

Background

Wine stoppers, fishing bobbers, hat liners, shoe soles, life preservers, baseball cores, car engine gaskets and even floor tiles: natural cork has a wide variety of uses that leverage its unique attributes to provide excellent performance in a number of ways.

Cork is a naturally versatile, flexible, durable, sound-reducing, insulating, antimicrobial and hypo-allergenic raw material, making it an ideal minor component or a main ingredient to many finished goods.

While cork usage dates back to as early as 2000 BC, the many advantages and unique characteristics of cork are often misunderstood or understated, especially when used as a flooring material. However, even a general understanding of what cork is, where it comes from, how it's made and how it was designed can enable others to specify, install and use cork with confidence.

The Mediterranean Cork Oak Tree



Cork is a completely natural raw material that originates from the Mediterranean cork oak tree, *Quercus Suber*. Unlike most trees, the bark of the cork oak tree does not carry sap and can be removed without harming the tree. This is what makes cork a sustainable and rapidly renewable resource - the bark can be continually harvested from the same tree.

Once a cork tree reaches maturity, the bark is carefully harvested using a simple single or double blade

hatchet. After harvesting, the cork bark is dried and stored until it is ready for one of the many manufacturing processes that await it.

The bark from mature cork trees is harvested every 7 - 9 years - their cork bark increases in quality with each successive harvest. Over the course of its roughly 200 year life span, a cork oak tree will produce 10 - 15 harvests of high quality cork bark.

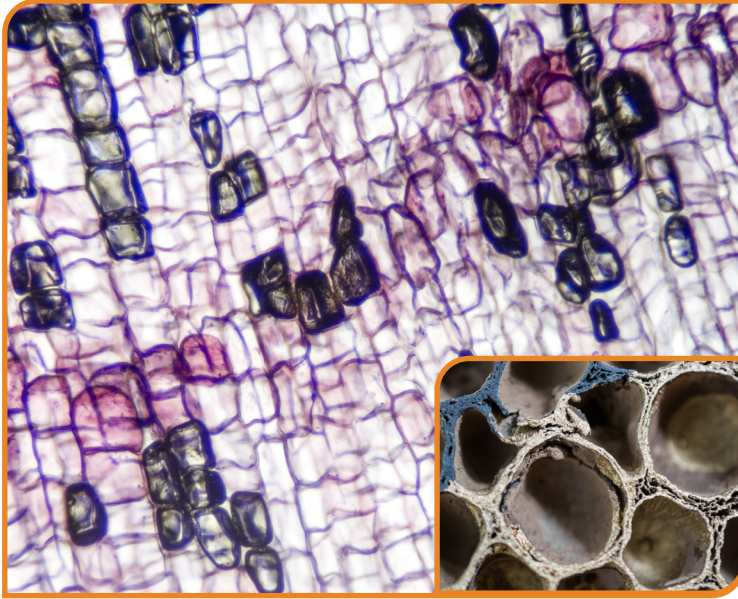
The Cork Manufacturing Process



Over the last hundred years, cork has become a colloquial term for wine-stopper, which is still the primary usage of cork bark to this day. However, the process of creating cork wine-stoppers also creates a large amount of cork scrap. This pre-consumer scrap is either used whole to create decorative cork products, such as cork wall tiles, or granulated for use in a variety of other products, such as traditional cork tiles. Nearly every part of the cork oak tree and its bark is used or recycled through this process.

To create traditional cork tiles, cork granules are mixed with a polyurethane binder and compression molded into 2' x 3' blocks. These blocks are baked or microwaved at varying temperatures to produce the different shades or colors seen within cork tiles - the darker the color, the higher the temperature and the longer the processing time. Once baked, the blocks are then shaved into rough sheets, which can subsequently be cut into cork tiles or planks.

Cork's Insulation Properties



One of the most interesting characteristics of cork is its cellular construction. Cork contains approximately 200 million individual cells per cubic inch, separated by strong, threadlike and resinous membranes that act as a natural binder. Though cork is cellular, these cells are closed and prevent capillary action.

