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Repair of mould damage by sealing off mould-infested areas – particle impermeability of structural layers

1. General situation; reasons for the research project conducted by AIBau and LBW Bioconsult

In building, layers of structural components are often affected by moisture, either depending on the type of insulation, or due to damage caused by water penetration. In the first case, negative effects on the quality of indoor air can be prevented by sealing off the affected area. In the second case, the problem of adequate remedies has to be considered.

The research study was intended to find out which building materials can prevent fungal spores from penetrating from moist areas to the interior of a room.

2. Subject of investigation

2.1 Survey among building experts

A survey among ca. 2,300 building experts was conducted to assess the number of cases of mould damage occurring over the past ten years, the part of the building where such damage was located, and the measures taken to carry out necessary repairs.

2.1.1 Practical experience with mould damage

Of the 251 experts (roughly 11%) who participated in the survey, 177 (i.e. 70% of 251) had had to deal with mould damage. The number of specified cases shows the broad response to this problem area: About 15,000 cases of mould damage have been dealt with over the past ten years by the experts taking part in the survey. Each participant had inspected and evaluated from only one case, or more than 100, up to 2,000 cases (Fig. 1).

The results show that mould infestation was found to be most frequent in floor constructions (118 of 177 items) and in light wall structures (114 items), whereas it was less frequent in roof cavities and other hollow spaces, e.g. under showers, behind the cladding of façades or on installation levels (Fig.2).

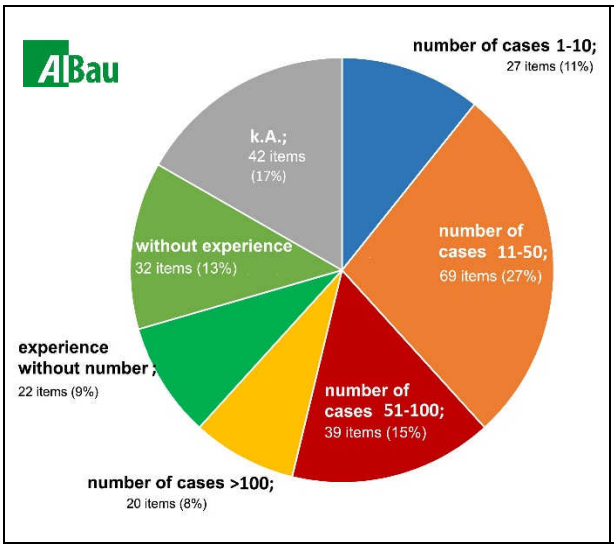

Fig. 1: Number of cases per participant

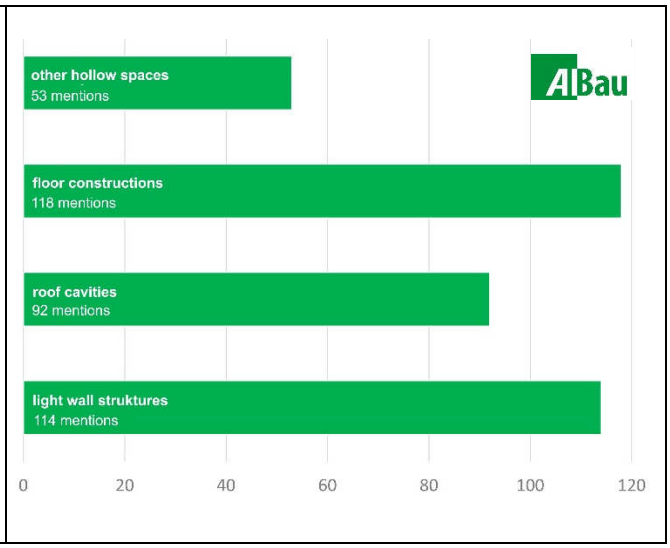

Fig. 2: Frequency of damage per area.

In more than half the cases, the mould infestation of various cavities was found to have no effect on the occupants or users of the building. For this reason, the concentration of airborne germs was seldom assessed. Nevertheless, in most cases (875) the structural conditions of these buildings were changed, that means the infested structural parts were dismantled and disposed of. This was because insurance coverage for the most part included damage caused by water, and because there was a legal claim to have the original state of the building restored. Moreover, most owners or occupants are not convinced that sealing off can be an effective and lasting solution.

2.1.2 The practical performance of sealing-off measures – typical examples

In the above-mentioned survey the participants had specified 56 individual cases of damage, 22 of which were accessible for inspection. Characteristically, mould growth occurred within two years after erecting the building or after constructional changes.

Among the items specified, there were 10 cases, in which the condition of the building remained unaffected in spite of mould growth.

2.2 Laboratory tests

Apart from the survey, simulations and laboratory experiments were performed to find out, if, and to what extent, current building materials and constructional components are permeable to mould spores and fragments of hyphae (cellular fibres).

