Masonry Canada

Fungal Mould Resistance Testing (FMRT) of Common Building Materials According to MIL-STD 810E

Masonry Canada is pleased to present this technical bulletin about Canada's building science research results that further reinforce the quality, durability and value of concrete and masonry products in buildings.

Masonry is a traditional and time-tested material that is often compared with new and innovative alternatives. The durability of masonry wall systems is witnessed across Canada and around the world, and the numerous advantages of masonry are well appreciated by builders and designers alike. The Fungal Resistance Testing (FRT) project was conducted by Bodycote Materials Testing Canada Inc. funded by the Ontario Concrete Block Association, Cement Association of Canada, and Masonry Canada. FMRT testing examined how well—and not so well—seven common materials used in building systems resisted mould growth.

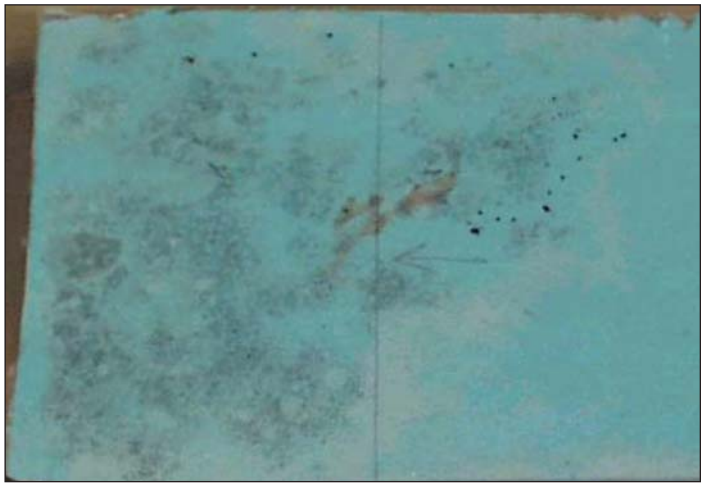
Research Results Show Concrete, Concrete Block and Clay Brick do not Support Fungal Mould Growth

A Canadian research study completed in September 2003, has shown definitive results that wood and drywall products are sources of mould growth. The study also showed that clay brick and concrete products tested did not sustain growth. The MIL-STD 810E was developed for the US Military (same as ASTM C1338) but includes a condensation period of 28 days to challenge materials. This is representative of conditions inside buildings in a cold climate. The testing, conducted by a ISO/IEC 17025 accredited independent laboratory with ISO 9002-1994 included seven samples of commonly used building materials.

This research study demonstrates that under identical conditions conducive to the growth of fungal mould, no mould is produced on clay brick, concrete block and concrete, whereas, substrates made of wood and paper products produced measurable amounts. These findings supply essential information for architects, facility planners and engineers to reduce liability, improve indoor air quality and lessen health concerns in new and renovation projects.

"It is reported that in 2002, insurance companies in the US paid out more than $2.5 billion in mould-related claims. With mould claims increasing and research studies in support, it's clear masonry products and systems offer superior moisture control and do not support fungal growth."

Bob Marshall, Executive Director, Masonry Canada



Sample 2: This water-resistant drywall showed moderate mould growth.

All samples of wood, gypsum and moisture-resistant drywall showed fungal infection, whereas all masonry samples showed no traces of mould. This wood tongue and groove sample (Sample 3) showed "severe growth" of fungal infection on the cut ends.

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Introduction

Masonry Canada submitted seven samples for fungal resistance testing. Samples were provided identification numbers and examined prior to testing. Samples were tested according to MIL (Military) STD 810E to determine fungal resistance. This 28-day test helps to quantify and compare the susceptibility of materials to fungal attack.

Numbers & Descriptions of Samples

#1 Drywall with white primer paint on one side
#2 Water-resistant green drywall
#3 Piece of 83mm (3 1/4") tongue & groove wood
#4 250mm (10") clay brick
#5 Concrete block-unsealed
#6 Concrete block with white primer paint
#7 Concrete piece - broken/uneven

Method

Five fungal cultures were used:

- Aspergillus niger (American Type Culture Collection ATCC 9642)
- Aspergillus flavus (ATCC 9643)
- Aspergillus versicolor (ATCC 11730)
- Penicillium funiculosum (ATCC 11797), and
- Chaetomium globosum (ATCC 6205).

The cultures were harvested with a mineral salts solution to prepare a mixed spore suspension. The stock cultures were prepared fresh. The viability of each fungal culture was confirmed. Cotton control strips, prepared as described in Method 508.4 were inoculated and incubated with a test specimen. Inoculation with the mixed five fungal spore suspension was accomplished by spraying the suspension in the form of a fine mist from an atomizer. The test materials were sprayed until the initiation of droplet coalescence.

