



TALLINN UNIVERSITY OF TECHNOLOGY
SCHOOL OF ENGINEERING
Department of Materials and Environmental Technology

**INFLUENCE OF FIRE RETARDANT TREATMENT ON
THE FIRE RESISTANCE AND MECHANICAL
PROPERTIES OF HEMP FIBRE REINFORCED PLA
COMPOSITE**

**TULETÕKKEAINE MÕJU KANEPIKIUGA ARMEERITUD PLA
KOMPOSIIDI TULEKINDLUSELE JA MEHAANILISTELE
OMADUSTELE**

MASTER THESIS

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SUMMARY

In summary, the influence of fire retardant treatment on the fire resistance and mechanical properties of hemp fibre reinforced PLA composite was studied in the master thesis. The hemp fibre surface was pretreated with alkali (5wt.% solution) and with combined treatment with silane (3wt.% by fibre weight). Composite specimens were prepared in six categories based on the fibre treatment: untreated (Un), alkali (Na) and silane (Sa), combined with borax and Palonot[®] applied as Fire retardants. Additionally, 3 groups of controls were fabricated from the non-fire retardant treated fibres (Un, Na & Sa) for the reaction to fire test. All samples were tested in reaction to fire, but only the fire retardant modified composites were tested in tensile and flexural properties. Results showed that samples with Palonot[®] have good fire resistance behaviour. Analysing the effect of the fire retardant treatment to the mechanical properties of the hemp composite the Palonot[®] treatment for untreated (Un) and (Na) pre-treated specimens had higher negative impact to the performance than specimens treated with borax. However, specimens pre-treated with (Sa) had better impact of the fire retardant treatment (palanot[®]) to the mechanical performance of the hemp fibre composite material compared to the borax treatment, that may be attributed to possible detachment of silane from the fibre surface, and weakening of the fibre properties as a result of the additional soaking in the borax solution. The SEM analysis confirmed the deposition of borax and the palanot[®] on the treated hemp fibre surface, which are seen as salt particles and grafting, respectively. Solving the problem of the reduction of mechanical properties' needs further research.