

RAPPORT

utfärdad av ackrediterat provningslaboratorium

Kontaktperson RISE

Datum

Beteckning

Sida

Gunilla Bok
Samhällsbyggnad
+46 10 516 57 78

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O100280- 197255

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(5)

Testing of critically moisture condition SP Method 4927

Mission

RISE AB has, on behalf of JL Kemi AB, carried out a test of treated pine wood. It is the material's (of the treatment) critical moisture condition as has tried. The test was carried out according to SP Method 4927.

Definition

The resistance of different materials to mold growth varies. This variation depends, among other things, on the materials' nutritional content, pH, surface structure with more. A way to describe a material or a treatment Resistance to mould growth is the relative humidity (RH) level at which mould can start to grow on the material or treatment. This level can be called the critical moisture condition, RH_{crit} .

RF_{chalk} is temperature dependent which means that at higher temperatures (more optimal temperature for molds) can fouling established at lower humidity levels which means that RF_{crit} becomes lower.

Method

SP Method 4927 is a laboratory method for determining the critical moisture state of building materials. The method can apply on clean material as not has become exposed for environmental conditions that pose a risk of mold growth. The method can also be used to test the effect of material treatment, such as a chemical treatment.

The results from SP Method 4927 can not be used for to evaluate how long a material can be exposed to different humidity conditions without mold growth occurring.

Method principle

A spore solution containing six various mold species as usually encountered on building materials are sprayed onto the test pieces. The test pieces are then placed in four different RH levels at 22 °C for twelve weeks. The testing was carried out from 2022-05-05 to 2022-07-28.

Procedure

Samples measuring 50 x 100 mm are used. A spore suspension is prepared sterilely and repeatable. The spore suspension contains spores from the following fungi *Euotium herbariorum* (CBS 115808), *Aspergillus versicolor* (CBS 117286), *Penicillium rubens* (CBS 401.92), *Aureobasidium pullulan* (CBS 101160), *Cladosporium sphaerospermum* (CBS 122.63) and *Stachybotrys chartarum* (CBS 109292). All fungi were purchased from Sporsuspensionens



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Box 857
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Brinell Street
4
504 62 Borås

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concentration is 10^6 spores/ml of each art. 0.4 ml sprayed on each sample. All mushrooms has been purchased from the CBS-KNAW Collections at Westerdijk Fungal Bio Diversity Institute in Utrecht, the Netherlands.

Incubation in climate chamber

The samples lies horizontally on GRID in climate chamber with sprayed page up in Twelve weeks. Four climate chambers have been used (CTS C-20/350, CTS GmbH, Hechningen, Germany).

The climate in the various the chambers is sat to 80%, 85%, 90% and 95% RF. The temperature is 22 °C. Temperature and RH are continuously logged using the climate cabinets' integrated sensors and saved using software (CID-pro).

Analysis of the growth

Every other week during probationary period taken the samples out from climate cabinets and analyzed in 40 times magnification. Mold growth is graded according to a five-point scale described in Table 1.

Table 1. Scale on assessment of fouling The pictures is a schematic illustration of Fouling. Fouling is not always visible to the naked eye.

Assessment	Description of mold growth detected	Illustration ¹
0	No fouling	
1	Initial growth; one or few hyphae present on the surface, no conidiophores	
2	Economical but clearly established growth. Conidiophores can occur.	
3	Spotwise close fouling with conidiophores.	
4	Close fouling on, in principle the entire surface.	

Assessment of RF at Other temperatures

RF_{chalk} is determined by the lowest RH level at which fouling has been assessed to correspond to grade two or higher on at least two of the seven samples. The critical moisture condition is then assessed to be somewhere between the RH at which fouling was observed and the underlying RH level.

$$RF_{low} < RF_{chalk} \leq RF_{higher} \quad \text{Equation 1}$$

A product or treatment classified to a of five material classes according to table 2. Note that these material classes are not described in the test method.

Table 21. Description of the various the material classes.

Class	$RF_{rite} \text{ } 22^{\circ}\text{C}$
Class A	$75\% \leq RF_{crit} \leq 80\%$
Class B	$80\% < RF_{crit} \leq 85\%$
Class C	$85\% < RF_{crit} \leq 90\%$
Class D	$90\% < RF_{crit} \leq 95\%$

Class	RF _{k_rite} 22°C
Class E	95% < RF _{crit}

When RF_{chalk} is temperature-dependent so is RF_{chalk} validated at 22 °C. RF_{chalk} at Other temperatures can be assessed by using equation 1.

$$RF_{crit(T)} = 105 + c(T^2 - 54 \cdot T) \quad \text{Equation 2}$$

Where T is temperature in °C and c is the value obtained in Table 2. Critical moisture state is calculated for the lower and higher the value in in equation 1. RF_{chalk} can Never be higher than 100% which means that the final RF_{crit} calculated in equation 2 can be expressed in equation 3.

$$RF_{k_rite} = \min(100, RF_{crit(T)}) \quad \text{Equation 3}$$

If the calculations is done in various temperatures (0-30 °C) can the critical humidity level described as curves in a diagram.