Incubation was conducted in an Envirotronics environmental chamber. Incubation conditions were controlled using an Environtronics System Plus control module. Incubation was at 30°C (86°F), 95% relative humidity for 20 hours, followed by four hours at 25°C (77°), 95% relative humidity. The 24 hour cycling was maintained over the 28 day incubation period. Controls were examined after seven days incubation to confirm the viability of the spore suspension. The samples were evaluated on the 28th day of testing using a binocular stereoscopic microscope or a magnifying glass.

Results

All fungal strain viability controls and the cotton chamber strips after 7 and 28 days incubation showed copious amounts of fungal growth indicating a valid fungal resistance test. The samples were examined at the end of the 28th day incubation period for the presence of fungal growth. The amount of fungal growth was rated according to the microbial test evaluation criteria in Table I. The results of fungal resistance testing are presented in Table II. Sample 1 shows trace growth on the painted side. Sample 2 shows moderate growth. Sample 3 shows moderate growth on the surface with severe growth on the cut ends.

Conclusions

Samples 1, 2, 3 support fungal growth. Samples 4, 5, 6, and 7 do not support fungal growth.


Sample 1

"Samples 1, 2 and 3 (drywall and wood) supported fungal growth. Samples 4, 5, 6, and 7 (clay brick, concrete block and concrete) did not support fungal growth."

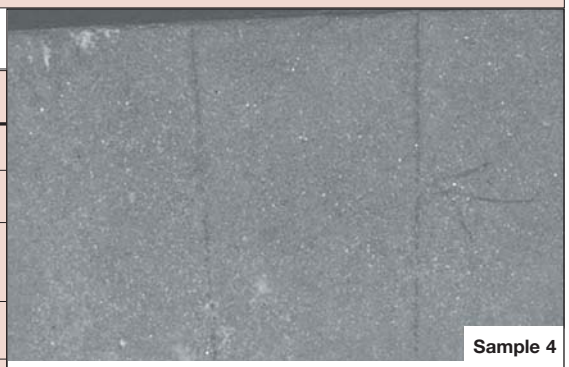
Concrete block, concrete, and clay brick will reduce mould claims and liability risks for architects and engineers. Following recommendations for the use of mould resistant products will eliminate the mould "food" of paper and wood products, greatly enhance indoor air quality and provide due diligence against future claims.

Table I: Microbial Test Evaluation Criteria

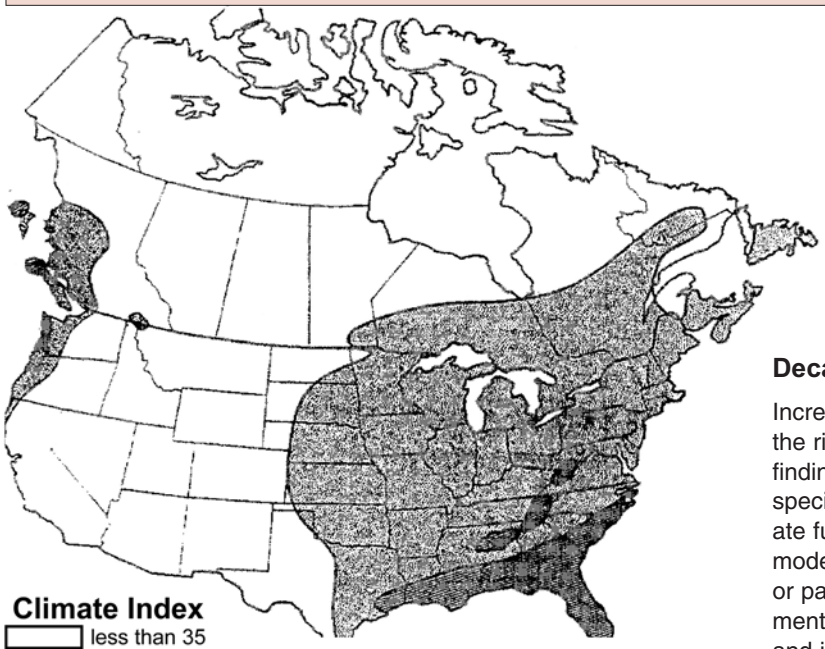
Amount of Growth	% of Area Component Covered	Grade	Organic Substrates
None	0	0	Substrate is devoid of microbial growth
Trace	1–10	1	Sparse or very restricted microbial growth and reproduction. Substrate utilization minor or inhibited. Little or no chemical, physical, or structural change detectable.
Slight	11–30	2	Intermittent infestations or loosely spread microbial colonies on substrate surface and moderate reproduction.
Moderate	31–70	3	Substantial amount of microbial growth and reproduction. Substrate exhibiting chemical, physical or structural change.
Severe	71–100	4	Massive microbial growth or reproduction. Substrate decomposed or rapidly deteriorating.

