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MOLD AND OTHER PATHOGENS IN OUR BUILDINGS

Paints with high resistance to humidity and microorganisms

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Mold and bacteria as a real and harmful problem for our health in buildings and industry
Inhibitory effect of FAKOLITH paints treated with BioFilmStop Technology against *Aspergillus* fungus.

1. Introduction to fungi (mold)

Many materials can be attacked by a fungal colony, since there is many species, and consequently, a huge range of characteristics and development capabilities on different substrates and conditions. We will divide them mainly into 2 types:

- **Yeasts:** are non-filamentous unicellular fungi that generally reproduce by budding or bipartition, through buds that grow until they divide and form a new individual.
- **Mold:** is formed by multicellular fungi and are formed by tubular elements called "hyphae" that grow, branch, and intertwine. One part, the most extensive and rooted, is introduced inside the surface where they are lodged, which can be any surface: walls, ceilings, plastics, wood, furniture, textiles, etc. Another part grows on the outer surface presenting a matte or cottony hairy appearance. They reproduce by spores, which are the ones that give the characteristic color to the mold and serve to reproduce and be transported either by air, water or through insects. Spores are very resistant to many treatments to destroy them.



The ideal places in our homes for breeding are those where there is humidity, organic matter, and poor ventilation; bathrooms, kitchens, bedrooms, corners, behind furniture, in window frames, and especially areas facing north (northern hemisphere).

It is well known that many of the diseases of plants and crops, as well as mycotoxin content in food, are caused by fungi, so crops must be treated with appropriate fungicides. Their ability to reproduce by spores is one of the characteristics that allow them to be found in countless places. On many occasions the exposure of mold to light air currents can already cause the spread of its tiny spores, or simply the adhesion to insects.

In the same way that certain fungi find in plants a suitable breeding ground, there are others that find a good living environment in our buildings, and just **as in the field they affect plants and trees, in our buildings, in addition to deteriorating the surfaces of walls and ceilings, clothing and other materials, they affect the health of people and animals**, both directly and indirectly.

Although many fungi are not harmful to health, and we even find them in many foods, such as a variety of cheeses, and it is even worth mentioning the discovery of Penicillin, by Alexander Fleming, through the beneficial common fungus *Penicillium chrysogenum*, we will focus on the negative aspects that many species of pathogenic fungi may have, and therefore we will focus on their toxic aspect.

2. What are the risks associated with the presence of mold?

For a long time, it was assumed that the most common consequences of prolonged contact with mold could be either a skin or respiratory tract infection or an allergy. The fact that the highly toxic products of fungal metabolism, the mycotoxins, also pose a health risk was not considered until later.

Fungal toxins (mycotoxins) are substances produced by several hundred species of molds that can grow on food under certain humidity and temperature conditions. Mycotoxins represent a serious risk to human and animal health. [More info from WHO here.](#)



Although, believe it or not, fungal infections have been able to damage the engine of a jet, cause the rotting of an entire production of inflatable boats, contaminate entire food and beverage productions, and even cause fires in electrical installations, they are also capable of affecting our health in our daily lives, both in our homes and in public places, workplaces, and industry.

Fungal infections inside buildings can cause skin infections, allergies, headaches, nausea, and respiratory disorders to their tenants, and if it is a prolonged exposure, and depending on the health status of each person, fungi can cause more serious health disorders. Not all fungi pose a risk to humans, but the existence of some on the surfaces of our buildings and industries is already evidence that they may be accompanied by others that are.

Some of the symptoms they cause are:

- Asthma and respiratory problems
- Eye irritation
- Muscle aches and pains
- Fatigue
- Nervous system problems
- Allergies

3. Let's take a common example, the *Aspergillus* fungus.

Although there are hundreds of species of *Aspergillus*, about twelve are related to human diseases. Among the most toxic, which can develop serious diseases, the following stand out: *Aspergillus Fumigatus*, *Aspergillus Flavus*, *Aspergillus Niger*, *Aspergillus Brasiliensis*, among others. *Aspergillus* is an opportunistic fungus, that is, it affects people with compromised defense mechanisms. It has several characteristics that make it one of the first candidates to develop in humans; the small size of its conidia allows its transmission through the air and therefore its inhalation to be very easy, its ability to develop optimally at 37°C, its ability to adhere to epithelial and endothelial surfaces, its tendency to invade blood vessels, its ability to produce toxins for mammalian cells...