Table 3. c Values from equation for each class with lower and upper values.

Class	RF _{low}	RF _{high}
Class A	0.043	0.036
Class B	0.036	0.028
Class C	0.028	0.021
Class D	0.021	0.014
Class E	0.014	-

Results

No deviation with respect on spore solution purity and vitality was noted.

Logging of the various climate cabinets shows to moisture and temperature in the cabinets where within margin of error.

Analysis results after Twelve weeks reported in table 5. The critical the moisture condition as achieved in the test is $80\% < RF_{crit} \leq 85\%$ which corresponds to class B.

Table 4. Climate data from climate cabinets

Goal RH	Lower limit value	Upper limit value	Average RH	Standoff RH	uRH	URH	Upper value	Lower value
95	92.5	97.5	95.0	0.2	0.7	1.4	96.4	93.6
90	87.5	92.5	90.0	0.3	0.7	1.5	91.5	88.5
85	82.5	87.5	85.0	0.4	0.8	1.5	86.5	83.5
RISE Research Institutes of Sweden AB			80.0	0.3	0.7	1.4	81.4	78.6

Table 5. Scale on assessment of fouling The pictures is a schematic illustration of the growth. Fouling is not always visible to the naked eye

95%	Assess- ment	90%	Assess- ment	85%	Assessment	80%	Assessment
Sample no.		Sample no.		Sam- ple no.		Sam- ple no.	
1	4	6	4	11	3	16	0
2	4	7	3	12	3	17	0
3	4	8	3	13	3	18	0
4	4	9	4	14	3	19	0
5	4	10	4	15	3	20	0

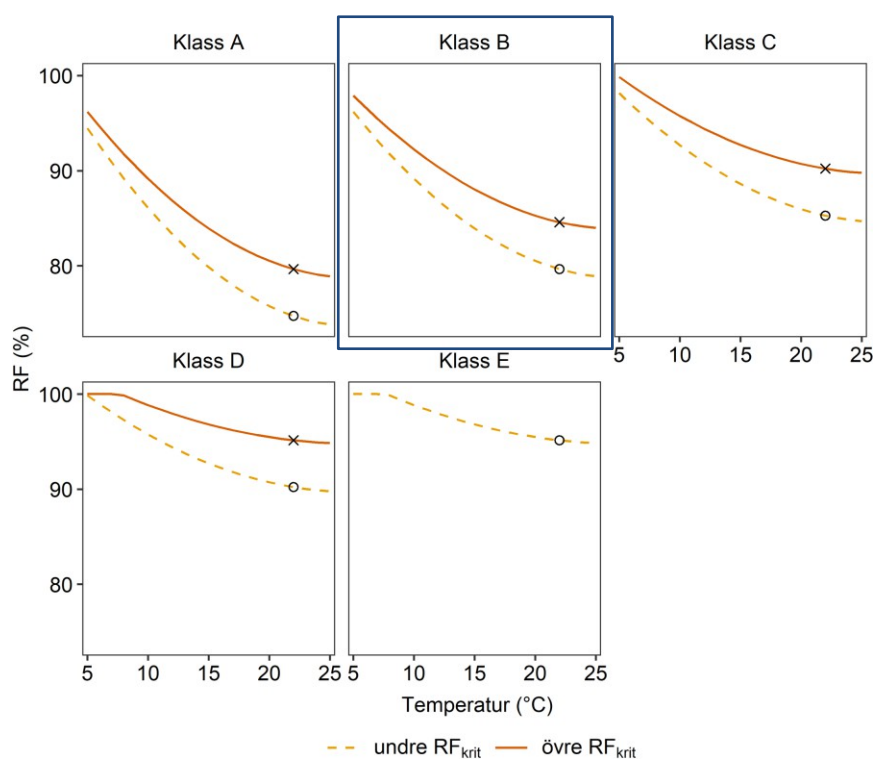


Figure 1. Calculated critically moisture condition corresponds to class B . The graphs shows the critical the moisture condition at different temperatures.

Analysis results after Twelve weeks reported in table 3. The critical the moisture condition as achieved in the test is $75\% < RF_{crit} \leq 80\%$ which corresponds to class A.

The results in this report applies only for the tested the samples. Contamination of materials may reduce the material's resistance to fungal mold growth.

RISE Research Institutes Sweden AB
Construction and real estate - Indoor environment and building physics

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Gunilla Book



Eva Sikander

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Signing parties

Gunilla Bok (GB)
RISE Research Institutes often Sweden
AB Corporate No. 556464-6874
gunilla.bok@ri.se



Signed 2022-09-15 11:20:57 CEST (+0200)

Eva Sikander (ES)
RISE Research Institutes often Sweden
AB Corporate No. 556464-6874
eva.sikander@ri.se



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