Service Life Performance of Bio-based Facade Materials – Modelling and Simulation of Appearance and Environmental Impact

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Abstract

The tendency for development of sustainable structures and increasing of environmental consciousness observed recently leads to the reactivation of the bio-architecture as an alternative to other construction materials. Recent advances in the biomaterials processing and modifications methods have delivered several innovative solutions for the building sector. However, in order to increase confidence for their use, a deep understanding of the material properties, structure, assembly, formulation and its performance along the service life is indispensable.

This work demonstrates an original modelling and simulation approach for visualization of the building appearance change during its service life. Performances of over hundred façade materials were evaluated for 18 months of the exposure to natural weathering conditions. Experimental data acquired with several sensors were used for development of the numerical models simulating the material degradation in a function of time and exposure. Dedicated algorithms simulating material deterioration by taking into account specific material characteristics, kinetic and intensity of weathering process as well as specific architectural details of the structure in service were extensively tested and validated.

The original software developed will assist architects/customers to select optimal bio-material solution for the custom requirements, assuring satisfactory performance and high aesthetical valour. Additionally, the software provides a guidance regarding the realistic maintenance scheduling as well as analysis of the environmental impact (LCA for the use phase) including optimal recycling options of façade elements after the end of its service life. The tool developed will be integrated with Building Information Modelling (BIM) software. It may become future

routine analysis used extensively by architects, designers and investors during design and use phases.

Keywords:
service life performance, bio-based building materials, Life Cycle Assessment, weathering, appearance, aesthetics, end of service life