

## MYCOTOXINS

Mycotoxins, also known as Microbial Volatile Organic Compounds, are secondary metabolites produced by fungi. Secondary metabolites are chemical compounds that are not necessary for cell life, but are toxins produced by the fungi to compete with other bacteria or fungi for available food in the environment. The fungi of most interest since the 1990's has been *Stachybotrys chartarum*, also known as the "toxic black mold."

Previously, most of our knowledge of the toxins from fungi was related to the food industry. *Aspergillus flavus*, a toxic fungi primarily known to contaminate peanuts, can cause liver damage. Its metabolites are known as aflatoxins. Other crops affected include cereals, oilseeds, spices and tree nuts. *Aspergillus flavus* and *Aspergillus parasiticus* produce aflatoxin B<sub>1</sub>, B<sub>2</sub>. *Aspergillus parasiticus* produces aflatoxin G<sub>1</sub>, G<sub>2</sub>. The B<sub>1</sub> toxin has been considered a carcinogen since 1988. There is now concern that inhaled toxins may be harmful to health in the indoor air from water damaged building materials

*Aspergillus fumigatus* is a filamentous fungi that has been implicated as the primary reason for respiratory aspergillosis in the indoor air. Gliotoxin has been identified as a cytotoxic metabolite. In a research paper from Applied and Environmental Microbiology in 2002, it was reported that gliotoxin was not only recovered from the spores and hyphae, but also from water damaged building materials where *Aspergillus fumigatus* had been present. This increased concentrate in water damaged building materials and HVAC systems is a health concern, especially for individuals being exposed repeatedly to the toxic effects of this fungus .

Mycotoxins are not limited to these three species of *Aspergillus*. Other major groups include **Ochratoxin**, **Citrinin**, **Ergot alkaloids**, **Patulin** and a number of toxins from the genus *Fusarium*. The *Fusarium* toxins that have the most effect on humans belong to the **Trichothecenes**.

Of all the toxins produced by fungi, none have had more scrutiny recently than those of *Stachybotrys chartarum*. Although over 200 trichothecenes are produced by fungi, the Macrocylic trichothecenes, produced by some strains of *Stachybotrys chartarum* are of most interest. Satratoxin G is a potent toxin which is thought to be produced by 1/3 – 2/3's of all strains of *Stachybotrys chartarum*. First noted in Russia in the 1940's, the toxin was blamed for the death of horses that had eaten grain contaminated with *Stachybotrys*. Here in the United States the *Stachybotrys* came to the forefront in 1994 when a child died from pulmonary hemosiderosis, and 9 other infants were hospitalized with the same symptoms in Cleveland, Ohio. The toxins were inhaled in the indoor air. This was the beginning of investigations into gypsum board and how easily it is colonized by *Stachybotrys*, when the wall board had become wet. Since then, this fungus has become known as the "toxic black mold" in the media.

Much research has been concentrated on this organism and its possible health effects on humans. Of concern are the toxic effects that may be encountered in the indoor environment. Some of the symptoms reported are neurologic, headache, fatigue, dermatitis, sore throats and coughing up blood.

In a paper published in 2008, in Toxicological Sciences, the authors present evidence that Satratoxin G can be released rapidly into the body, when inhaled. The paper also reports that the toxin is immunosuppressive and appears to bind tightly to lung cells.

In another research paper from the International Journal of Molecular Sciences in 2009, researchers reported that they had very good results recovering aflatoxins, trichothecenes and ochratoxins from urine samples. The patients involved in this study all had exposure to mycotoxin producing molds in the indoor environment.

Although research has made great strides in the last 16 years considering the effects of mycotoxins in the indoor air, further study is necessary to relate *Stachybotrys chartarum* to some of the symptoms reported by individuals. To complicate the picture, it is thought that there is a synergy

between fungi, bacteria and VOC's produced by new building materials that may suppress the immune system and allow organisms such as *Aspergillus fumigatus* do its damage in the lungs.

What is agreed upon by the medical community is that water damaged buildings are a health hazard to the occupants. If an individual is living in a wet or damp environment testing can be performed to determine if high levels of fungi, bacteria or VOC's are present. Please call 770 938-4861 for information on testing.