ungi can cause various mycoses and allergic diseases affecting the skin, eyesight, ears, respiratory system, etc... causing from local infection to very serious clinical pictures; Onychomycosis, Otomycosis, Sinusitis, allergic bronchopulmonary aspergillosis, Aspergillomas, chronic invasive or necrotizing pulmonary aspergillosis, and other systemic manifestations affecting various organs, such as the brain, spleen, stomach, liver and kidneys. The following are some common fungal mycoses:

Fungi	Pathology	Body parts affected
Absida corymbifera, A. italiana, A. ramosa	Phycomycosis	Skin
Aspergillus (especially, A. fumigatus)	Aspergillosis	Especially lungs, also heart, kidneys, digestive tract and CNS.
Basidiobolus ranarum	Phycomycosis	Skin after injuries
Cephalosporium (e.g. C. acremonium, C. falciforme, C. recifei)	Cephalosporiosis	Eyes, skin, nails and ear canal
Cladosporium manzinii c. werneckii	Black ringworm	Skin
Cladosporium trichoides	Cladosporiosis	Skin, internal organs
Cunninghamella elegans	Phycomycosis	Skin
Curcularia geniculata C. lunata, Fusarium	Mycotic keratitis	Eyes
Fusarium	Fusariosis	Skin
Mortierella (e.g. M. niveo- luteum)	Mortierella mycosis	Respiratory organs
Mucor (e.g. M. cinelloides, M. javanicus, M. spinosus)	Phycomycosis	Respiratory organs, SNA, eyes, skin
Neurospora sitofila	Mycotic keratitis	Eyes
Paecilomyces	Paecilomycosis	Respiratory organs
Penicillium (e.g. P. commune, P. spinolosum)	Penicilliosis	Respiratory organs, SNA, eyes, skin, hearing
Philaphgora verrucosa	Chromium (blast) mycosis	Skin after injuries
Rhizopus (e.g. R. oryzae, R. arrhizus, R. microsporus)	Phycomycosis	Skin
Scopulariopsis (e.g. S. fusca, S. breviaculis)	Scopulariopsidosis	Eyes, skin, nails
Verticillium (e.g. V. cinnabarium)	Verticilliosis	Skin after injuries, eyes

4. Fungi in buildings

We can state almost with certainty that all buildings harbor mold. Many products used in our daily life are susceptible to colonization by fungi. Thus, walls, ceilings, roofs, damp areas, condensation points, thermal bridges can be colonized both externally and internally by certain types of fungi. Wooden constructions and cellulose products, textiles, organic paints, are examples of materials suitable for the rapid development of mold.



It is obvious that fungi generally require a minimum humidity AW threshold for their development. Thus, the existence of a fungal infection can have its origin in many places: in showers and bathrooms, after water leaks and remodeling works, roofs in need of repair, on north-facing walls, where there is condensation due to inadequate ventilation and of course in multiple industrial production processes, such as the paper industry, or the food industry in general.

Today we have hermetic windows with insulating glazing, ETISC thermal insulation systems on the inside and outside, the floors are often made of synthetic materials and the walls are coated with non-breathable plastic paints. Insufficient ventilation creates condensation points due to thermal differential, which encourage the growth of mold.

5. Controlled natural ventilation, basic prevention in dwellings.

In the age of technology and energy savings, we must get used to the fact that a building, like any other technical installation, requires maintenance. The airtightness, insulation and energy savings of buildings are already a significant quality feature. If the aim is to reduce energy consumption for heating or air conditioning, with the consequent emission of CO₂, the way to achieve this goal is through maximum airtightness of buildings, but with sufficient and controlled ventilation, or the consequence will be more sick buildings.

The easiest way to ventilate a building, and within the reach of everyone, is to renew the air through the windows. For dwellings, both new and old, you can opt for frequent ventilation, or brief but intense ventilation. Below is a table comparing various options for natural ventilation methods:

Type of ventilation	Renewal rate m ³ /hour	Ventilation time for air renewal
Windows open with blinds down	0,5 a 2,0	30 minutes to 2 hours
Partially open windows	5 a 10	6 to 12 minutes
Windows completely open	9 a 15	4 to 7 minutes
Windows facing each other fully open (cross ventilation)		1.5 minutes

Indicative Fraunhofer residential air renewal coefficients.