As such, cork does not easily absorb water or liquids - in fact, cork floats. This is likely the oldest known characteristic of cork, as its first known usage was as a fishing line bobber. Additionally, cork's closed cell nature enables it to compress and recover easily, which is why it is so widely used in wine bottling. This characteristic is what makes cork impervious to water and yet comfortable and soft under foot, especially when compared to other flooring products.

Due to its cellular nature, cork is 50% air by volume. As such, cork is an excellent thermal and sound insulator - it absorbs and dissipates much of the energy that passes through it, due in large part to the amount of air within it. In fact, our cork products have been independently tested to confirm this.

When tested in accordance with the ASTM C518 Test Method for Steady State Heat Flux, our cork products have a thermal resistance (R value) of 0.7 - 1.01, which is similar to 1" plywood, 6" concrete and carpet with a pad. When tested in accordance with the ASTM C423 Test Method for Sound Absorption, our cork tile products have a Noise Reduction Coefficient (NRC) of 0.05, which indicates a 5% reduction in sound. When tested in accordance with the ASTM E2179 Test Method for the Effectiveness of Impact Sound Transmission Reduction, our cork click-and-lock products have a Delta Impact Isolation Class (Δ IIC) of 24, which is extremely high for a resilient flooring product.

Cork's Antimicrobial Properties



Cork is often touted as an antimicrobial material, perhaps due to its aforementioned closed-cell construction. However, few independent studies have been conducted to confirm this - in fact, few manufacturers have conducted independent testing either. To explore this property of cork and independently confirm its antimicrobial nature, we conducted an antimicrobial

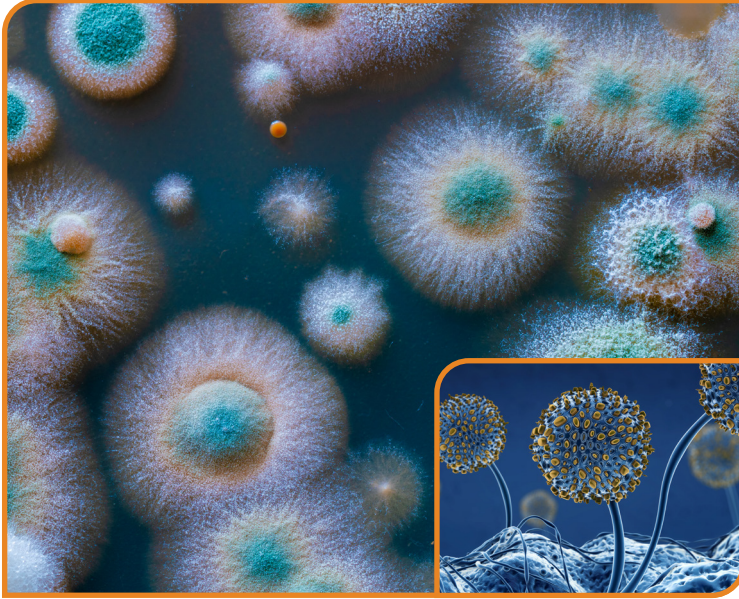
assessment via the ASTM E2180 Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Hydrophobic Materials. We tested the unfinished and pre-finished versions of our cork products in order to see how microbes behave on both surfaces and to see if there are any performance advantages to pre-finished cork.

To conduct this test, slurries of gram-positive bacteria and gram-negative bacteria are placed on separate samples and incubated at 80% RH for 24 hours - Staph (gram positive) and Pneumonia (gram negative) were the particular strains used for our test. After the incubation period, the slurries are removed from the surface of each sample and analyzed for microbial growth or reduction, using a control sample for comparison.

Our testing showed that both finished and unfinished cork tile reduced Staph and Pneumonia bacterial strains by over 99% - in fact, unfinished cork performed slightly better than pre-finished cork. This confirms what many have speculated about cork for years - it will not contribute to the growth and reproduction of bacteria and will actually aid in the destruction of these bacteria over a 24 hour period.

Given the rise of viral pandemics worldwide, specifiers and end-users alike have developed a heightened sense of awareness when it comes to cleaning and disinfecting interior spaces, including floors. The antimicrobial nature of cork should give those who select and use cork some piece of mind.

