GREENHECK
Energy Recovery Application
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PRODUCT APPLICATION GUIDE
A technical bulletin for engineers, contractors and students in the air movement and control industry.

Moisture Transfer and Fungal Growth in Desiccant-Based Enthalpy Wheels

There is evidence that fungi germinate when water condenses onto surfaces of air handling systems where nutrients are present. Surfaces which remain wet for a period of 12 to 24 hours allow fungi and mold spores already present to "bloom", resulting in a potential IAQ problem. This knowledge has led to questions of whether desiccant energy recovery ventilation wheels, which in fact transfer water from one airstream to another, could provide a medium for growth of mold and fungi. Such is not the case for Greenheck's enthalpy wheel, nor has it been reported in the literature for other enthalpy wheels.

In silica gel-based desiccant wheels, the water molecules are transferred by sorption, individually, onto and off of the silica gel surface. Water is present on the wheel in a molecular layer only. Condensation does not occur. Desiccant wheels experience "dry" moisture transfer in that there is no bulk liquid water present which could support fungal growth or dissolve other chemical species. The transfer of water onto and off of the wheel's desiccant surfaces occurs in the vapor or gas phase. There are no "wet" surfaces and liquid water does not enter the airstream.

Some desiccant wheel manufacturers advertise the selectivity (based on molecule size) of molecular sieves with regard to molecules such as benzene and other volatile organics; silica gel is also highly selective for water, based on the strong preference of the gel surface for the dipolar water molecule as opposed to other species. Data from both Davison/Grace and GRI independent research support this.

The sensible (non-desiccant coated) wheel can transfer water through a mechanism of condensation and re-evaporation, however, again, there is no accumulation of water, unless the frosting threshold is violated through misapplication of the component. In this case, the water is in the form of frost or ice which does not support fungal growth. All sensible (uncoated) wheels from all manufacturers are identical in this regard.

Proponents of plate type heat exchangers frequently point out that sensible plate type heat exchangers do not transfer water between airstreams, suggesting that this is an advantage, while ignoring the energy, comfort, and IAQ advantages of enthalpy exchange which requires the movement of water from one airstream to another. Note also, that sensible plates do accumulate water in the core and drain pans on both sides of the exchanger under the right conditions. While we are not aware of any field problems with fungal growth in plates, it should not be suggested that liquid water is not present in these products.

Both moisture and nutrients are required to support fungal growth. Therefore dirt accumulation on heat wheels is of potential concern. It is also true that any heat wheel can accumulate semi-volatile compounds like tars and grease which are deposited on surfaces. These surfaces can then become sources, in the same way that a filter or any other element of an air handling system can become a source of compounds accumulated over time. The Greenheck wheel, made by Airxchange, was designed to respond to these issues over the life of the system by providing for cleaning and maintenance with washable desiccant surfaces, removable segments and easy to access cassettes. Many aspects of this technology are patented and are unique in the industry.

Finally, it is worth noting that Airxchange has 70,000 wheels in the field, including both desiccant and sensible varieties in a broad range of applications, without a single reported instance of mold or fungal growth on the wheel. In fact, in many cases, energy recovery ventilation units have been installed successfully for the purpose of correcting mold and fungal growth problems resulting from inadequate ventilation and excessive humidity levels in the space.

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