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DETERMINING OPTIMAL VERSION OF THE FILLER 1toFILL MONUMENTS, A SUSTAINABLE SUBSTITUTE FOR EPOXY FILLERS

Different versions of the vapour-permeable, water-proof, comprising only natural raw materials **filler 1toFILL Monuments**, which have been developed by the undersigned in 2013-2016, were subjected to a series of tests. Each test used an increased level of moisture impact, with the goal being to determine the optimal version of the filler.

Results for a standard test piece made from pine wood were as follows:



Test piece made from pine wood



Test piece filled with 1toFILL Monuments

Test 1. Four test pieces were filled with four different versions of 1toFILL Monuments. After drying, these were left in their current state (i.e. not sanded down) and submerged for six months in a bowl of water. The test pieces remained fully intact, and there was no sign of destruction of the filler or detachment from the wood.



Test 1. 1st December 2015



Test 1. 20th April 2016

Test 2. One test piece was subjected to the freeze-thaw test. It was kept in a freezer for 20 hours every day at -4°C and for the remaining four hours submerged in water at 20°C , over a period of 30 days. The test piece remained fully intact.



Test 2. 23rd April 2016



Test 2. 21st May 2016

See all the photo's of the Test 2: <https://drive.google.com/folderview?id=0B9xu91y978svSEJRbUpTZHmRIU&usp=sharing>

Test 3. The test pieces in Tests 1 and 2 were not sanded down, as doing so may weaken the filler's adhesion. In this test, two test pieces with two improved versions of 1toFILL Monuments were sanded down and subjected to the above freeze-thaw test for the period of 30 days. Both pieces remained fully intact.



Test 3. 25th April 2017



Test 3. 25th May 2016

See all the photo's of the Test 3: <https://drive.google.com/folderview?id=0B9xu91y978svUUVNzBsNW83V28&usp=sharing>

Test 4. The most severe wood filler test involves the test piece being coated and then left in the open air. Contrary to popular belief, coating the woodwork of, for instance, the façade of a building, can in fact be detrimental to the wood. Similarly, the less the coating is vapour permeable, the greater the potential damage. While coating protects against exterior moisture, such as rain, it also hampers the evaporation of the moisture from the wood, which stimulates the growth of fungi and, eventually, mould. The tensions between the parts of the wood with different moisture content may also cause the filler to detach.

The final test was hence set up as follows:

13 different versions 1toFILL Monuments, based on the version from Test 3, were used to fill 13 test pieces. These were sanded down and coated three times with highly vapour-permeable rectified linseed oil-based paint (Allback, Sweden). The bottom of each test piece was left uncoated to allow the moisture to penetrate into the test piece freely, resulting in significant impact upon both the timber and the filler. On June 22nd 2016, the cured test pieces were placed outdoors. After 7.5 months, 12 of the 13 pieces showed partial detachment of the filler and growth of fungi/mould along the cracks.

The exception was the test piece, circled in red. See the photo's on the next page.



Test 4. 15th August 2016



Test 4. 15th Februari 2017

In conclusion, repairs made using this version of 1toFILL Monuments in a window frame or a door frame, painted with Allback linseed oil paint, will remain intact for many years (in a domestic setting, the moisture impact is much lower than in the current experiment).

The optimal version of 1toFILL Monuments, based on the results of the above experiment, is currently available for purchase, <http://www.1tofix.eu/>

Test 5. To demonstrate the importance of the vapour permeability of the coating, we conducted a final test under even more extreme conditions. The new test pieces, one of which contained the successful combination from the previous test, and the rest containing variations of this version, were set on a tray and placed outdoors on November 30th 2016. Some of the test pieces were given three coats of vapour-permeable Allback linseed oil paint. Others were given three coats of completely vapour-impermeable paint. This was a rainy time of year, with night temperatures dipping below freezing. Within two days, the tray had filled up with water that did not have time to evaporate. The test pieces were therefore subject to an unusually high moisture exposure, as well as a natural freeze-thaw cycle. Again, the combination of 1toFILL Monuments and Allback linseed oil paint showed excellent stability, even after 2.5 months (see the test piece in the photo below, circled in red). The test pieces painted with the vapour-impermeable coating, however, began to show cracks by day three!



Test 5. 30th November 2016



Test 5. 15th Februari 2017

Conclusion: the more vapour permeable the coating/paint and the filler, the longer the “wood-filler-coating” will remain intact. The combination of 1toFILL Monuments + Allback linseed oil paint currently offers the best vapour permeability!

NB: It would not be possible to perform such a test for two-component epoxy fillers. The reason for this is that epoxy, according to its manufacturers, is completely vapour impermeable and must be thoroughly protected from any contact with moisture. The smallest cracks in the seams of a window frame, for example, will lead to the detachment of the epoxy filler, moisture accumulation, and, eventually, the rot and decay of the woodwork. This is obviously a fatal weakness of epoxy filler, with negative consequences for façade elements including windows, door frames and the like.

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