6. In which sectors do you need to be more cautious about mold and other pathogens?

It is difficult to prioritize when we are talking about health, so we will simply mention some of the places where, in our opinion, it is essential to consider special measures:

- Food industry.
- Clinics and hospitals in general.
- In public buildings.
- In dwellings and homes.
- In the workplace and industry.
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7. What types of climates are most prone to mold growth?

Although the tropical climate is ideal for mold growth, given the constant presence of moisture, today, in almost any type of climate, there are conditions for mold growth, since industrial processes, building orientations, construction defects, lack of ventilation, excessive insulation, effects of climate change, etc., within a global climate, constantly produce microclimates suitable for mold growth.

8. The invisible danger, bacteria, biofilm, virus, and other pathogens.

While fungal infections in our buildings and industry are visible and easily detectable, there is a much greater danger in certain sectors, and that is from certain bacteria, which are not perceptible to the human eye, and whose growth can be extremely rapid and dangerous in certain situations.

If a surface remains wet for a short time it is sufficient for a biofilm to form on it, whether it is a mineral material, a bath, a contact lens or on food handling surfaces. Once the cells are attached to the surface, it is very difficult to remove them without mechanical action and the use of appropriate cleaners and disinfectants.



Biofilms develop faster when they have a continuous source of nutrients. In general, they adhere to almost all types of surfaces such as plastic, stainless steel, aluminum or glass and can also be found on food contact surfaces, such as gaskets, food processing machinery and equipment, etc.

After adhesion, the bacteria in the biofilm begin to cluster and grow to create microcolonies. To briefly cite a few examples, some bacterial species are known to be more prone than others to form biofilms, such as *Listeria monocytogenes*, a species that colonizes moist environments and is difficult to eradicate in food processing environments. Similarly, it is common to find *Pseudomonas* spp. in biofilms, especially on stainless steel and other food contact materials, while *Bacillus cereus* and *Salmonella* are able to better survive various disinfectants if they are protected by a biofilm.

Since these formations can contain pathogenic microorganisms and are more resistant to disinfection, they increase the likelihood of contamination and cause foodborne and nosocomial infections, which is why the presence of biofilm on surfaces in the food industry and risk areas in the health sector is considered a clear **health risk**. For this reason, these sectors in particular have detailed hygiene, cleaning and disinfection plans, to which Fakolith also provides solutions and prevention solutions with its paints and coatings treated with BioFilmStop technology.

9. Food industry and healthcare sector, high risk against biofilm, bacteria, fungi, virus:

Hospitals, health centers and food industries are facilities where the aim is to avoid and prevent the proliferation of pathogenic germs such as bacteria, viruses, and fungi, since they tend to establish themselves and form biofilms or biofilms in many places in these areas.

This type of microbial conformation occurs when the cells of these microorganisms adhere to a surface or substrate, forming a community, which is characterized by the excretion of a protective adhesive extracellular matrix. The problem lies in the fact that these biofilms act as reservoirs of pathogenic microorganisms, which if they reach the right place can cause a multitude of diseases and health complications. Although there are many more, among the biofilm-forming bacteria, due to their repercussions we can highlight, among others:

1. *Listeria monocytogenes* (Gram + bacteria) is an important pathogen responsible for food poisoning and numerous studies have shown that it is able to adhere and form biofilms on surfaces in contact with food or materials. In addition, it is a bacterium capable of growing at refrigeration temperatures, so its importance in clean rooms and cold environments is more than demonstrated.
2. *Salmonella* spp (Gram - bacteria), is one of the most important pathogens, causing more than 95% of cases of foodborne infections and about 30% of the infections caused result in death.
3. *Pseudomona aeruginosa* (MRSA) is an alternating bacterium, which develops in highly organized communities. It also has the ability to grow under refrigeration. They can be highly resistant to disinfection with H₂ O₂ (hydrogen peroxide), as well as to a wide range of antibiotics.

