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研　究　主　論　文　抄　録

論文題目　RESEARCH ON APPLICATION OF UNDERWATER SHOCK WAVE FOR FIBER, WOOD PROCESSING AND COMPOSITE FABRICATION
（植物性繊維、木材加工品及び、複合製品に対する水中衝撃波処理に関する研究）

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主論文要旨

《本文》This dissertation contains a study that is mainly involved in the detonation of high explosive and phenomenon of underwater shock wave and their potential applications for the processing and development for achieving high performance natural fiber (jute and cotton), wood and fiber reinforced composite materials. The dissertation totally consists of six chapters. Chapter 1 is an introduction which provides some background information on the technique using high pressure from the detonation of explosives, the issues and objectives of study, and the contents of this dissertation.

Chapter 2 covers the basic theories related to the shock wave and detonation wave generated by the explosion of solid explosives in the liquid like wave. A brief introduction regarding the used materials for the research is also described in this chapter.

In chapters 3 and 4 the methods for generation of underwater shock waves by explosion and effect of their interaction with natural fibrous materials (jute and cotton) are presented. After the shock wave treatment, treated fibers were allowed to characteristic analysis such as fiber morphology, permeability, breaking strength, and wicking behavior etc. Scanning electron micrographs of treated jute and cotton shows micro cracks or micro roughness on the surface. Shock wave treated jute fiber is showed higher permeability and lower breaking strength than that of controlled fiber by inducing micro cracks and roughness on the surface. Shock treated cotton sample fiber is also showed improved wicking properties than that of controlled cotton sample.

The dissertation continues with chapter 5 in which the wood materials are modified using underwater shock wave technique to improve the durability, permeability and fire protecting properties. Seasoned wood samples were subject to under water shock wave to modify the surface and modified sample are also allowed to above physico- mechanical characteristics. The surface morphology of treated wood samples are analyzed using Scanning electron microscopy (SEM). Permeability test are also performed using air chemicals injection device

with air conditioner pressure and simple dipping in water tank. Results found from the all investigation that processed wood samples show high performance against fire and improved drying property. Improved permeability also found after water based chemicals solution as well as dipping test.

Chapter 6 presents the investigations done on the physico -mechanical properties of the shock treated jute fiber reinforced plastic (FRP) composite materials. Shock treated jute fiber is employed as a reinforcement to fabricate polymer matrix (unsaturated polyester) composite. Water uptake test, flexural stress -strain behavior also investigated. The performance of the FRP made from shock wave treated jute fiber against water is relatively better than that of FRP made up of controlled untreated jute fiber. Mechanical properties are reduced due to fiber surface cracking induced by shockwave.

Finally, chapter 7 draws some conclusions from the outcomes of the experimental studies.