

Performance of Paraloid B72® combined with the application of biocides on wood degraded by fungi

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Abstract

When timber elements in heritage buildings are moderately degraded by fungi and assuming underlying moisture problems are solved, two actions can be taken: i) use a biocide product to stop fungi activity ii) consolidate the degraded elements so that the timber keeps on fulfilling its structural and decorative functions. Indeed, the option of maintaining in the building the original (even though deteriorated) timber has been gaining more and more importance, as the loss any element may contribute to the loss of the historical identity of the building.

This paper presents the laboratory work performed with the purpose of understanding the mechanical performance of maritime pine timber degraded by fungi (with mass losses lower than 20%) when subjected to consolidation by impregnation with Paraloid B72®, combined with the previous application of a biocide.

Three commercially available pre-selected biocide products were used: a light organic solvent (X), a boron water-based (BC) and a water-based emulsion (A). After the products were applied to five sets of specimens (Control, PB72, X+PB72, BC+PB72, A+PB72) these were subjected to mechanical tests: axial compression test (NP618) and resistance to indentation (ISO 3350). Four similar sets of replicates were subjected to an evaporation ageing procedure (EN73) after the products were applied and equally tested.

An increase in mechanical strength was observed for the consolidation product with no significant influence of the previous use of biocide product. The specimens subjected to ageing showed a slightly better general mechanical performance than those not aged.

1. INTRODUCTION

Timber consolidation by impregnation consists on forcing a specific fluid material to penetrate it, which when hardened will give back its integrity and promote an improvement of the physical and mechanical characteristics [1] [2] [3]. In an ideal case the original properties of the wood should be recovered [4]. Out of the thermoplastic products for consolidation of timber degraded by fungi acrylic resin Paraloid B72® has provided the best results so far in terms of mechanical strength increase [6] [7].

In addition to strengthening the wood structure, the materials used may also impart some resistance against biological pests [4]. However several authors found that synthetic consolidants and particularly Paraloid B72 do not increase the resistance of wood against fungi. In 1986 Nakhla [7] recommended that whenever the use of synthetic resins became necessary (e.g. in bridges) a fungicide should also be applied. More recently Unger et al. [4] and afterwards Reinprecht cited by Olstog & Kucerova [8], when analyzing the influence of various synthetic consolidants on the degradation process of Spruce resinous timber (*Picea abies* Karst.), also found that they do not improve the timber's resistance to brown rot and advised for the simultaneous use of a chemical preserver. Moreover Unger et al. [4] state that an ideal consolidant should be compatible with wood preservatives applied earlier. However no scientific studies seem to have been divulged proving its compatibility.

Concerning the type of preservative to be used, present day maintenance or rehabilitation interventions in old buildings will necessarily lead to the use of newer and more environmentally benign compounds on existing timber [9] [10]. In fact the last two decades of the 20th century dramatically changed the panorama of treatment products. Environmental concerns, disposal issues and the general public's perceptions questioned the use of traditional active substances [10] [11] [12]. Today one sees many preservative types emerging to fill gaps in the market [13]. Solvent-based colored preservatives and micro emulsion water-dilutable concentrates with organic fungicides and insecticides are two of the possibilities [13]. The use of boron stands out due to its characteristics of very low toxicity to mam-