



University of Zabol

Graduate school

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**The Thesis Submitted for the Degree of Ph. D in the field of
wood Composite products**

**Modification of date palm leaf by chemical
treatments such as Alkoxysilane and
physical for manufacturing cement-based
wood composites**

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Abstract

In this research, the effect of chemical treatments of palm leaf particles with melamine formaldehyde, nanoclay montmorillonite and alkoxy silane (tetramethyl orthosilicate) and heat physical treatment of particles at different levels on the mechanical and physical properties of wood cement particle board was investigated. For this purpose, in order to make cement particle board, palm particles and cement were combined with a weight ratio of 30 to 70 and in the presence of 5% calcium chloride (based on the dry weight of cement). Palm modified particles with chemicals materials melamine formaldehyde (0, 2 and 4 percent), nanoclay montmorillonite (0, 2 and 4 percent) and alkoxy silane (0, 7.5 and 15 ml/liter based on the dry weight of the particle wood) and physical heat modification (without heat and 180 °C) were used for construction. Mechanical properties (including modulus of rupture and modulus of elasticity, internal bonding and compressive strength) and physical properties (including water absorption and thickness swelling of 2 and 24 hours) were measured according to the European standard. Also, qualitative tests of infrared spectroscopy Fourier Transform *Infrared* (FTIR), *Scanning Electron Microscope* (SEM) and Thermogravimetric analysis (TGA) were performed. In general, the results showed that the chemical treatment of palm particles with melamine formaldehyde, nano montmorillonite and alkoxy silane and heat treatment had a positive effect on the mechanical and physical properties of cement wood boards, so that by increasing their amount, the greatest mechanical resistance and the lowest undesirable physical properties were obtained. The significant increase in the desirable resistance and physical properties of the resulting boards can be attributed to the reaction between the hydroxyl groups of the palm components with the active groups of alkoxy silane, the removal and control of hydration inhibiting substances including extractive and sugary soluble in water materials with heat treatment and melamine formaldehyde and nanoclay montmorillonite filling properties and cement reinforcement and greater cohesion between palm particle and cement. The results of FTIR showed an increase in the peak intensity of Si-O bonds in samples modified with alkoxy silane and nanoclay, the presence of triazine group in melamine modified particles and a decrease in the peak related to hydroxyl groups with heat treatment, this confirmed the chemical and physical modification of palm particle. The results obtained from the SEM indicated the improvement of compatibility between the modified particle and cement. Curves of TGA showed the thermal stability of wood-cement board made with the combined level of variables at the highest value.

Key words: cement wood, chemical and physical treatments, tetramethyl orthosilicate, nanoclay montmorillonite, palm