Other relevant bacteria within these sectors are:

- **Food industry:** *Escherichia coli*, *Clostridium perfringe*, *Clostridium botulinum*, *Yersinia enterocolitica*, *Campylobacter jejuni*, *Staphylococcus aureus*, *Shigella* spp., *Salmonella enteritidis*, *Salmonella typhimurium*, *Vibrio* spp, etc.
- **Sanitary sector:** *Staphylococcus aureus* (MRSA), *Escherichia coli*, *Streptococcus fecali*, *Bacillus subtilis*, *Shigella dysenteriae*, *Vibrio cholera*, *Mycobacterium tuberculosis*, *Legionella pneumophila*, *Corynebacterium* spp. etc.

Although they share some genera of bacteria, the species will depend more on each sector, and the most dangerous thing is that they are not visible to the naked eye, as is the case with mold.

The existence of mold, we already know that wherever it is, and beyond an aesthetic problem, represents a health risk for workers who work in affected areas, but also in the food industry mold and even more bacteria can contaminate the production of food and beverages mainly in 2 ways (cross-contamination):

- **Direct contamination:** that which occurs when mold and/or bacteria existing in the facilities directly contaminate the produced food, which is colonized.
- **Indirect contamination:** that which occurs when mold and/or bacteria existing in the facilities, walls, ceilings, etc., react with base components, chlorinated water, and other elements such as phenols, etc., creating metabolites (toxins and/or mycotoxins), which develop new compounds that contaminate the production. Well-known cases are, for example, in the wine industry, contamination of the production by TCA, TBA, BRET that affect entire batches, varying the characteristics of smell and taste, and making it unusable. On the other hand, the cultivation and consumption of foods such as cereals, peanuts and other oilseeds, nuts, dried fruits, rice and corn, etc., with a high presence of Aflatoxins represents a real global health problem, which is increasing with climate change.

10. How can we help prevent mold and pathogenic microorganism infections?

Medicine is responsible for the treatment of these infections in the human body (mycosis). But we consider that prevention in general is a very important factor to consider, both in private areas, in industry in general, in the workplace, as well as indispensable in high-risk areas, as undoubtedly are the food industry and health sector, clinics and hospitals, and even more so, especially during construction and renovation processes, and in sensitive areas such as operating rooms.



Aspergillus Niger culture, and the inhibition halo of BioFilmStop technology.


Therefore, if in addition to an adequate and necessary hygiene, cleaning and disinfection plan, we regulate or correct the behavior of the surfaces of our buildings and industries with respect to humidity and its consequences, with suitable paints and coatings, we will consequently reduce the risk of infection for humans and for food production, increasing our quality of life and protecting our health.

In the food industry, food poisoning can cause fatal injuries to people, economic losses, penalties, fines, and corporate disrepute, which no serious businessman can afford to deal with without thorough dedication. [More info of WHO here about food safety.](#)


In the healthcare sector, HCAI, healthcare-associated infections, already in the WHO report "[Report on the Burden of Endemic Health Care-Associated Infection Worldwide](#)" it was found that at least 1 in 10 patients experience an infection during healthcare in Europe, with 37,000 deaths/year as a direct result of these infections, which also generate in hospitals approximately 16.4 million extra days of stay with an extra cost in Europe of 7 billion €. [More info about HCAI in our blog.](#)

Fakolith has an extensive list of references for the use of its hygienic-sanitary paints in the food industry and sanitary sector, as well as in homes, houses and public buildings concerned.

Fakolith Chemical Systems, has developed its HACCP in collaboration with the National Center of Technology and Food Safety, has obtained the Sanitary Registry of Industries and Food Products RSIPAC N°39.05377/CAT, General Sanitary Registry of Food Companies and Food RGSEAA ES39.005259/T, and Registration of biocide manufacturer ROESP E-0043-E, among other registrations and certifications that are in force.

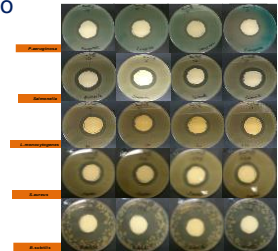


Effectiveness against... moisture mold, biofilm & bacteria, virus



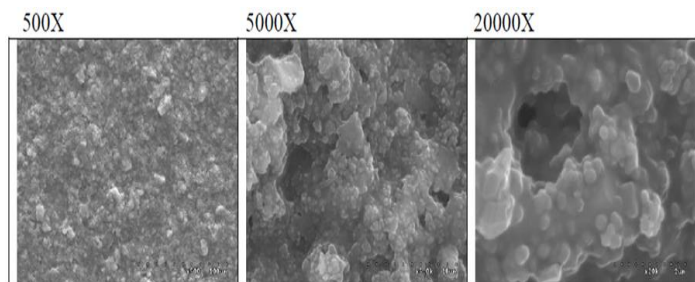
Inhibits biological contamination from surfaces to the environment & food

