycloheximide and consequently it will not grow in media that contains it.
- The best method of sampling for *Ceratocystis* or *Ophiostoma* is by tape-lift sampling or bulk wood sampling where examination is complete through direct microscopy examination.
- Occasionally, hyphae can become airborne through sanding or other means of remediation that can be picked up by spore trap air samples.

Acceptance of Lumberyard Mold – Sap stain penetrates into sapwood and cannot be removed by vacuuming or chemical cleaning. However, sanding and dry-ice blasting are methods to remove sap stains.

- The presence of lumberyard mold on building framing is not from building moisture problems, a recent flood or water damage.
- Sap stain is allowed in varying degrees in most lumber grades at mills and lumber yards.
- The presence of lumberyard mold on wood building framing is common and will remain unchanged (meaning it will not grow) during the life of the building.
- Although sap staining reduces the aesthetic value, the strength of lumber is unaffected.
- Mycotoxins affecting human health are not known for the C/O group.
- The black sap staining color often seen on sapwood is dead fruiting bodies from lumberyard mold. Black sap staining does not release spores, nor do they harm wood’s structural integrity.

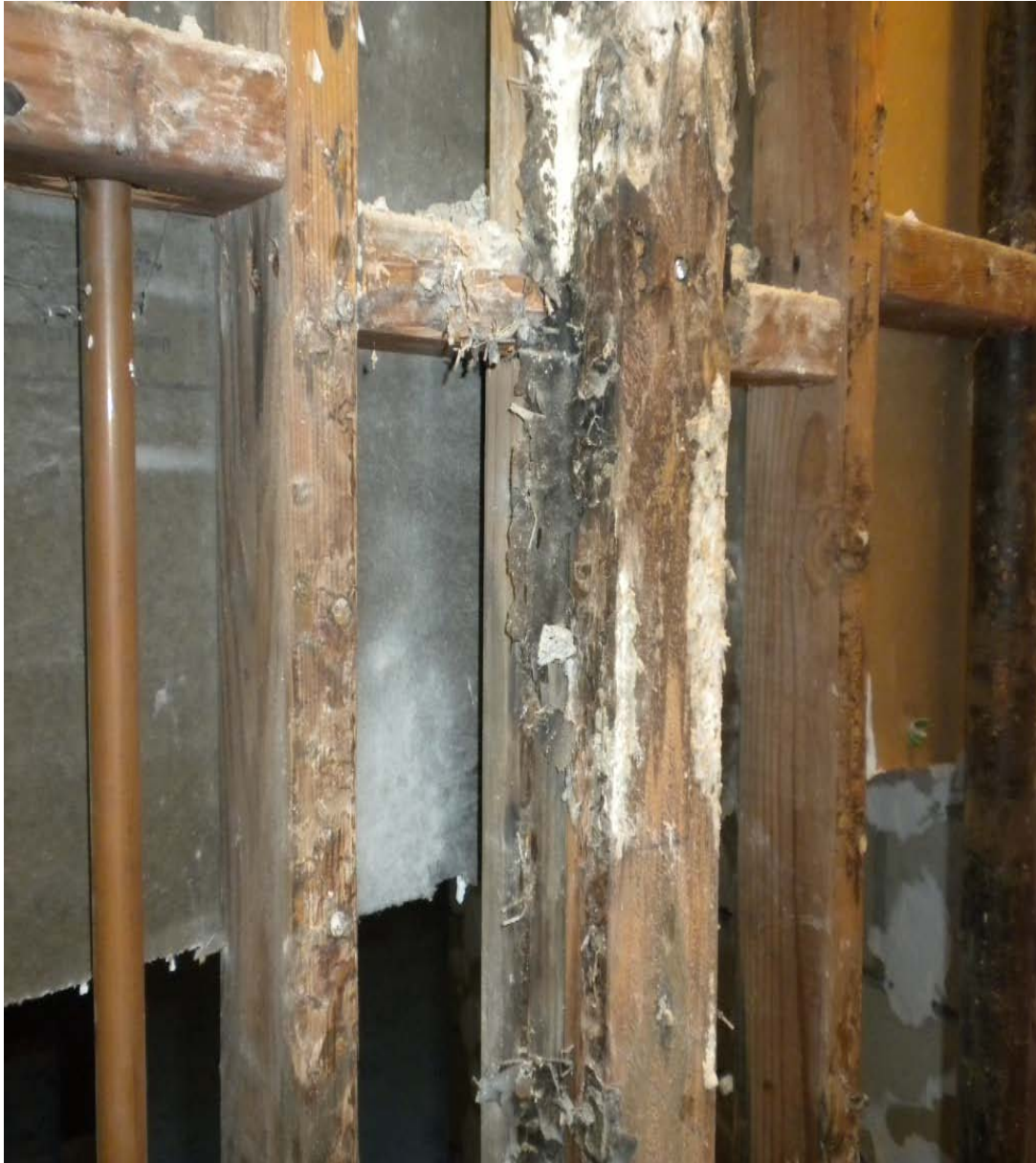
Identifying Patterns of Lumberyard Mold

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Identifying Patterns of Lumberyard Mold

Remediation Considerations



Is it necessary to identify lumberyard mold on this bathroom shower lumber? No. What's required to mitigate damage: Wood rot will be cut out and the remaining framing dried and mold remediated.