Table I: Microbial Test Evaluation Criteria

Description of Sample	Grade	Amount of Growth
Drywall with white paint on one side	1	Trace
Water-resistant drywall	3	Moderate
Piece of 83mm (3 1/4") tongue & groove wood	3	Moderate
250mm (10") clay brick	0	None
Cement block-unsealed	0	None
Concrete block with white primer paint	0	None
Concrete piece - broken/uneven	0	None



Clay brick (Sample 4) and a chunk of broken and uneven concrete (Sample 7) were devoid of mould growth.



Decay Hazard Map Source

Decay Hazard zones show higher mould risk areas

Increased levels of precipitation and long wet seasons increases the risk of mould growth caused by precipitation. The test's key findings showed that moisture-resistant drywall-which is often specified for washrooms and bathrooms-actually shows moderate fugal growth. Given that mould requires moisture, oxygen, moderate temperature and an organic food source such as wood or paper building materials, mould enjoys a veritable feast. Cement board and cement block are not food sources for mould and is the preferred choice to prevent damage, liability and health concerns.

Other resources support test results for masonry use

Now the research has been completed, it's a matter of connecting the dots: leaky buildings, lawsuits, insurance claims, public health issues—what more needs to be said about mould. Prevention?—a prevention that starts with better building materials.In addition to research from Masonry Canada, check out resources, such as:

- The Ontario Concrete Block Association (**www.ocba.ca**). Their new *Focus on Mold* is available at **www.ocba.ca/Media/Mold.pdf.** In this publication, the OCBA notes the following information: *Remember that concrete masonry is not a source of food for mold and therefore, wherever possible, the use of concrete masonry is advised where sufficient air circulation is not available or the penetration of moisture is possible.*

- The OCBA also published the reference document *Focus for Architects*, available at **www.ocba.ca/media/Architects.pdf.** In performance ratings in a national study of architects, concrete materials were ranked on relative performance characteristics. Results show architects choose concrete block products most frequently for interior partition walls, exterior walls (especially load-bearing) and foundations and basements Also check *Focus for Contractors* at **www.ocba.ca/media/Contractors.pdf.**

- *Mold - A Risky Issue for Architects and Engineers?, CM News, August 2003*, available from National Concrete Masonry Association at **www.ncma.org/online/mold.html.**

- In a recent survey in British Columbia, some 75 per cent of new condo buyers say despite assurances of recent changes in condominium law, they prefer concrete. Cement Association of Canada (**www.cement.ca/cement.nsf**)

- *The Condominium Owner's Guide to Mould and Fighting Mould: The Homeowner's Guide* from CMHC at **www.cmhc-schl.gc.ca.**

- *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*, from the City of New York's Department of Health, at **www.nyc.gov/html/doh/html/ei/eimold.html.**

- The US Centers for Disease Control and Prevention (**www.cdc.gov/nceh/airpollution/mold**) clinical notes state: "In immunosuppressed hosts: invasive pulmonary infection, usually with fever, cough, and chest pain. May disseminate to other organs, including brain, skin and bone. In immunocompetent hosts: localized pulmonary infection in persons with underlying lung disease. Also causes allergic sinusitis and allergic bronchopulmonary disease."

- *Residential Technology Brief No. 11 on Mold and Moisture*, by the Portland Cement Association at **www.concretehomes.com**

- *A Brief Guide to Mold, Moisture, and your Home*, by the US Environmental protection Agency, at **www.epa.gov/iaq.**

Testing in the FMRT study was completed on seven commonly used building materials, with a 28 day incubation for each sample.

Information on Masonry Canada

Masonry Canada's technical projects with downloadable files are found at www.masonrycanada.ca. Questions regarding this research and masonry in general may be addressed to: Bob Marshall, P.Eng., Executive Director, Masonry Canada, Infomasonrycan@aol.com. For additional copies of this bulletin, contact a Masonry Canada member (see website listings) or call 1-888-242-3335.

Acknowledgements

Masonry Canada wishes to acknowledge the financial support and volunteer technical review efforts associated with the development of this technical bulletin.
Don Gordon, Atlas Block Co. Limited, Midland, ON
Bruce Clark, P.Eng. MBA, CCI Industries Ltd. Edmonton, AB
Fred Clarke, FCSC, Richvale York Block Inc. Gormley, ON
Patrick Kelly, M.Eng., P.Eng., Hanson Brick Ltd., Mississauga, ON
Rico Fung, P.Eng., Cement Association of Canada, Don Mills, ON
Tricia Brown, Bodycote, Mississauga, ON
Bob Marshall, P.Eng., ED, Masonry Canada, Beeton, ON
Michael Werner, P.E. National Concrete Masonry Association, Herndon, VA, USA

This project was funded by the Ontario Concrete Block Association, Cement Association of Canada and Masonry Canada.

The goals of Masonry Canada are to ensure the advancement of masonry technology, to promote the use of masonry materials, components and assemblies in construction across Canada, and to be the national voice of the Canadian producers of masonry products.

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