Cork's Antifungal Properties



Another lesser known and discussed property of cork is its antifungal properties. It is often assumed that, given the right conditions, just about any smooth surface can and will grow mold, especially natural products. Though not always visible, the presence of mold can have a negative impact on the air quality and health of building occupants, especially for those that are sensitive or allergic to mold.

To explore this, we conducted an antifungal assessment via the ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi. To conduct this test, three samples of our pre-finished cork tile were inoculated with a composite mold spore suspension - the suspension was sprayed so that the entire surface of each sample was moistened. The

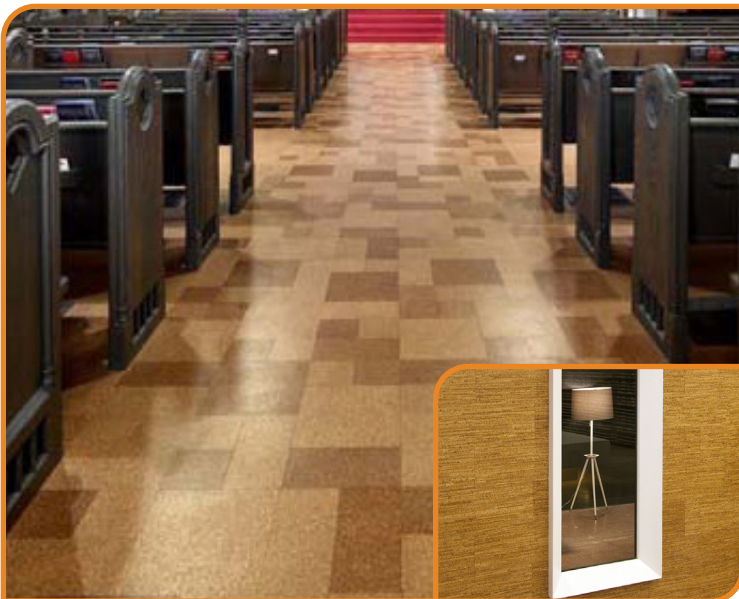
inoculated the samples were incubated at 82° - 86° F and at least 85% RH for 28 days. The samples were analyzed for mold growth in a weekly, using the following ratings:

Observable Growth	Rating
None	0
Trace Growth (<10%)	1
Light Growth (10-30%)	2
Medium Growth (30-60%)	3
Heavy Growth (60-100%)	4

After one week, the pre-finished cork had no fungal growth whatsoever. From weeks 2 - 4, only trace levels of growth were seen, meaning less than 10% - the growth was so minimal, it was only visible under a microscope. This is likely due in part to the pre-applied polyurethane coating, but also due to cork closed-cell nature. We tested vulcanized rubber, recycled rubber and vinyl products, some of which also had similar pre-applied polyurethane coatings, and yet cork was the only product that did not have heavy growth by at least week 4 - some products had heavy growth in as little as 2 weeks.

It's important to note that the conditions ideal for mold growth are not continually present in all environments or locations, especially in indoor areas. The time it could take for even slight mold growth on pre-finished cork tiles could be substantially longer than the ideal conditions created in a laboratory. However, the results of the G21 assessment are encouraging - mold cannot grow on the surface of pre-finished cork time in substantial amounts, especially when compared to other flooring surfaces.

From Tree To Tile



Given how unique, sustainable and versatile cork is, combined with its many performance characteristics, cork is an incredible surface for a wide variety of interior spaces. With installations that date back to the early 1900s, cork materials have the longevity of wood, yet the comfort of rubber.

Because of its sound reduction capabilities, cork is commonly used in libraries, churches, universities, corporate offices and residential applications. However, in recent years, cork has also been used in restaurants, spas, hotels and even healthcare facilities, due

in large part to its resilience, durability and natural resistances. Cork can even be used on vertical surfaces as a stylish tackable material that reduces room-to-room noise.

Homogenous cork patterns can be sanded and refinished for the lifetime of the installation, making it a repairable, long-lasting floor or wall covering. When properly maintained and cared for, cork materials can be a permanent flooring solution for generations.