Fakolith's [wide range of hygienic-sanitary paints](#) includes paints with high resistance to humidity, which as a secondary function linked to this resistance, are treated with BioFilmStop antimicrobial technology (BPR Art 3 and 58), effective and tested with 99.9% effectiveness against bacteria and biofilm, fungi, yeasts and Coronaviruses (*Aspergillus*, *Cladosporium*, *Penicillium*, *Algae Escherichia Coli*, *Listeria monocytogenes*, *Salmonella enteritidis*, *Pseudomonas aureuginosa*, *Legionella pneumophila*, *Aspergillus brasiliensis*, *Candida albicans*, *Staphylococcus aureus* MRSA, *Coronavirus Human and Feline*, etc.)



Fakolith's BioFilmStop Hygienic antimicrobial technology is developed, evaluated and tested qualitatively and quantitatively both in external accredited laboratories and by Fakolith as an [innovative R&D&I intensive SME](#), within the framework of ongoing official research projects, under various international standards such as ASTM D2574-16, ISO 846, VDI 2083, ISO 22196, ISO 15457:201, ISO 21702.

Another synergistic factor is the choice of the special nature, purity and qualities of our resins, pigments, and mineral fillers, studied in each coating so that together with the oligodynamic action of latest generation active ingredients, free and encapsulated, they provide the paint film with a high resistance to humidity and its consequences, both in the industrial environment and in buildings in general and in the home.



Scanning electron microscope photograph of Disperlith Industry paint film.

To achieve maximum optimization in a renovation, it is necessary to consider

- Correction of defects in workmanship and inadequate maintenance defects
- Adequate ventilation, whether natural or artificial.
- Proceed with an adequate cleaning and sanitation of affected areas.
- Activate perspiration with special treatments, such as water repellency.
- Achieve a reduction of AW on surfaces, reach the minimum threshold of microorganism growth.

- To have as a final finish, special paints, which applied in daily or severe industrial climates, resist in a balanced way, situations with different types of humidity (capillary, environmental, condensation, thermal shock, cleaning and disinfection), and consequently enjoy paint films resistant to the problems generated by humidity, such as molds, saponification, condensation, chipping, etc.

11. 3-steps system

Our systems of prevention, protection, and solution mainly for open surfaces of walls and ceilings, floors, and other surfaces affected by humidity and microorganisms, roughly consists of 3 basic steps or processes:



- 1- **Cleaning and disinfection** (usually FK-12 or BioFilmStop Cleaner)
- 2- **High moisture-resistant consolidating primer** (generally Disperlith Primer)
- 3- Finish with the most suitable **FAKOLITH Hygienic- paint**.

- [Disperlith Hygienic](#) - The Ecolabel, where the risk is not severe.
- [Disperlith Industry](#) - The all-rounder for the private and industrial sector, CE marked.
- [Disperlith Elastic](#) - In addition elastic and waterproof, CE marked.
- [Dispaint Hygienic Forte](#) - Multi-purpose enamel, with CE marking
- [Anti-Mold KIT](#) - A solution to repair moisture damage and mold for 10 m².
- And other [Hygienic](#) or [Food Contact](#) specialties for professionals.

Our service to industry includes a personal or telematic visit by a specialist technician, who, after analyzing the environment and the data provided, will make a personalized technical prescription at no cost or obligation, and if necessary, we will make a sample applied as a reference witness of the proposed treatment.

12. Endorsed by official audited R&D&I projects.

Fakolith has the official seal of innovative SME of the European Union. The sustainable development of BioFilmStop and FoodGrade technologies of our paints and coatings is constant, thanks to official projects developed and led by Fakolith in consortium with partners and official technological centers of recognized prestige.

The projects cover both basic research and technological innovation and are co-funded by the European Union and the Ministry of Science and Innovation.

[Consult our projects by clicking here](#)



INNOVATIVE SME

Valid until Jan 21st 2025

FAKOLITH TECHNICAL DEPARTMENT

(12-07-2022)



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