Research for the Benefit of SMEs

Title: Development of a solvent-free coating process for wooden facades

Acronym: DURAWOOD

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Deliverable 3.4	Report of the results of the long-term field tests of DURAWOOD treated and untreated wood and of the disinfection tests
Associated WP	WP3 – Microbiological Testing
Associated Task	Task 3.3 – Long-term field tests of DURAWOOD treated and untreated wood
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Publishable Executive Summary

This report outlines the work carried out as part of an EC funded project called DURAWOOD - *Development of a solvent - free coating process for wooden facades* in Work package 3 – *Microbiology testing*.

The previous deliverable 3.3 – *Validation of the PCR system and results of the comparative test of DURAWOOD treated and untreated wood at laboratory level* reported the results of tests with the laboratory prototype (best conditions for hydrophilisation and hydrophobisation).

In the present deliverable are reported the results of tests with the industrial prototype which had been installed at the two SME project partners ARY and SETA.

These wood samples were inoculated with the wood decaying fungi *Coniophora puteana* for hardwood and *Trametes versicolor* for softwood. The wood test samples were analyzed with the PCR method (analyzing the growth into the wood sample) and simultaneously with the EN 113 method (mass loss). In addition to the wood decay tests the wood samples were also analysed for their resistance against blue stain fungi (on the basis of EN 152).

To reveal a direct effect of the plasma treatment tests were performed to investigate the antifungal effect on fungal spores with previously inoculated wood.

In summary it can be noted that the results depended on number of parameters (wood, treatment, coating, etc) and were somehow difficult to interpret. No clear effect of the plasma application against wood decay or blue stain fungi could be detected in combination with the different coatings. In the majority of cases, no differences were detected between the samples with and without plasma pre-treatment but it may be assigned in part at least to a better adhesion of certain coatings used at ARY. Regarding wood samples with solvent-based coatings of ARY, they appeared to be resistant against wood decay and blue stain independently of the plasma application. The water-borne coated samples of ARY showed all wood decay (indicated by the mass loss) after 8 weeks incubation. One treatment group (plasma and water-borne coating) had less mass loss compared to the water-borne coated sample with a primer and compared to the reference sample. That could indicate a probable positive effect of the hydrophilising plasma.

Especially with SETA wood samples some problems arose, because they were not standardized (different wood grain, knotholes, discoloured, etc.). In addition the coatings used at SETA were not as professionally applied as at ARY (spray booth) because they were applied by hand by RTD partners (due to not compatible timing of the plant operators there and the long validation trials whereby coating must be applied directly after plasma pre-treatment). The solvent-borne coating, for example was not well cured due to a wrong formula. That is why no general conclusion about the effect of the plasma application could be derived.

The results of the experiments performed with the industrial prototype are difficult to interpret. No clear effect of the plasma could be revealed underneath different water-borne or solvent-borne coatings mainly due to the variability in experimental

conditions, e.g. wood samples. In some experiments the incubation period has been too short.

One of the main reasons why no effect of the plasma against fungi could be detected might be the thin effective layer of the plasma treatment. One might assume that the uneven, rough wood surface is not homogenously treated with the plasma electrode used for the experiments. A plasma electrode which generates a "thicker" plasma layer which penetrates deeper into wood, as was identified at the end of the project, might be more promising.

In addition to the long-term experiments with first plasma treated and then inoculated wood samples, experiments with pre-inoculated samples have been performed to reveal a direct disinfecting effect of the plasma. As a result, it was demonstrated that the **hydrophilising plasma had a clear antifungal effect**. Additionally a "thicker" plasma layer could also be more efficient in reducing fungal spores also with hydrophobising conditions.