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Path to Working Files: DecaDoc\Application Notes\Master\AG\14531-01 AN Tracking Moisture in Buildings with Water Activity

Dimensions: 8.5 inch wide, 11 inch tall

Material: Paper, 92 Bright White or better, 75g/m² or heavier

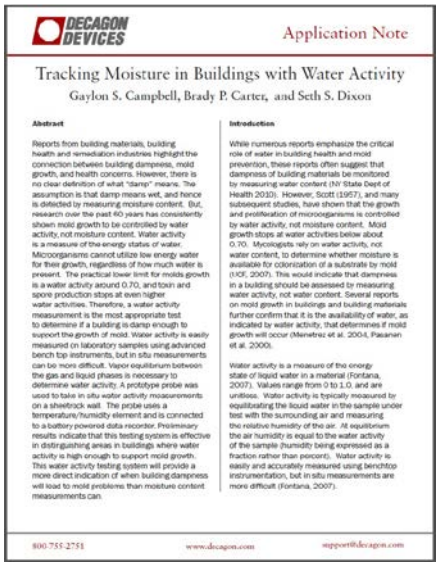
Colors: Color Print on White

Printer: HP Color LaserJet 5550-PS

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale **



DECAGON DEVICES Application Note

Tracking Moisture in Buildings with Water Activity

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Abstract

Reports from building materials, building health and remediation industries highlight the connection between building dampness, mold growth, and health concerns. However, there is no clear definition of what "damp" means. The assumption is that damp means wet, and hence is detected by measuring moisture content. But, research over the past 60 years has consistently shown mold growth to be controlled by water activity, not moisture content. Water activity is a measure of the energy status of water. Microorganisms cannot utilize low energy water for their growth, regardless of how much water is present. The practical lower limit for molds growth is a water activity around 0.70, and toxin and spore production stops at even higher water activities. Therefore, a water activity measurement is the most appropriate test to determine if a building is damp enough to support the growth of mold. Water activity is easily measured on laboratory samples using advanced bench top instruments, but in situ measurements can be more difficult. Vapor equilibrium between the gas and liquid phases is necessary to determine water activity. A prototype probe was used to take in situ water activity measurements on a sheetrock wall. The probe uses a temperature/humidity element and is connected to a battery powered data recorder. Preliminary results indicate that this testing system is effective in distinguishing areas in buildings where water activity is high enough to support mold growth. This water activity testing system will provide a more direct indication of when building dampness will lead to mold problems than moisture content measurements can.

Introduction

While numerous reports emphasize the critical role of water in building health and mold prevention, these reports often suggest that dampness of building materials be monitored by measuring water content (NY State Dept of Health 2010). However, Scott (1957), and many subsequent studies, have shown that the growth and proliferation of microorganisms is controlled by water activity, not moisture content. Mold growth stops at water activities below about 0.70. Mycologists rely on water activity, not water content, to determine whether moisture is available for colonization of a substrate by mold (IAQF, 2007). This would indicate that dampness in a building should be assessed by measuring water activity, not water content. Several reports on mold growth in buildings and building materials further confirm that it is the availability of water, as indicated by water activity, that determines if mold growth will occur (Menetrez et al. 2004, Pasanen et al. 2000).

Water activity is a measure of the energy state of liquid water in a material (Fontana, 2007). Values range from 0 to 1.0, and are unitless. Water activity is typically measured by equilibrating the liquid water in the sample under test with the surrounding air and measuring the relative humidity of the air. At equilibrium the air humidity is equal to the water activity of the sample (humidity being expressed as a fraction rather than percent). Water activity is easily and accurately measured using benchtop instrumentation, but in situ measurements are more difficult (Fontana, 2007).

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