2.2.1 Experimental setup and method

Measurements were taken in a double chamber, which was installed in the laboratory and which was impermeable to particles (Fig. 3 and 4). Sporulating mould cultures were placed into one of the chambers (the so-called “black area”).

The other chamber (the so-called “white area”) was cleaned and disinfected; then a collector of airborne germs (Holbach) was put inside together with a nutrient medium and object slides. Between the two chambers currently used building materials were first tested for permeability to spores and particles (Fig. 5). In a second step a floor screed edge-joint between sand-limestone and concrete was also tested for permeability (Fig. 6).

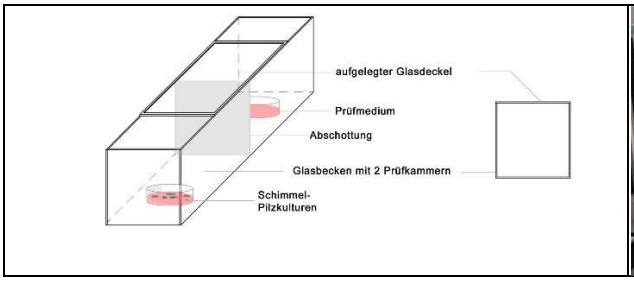

Fig. 3: Experimental setup to test the permeability of building materials

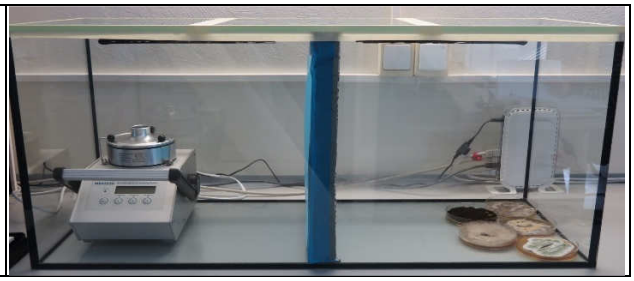

Fig. 4: Laboratory setup to assess the permeability of building materials

Fig. 5: Building materials placed between the „black“ and the „white areas“ for tests, here: wet room panels

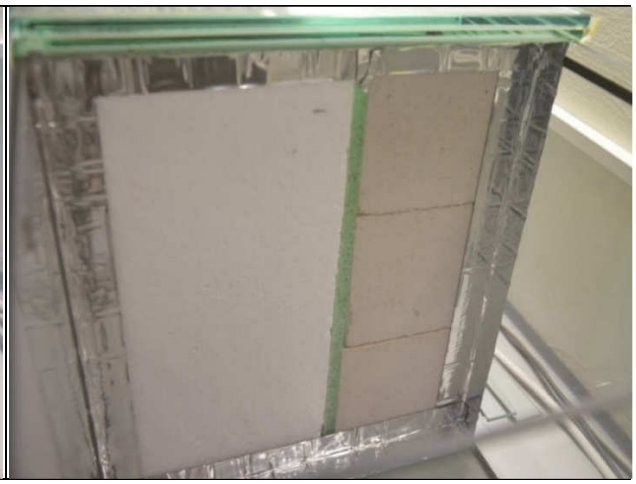

Fig. 6: The permeability of screed edge joints was tested together with concrete screeds

2.2.2 Results of the laboratory tests and their relevance to building practice

In the so-called “black area” the limit value was more than 5,000 KBE/m2 (CFU, colony forming unit), and the test slides were completely covered by an indeterminable amount of spores. Measurements in the “white area” have shown that none of the tested materials are permeable to fungal spores or hyphae particles. Given the usual degree of tightness of edge joints, all the tested building materials can be regarded as effective barriers to mould growth.

But when the insulating strip was removed from the screed edge joint, the concentration of growing spores and the total amount of airborne spores increased, especially after activating the air turbulence in the “white area”.

2.2.3 Pumping effects at floor screeds

In the experiments concluded so far on screed layers, the turbulence created by computer ventilation was used to simulate simple differences of air pressure. It was not possible, however, to validate the effect of convection on the exchange of air between the level under and above the screed, by which particles from under the screed might be transported into interior rooms. This question is to be dealt with in another investigation.

3. Conclusion

In cases of mould growth, decisions on whether to exchange or keep the infested structural parts are frequently not taken on the basis of hygienic requirements, but depending on a legal claim against other people concerned.

As typical cases and special tests have proved, there are no harmful effects on occupants, if structural components contain mould, as long as it does not damage the building construction. The findings also show that currently used building layers and sufficiently tight edge joints will seal off such substances from the interior of the room.

Provided that there are no unpleasant smells and no damaged materials, mould effects in structural parts can generally be repaired without dismantling the old construction and replacing it with new components.

This project could not investigate the pumping effect on floating screed, but research is intended to be continued in this field.

4. Project Data

Short title: Repair of mould damage by sealing off

Project number:	SWD-10.08.18.7-17.38
Conducted by:	AIBau – Aachener Institut für Bauschadensforschung und angewandte Bauphysik, gGmbH, Aachen
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Covered by federal funds:	49,080.- Euro
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