

## Improving fungal decay resistance of solvent and waterborne polyurethane-coated wood by free and microencapsulated thyme essential oil

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**Abstract:** Free and microencapsulated thyme essential oils (*Zataria multiflora* Boiss) were incorporated into solvent and waterborne polyurethane coatings separately to ~~increase~~ enhance decay resistance of the biocide free coatings. The essential oil was extracted by hydro-distillation in a Clevenger-type apparatus for 4 h. Poly (methyl methacrylate) (PMMA) microcapsules containing thyme oil as an active ingredient were prepared ~~by~~ through solvent evaporation method with oil in water emulsion system. Fungal resistance of the coated hornbeam wood (*Carpinus betulus*) against white rot fungus *Coriolus versicolor* CTB 863 A and brown rot fungus *Coniophora puteana* BAM Ebw. 15 ~~were~~ was ~~carried out~~ tested according to European EN-113 standard before and after six-cycle accelerated aging test (ASTM D1037). ~~Results~~ The results showed ~~revealed~~ that the core-shell capsules were formed properly, and their sizes were in the range of 5-50 $\mu$ . The encapsulation efficiency determined by UV-visible spectrophotometer at  $\lambda=275$  nm was 67%. The free essential oil was not efficient enough to improve the fungal resistance, while the microencapsulated oil enhanced the resistance even after the accelerated aging via a controlled-release mechanism ~~and as well as~~ protection of the susceptible ingredients through the shielding effect of the polymeric shell.

**Keywords:** Fungal resistance, Microencapsulation, Polyurethane coating, Thyme essential oil, Poly (methyl methacrylate), Hornbeam wood.

### Introduction

~~In~~ Over the last few decades, there has been a growing interest in ~~the utilization of~~ utilizing green preservatives to protect wood and wood-based products from biological agents due to negative effects of many chemical preservatives on human health. Essential oils with anti-microbial effects are organic compounds, which are produced from various parts of aromatic plants.<sup>1</sup> ~~A large number of~~ Extensive studies have focused predominantly on inhibitory effects of the essential oils extracted from different plants on the growth of wood-decay fungi and molds.<sup>2-9</sup> The essential oils containing phenolic compounds such as *carvacrol*, *thyme*, *eugenol*,<sub>2</sub> and oxygenated sesqui-terpenes ~~like~~ such as *elemol* have a high efficiency against the wood-decay fungi.<sup>1</sup>