Research for the Benefit of SMEs

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

Acronym: DURAWOOD

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Deliverable 5.2	Report on the industrial results and recommendations for future commercialization
Associated WP	WP5 – Technology Validation at Industrial Level
Associated Task	Task 5.1 Definition of the trials at industrial level Task 5.2: Installation of DURAWOOD system at several partner facilities Task 5.3 Trials at industrial scale (end users) Task 5.4 Analysis of the results Task 5.5 Recommendations for future commercialization
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Prepared by (Lead Partner)	STUBA, IRIS
Partners Involved	Ttz, ARY, SETA
Authors	Elodie Bugnicourt (IRIS), Radovan Tino (STUBA), Anne Baars (ttz), Carsten Harms (ttz)
Dissemination Level	RE

Publishable Executive Summary

This report outlines part of the work carried out as part of an EC funded project called DURAWOOD - *Development of a solvent-free coating process for wooden facades* in the work package 5-*Technology Validation at Industrial Level.*

Previous deliverable D5.1-*Manual of installation instructions of the DURAWOOD prototype* reported the procedure for installing and using of the process prototype machine.

The present Deliverable 5.2-*Report on the industrial results and recommendations for future commercialization* reports a number of tests that were performed to validate the efficiency of the DURAWOOD system under different conditions in terms of wood, sizes, coatings and primers combinations. Tests relevant to industrial uses were performed at semi-industrial speed in the facilities of 2 SMEs among wood producers in the consortium: SETA in Slovakia and ARY in Spain. The prototype was then transferred to the SME PLASTECH which will keep it for post project demonstration.

The properties of the resulting wood panels after plasma treatment are reported in terms of initial wettability, coating durability and resistance to fungi.

In terms of initial wood polarity, the modifications at the prototype scale reached levels rather similar to those previously obtained at lab scale in WP2 both towards hydrophilisation and hydrophobisation depending on the plasma pretretament conditions.

In terms of coating adhesion, plasma applied in hydrophilisation conditions at ARY prior the application of water borne coatings (WBC) resulted in improved adhesion. Sample treated with primer then with plasma and finally with WBC had higher adhesion by 76% than samples without plasma treatment. In the case of ash, the increase was by 32%. Plasma in hydrophobisation conditions on oak with subsequent application of solvent based coating (SBC) led to an adhesion 7% greater than for samples which were not treated with plasma. The presence of a primer layer did not show difference in the final adhesion. In case of ash, plasma treatment provided increased adhesion by 21%. Samples from SETA were difficult to evaluate due to the poor uniformity of the coating application. However, again a positive effect of plasma treatment on WBC adhesion was measured. Weathering tests indicated worse stability of artificially aged spruce treated with plasma, whereas the effect of plasma treatment was positive on larch. Weathering tests allowed PAMAK to optimize the durability of their WBC with UV stabilizers. After 6 weeks of artificial ageing, adhesion of plasma treated samples was higher by about 5% than for samples without plasma pretreatment.

Additionally, the tests here reported also deal with the weathering profile of a series of improved coatings formulated by PAMAK which were tested using the plasma lab scale unit. For this series of experimentally prepared coatings containing UV absorbers, the effect of plasma in terms of improvement in adhesion and extention of wood durability can be even higher than for standard coatings.

The results of the fungal experiments were difficult to interpret. In most cases no clear effect of the plasma could be revealed underneath different WBC and SBC mainly due to the variability in experimental conditions, e.g. wood samples and coating application, especially for SETA samples. In some experiments, the incubation period was too short. ARY samples had some extent of intrinsic resistance against fungi. Samples treated with plasma and WBC had lower mass loss compared to the samples with WBC and primer, which could reveal a positive effect of the plasma. Detailed results are reported in D3.4- *Report of the results of the long-term field tests of DURAWOOD treated and untreated wood and of the disinfection tests.*

Although not all the results of the industrial trials confirm the long term effect of plasma on wood durability especially regarding its resistance to fungi, the results still appear generally promising. Indeed, on the one hand the conditions in the industrial validation trials were much less controlled than those for the lab scale testing and it is believed to be one of the reasons for variability of the results, and on the other hand, the project allowed reproducing the lab scale results in terms of the plasma effect on the contact angles on wood surface which were in the same range as previously observed at the lab scale. In terms of longer time results, it was showed that plasma treatment provides water-borne coating with better adhesion than without plasma treatment. It is additionally fitted reminding that in this project, plasma was not primarily used for decontamination of the wood surface but for surface modification to improve coating adhesion.

Finally, some recommendations for improvements of the DURAWOOD prototype are discussed to turn it into a commercialisable plasma treatment system. Most significant recommendation is the use of different plasma electrode that appeared on the market at the end of the project in order to improve the efficiency of the plasma treatment for non flat wood surface and increase the depth of the plasma action to enhance its antifungal action.