Identifying Patterns of Lumberyard Mold

Industry Standards and Guidelines

S520 Standard – The ANSI/IICRC S520 Standard and Remediation Guide for Professional Mold Remediation, 2008 edition, and the ANSI/IICRC S500 Standard and Reference Guide for Professional Water Damage Restoration, 2006 edition, don't have a position about whether sap stain fungi (lumberyard mold) represents: an occupant or remediation worker exposure issue; does it represent a building decay issue.

Standard Practice – The standard industry practice is to remove all visible mold growth no matter its cause or source. The ANSI/IICRC S520 says: “Remove mold growth on wood framing members by HEPA vacuuming followed by damp wiping, wire brushing, sanding, or other appropriate method.” It doesn't say – “remove only mold growth caused by the water damage.”

I believe there is ambiguity about when to stop the mold remediation process when a technician can clearly see mold growth or patterns of mold staining on other building materials. Technicians are not trained to distinguish types of mold growth. When technicians see mold growth they're trained to continue to explore water and moisture sources followed by removing mold damage.

Question – When a technician finds mold growth beyond known water damaged areas, where do they stop, or do they continue with the remediation process until mold growth is eliminated no matter its cause or source?

Answer –

1. Use common sense. When building framing continues to show signs of mold growth but it is outside the current remediation scope of work, technicians are expected to bring this condition up to their supervisor.
2. When the appearance of mold on building framing looks like sap staining or some other condition occurred such as wood rot (wet and dry rot), a qualified and independent third party indoor environmental professional (IEP) with strong construction framing experience should make the call:
 - a. The mold remediation work is complete and repair and restoration can begin;
 - b. Other conditions are present that caused or are causing mold growth such as moisture that supports mold growth of *Meruliporia incrassata* (Poria);
 - c. Rain entered the structure causing wood rot;
 - d. The presence of black, brown or blue staining on wood or the presence of dead surface molds on sap came with building materials at the time of construction.
3. All determinations should be supported by photographs and if necessary microscopy analysis. The report may say: Analysis shows the presence of lumberyard mold *Ceratocystis/Ophiostoma*-group of fungi that is commonly found in pine constructed buildings. The presence of this mold is not known to cause framing decay or building damage.

Identifying Patterns of Lumberyard Mold

Picture Study



Which color of wood represents the heartwood?

Identifying Patterns of Lumberyard Mold



Which 4 x 4 piece of lumber has lumberyard mold on it? Do you see lumberyard mold on the right or left piece? If you don't see lumberyard mold on the right or left piece why not? From a construction point of view should the 4 x 4 piece of lumber with sap staining be disposed?

Identifying Patterns of Lumberyard Mold



Which piece of wood has sap staining (lumberyard mold)?

Identifying Patterns of Lumberyard Mold



Picture shows wood panel having deep blue sap staining. Investigation showed sap staining is on every panel. Since panels are made in plies the middle ply may have sap staining. Should these panels not be used in building construction?

Identifying Patterns of Lumberyard Mold



After mold remediation, picture shows building framing without visible signs of mold growth and lumberyard mold. One can see the graining of wood where there is lighter and darker coloring.

Identifying Patterns of Lumberyard Mold



Building framing after mold remediation.

Identifying Patterns of Lumberyard Mold



Building framing with wood staining from metal clips (staples).

Identifying Patterns of Lumberyard Mold



Many issues are in this picture involving mold growth from water damage including the second floor subfloor, first floor ceiling joists and drywall. From this picture can you identify the lumberyard mold?

Identifying Patterns of Lumberyard Mold



Heartwood doesn't support sap staining but the lighter color sapwood will. From the picture above can you tell what sections of lumber are made from heartwood and sapwood? Which piece of lumber has sap staining?

Identifying Patterns of Lumberyard Mold

About the Author:

Patrick Moffett is a senior environmental/industrial hygienist, California registered environmental assessor, licensed general contractor in several states, certified master restorer and a certified building science thermographer.

Patrick is employed by Environmental Management & Engineering, Inc. (EME) located in Huntington Beach, California, where he investigates and assesses building related problems.

Patrick has over 20 years experience in water damage restoration as a large-loss specialist. He provides expert testimony in third-party and insurance-related mediation, arbitration and court cases.

Patrick serves on various industry taskforces and he's an approved IICRC instructor in water damage restoration and microbial remediation; OSHA 500 and 501 compliance safety trainer.

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