UNIVERSITI TEKNOLOGI MARA

THE EFFECT OF n-BA, HDDA AND TMPTMA ON CHEMICAL AND PHYSICAL PROPERTIES OF ULTRA-VIOLET VULCANIZATION NATURAL RUBBER LATEX

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The NR latex formulated with 2 pphr of 2–hydroxy-2-methyl-1-phenylpropanoid photo-initiator and 3 phr of acrylate monomer (n-BA, HDDA and TMPTMA) was labelled as NR/n-BA, NR/HDDA and NR/TMPTMA. The formulations were exposed to UV radiation source from 400W medium pressure mercury lamp at 30, 90, 180 and 300 minutes. The irradiated latex formulations formed into rubber film by using coagulant dipping method. The rubber films were subjected to testing such as tensile strength, modulus, swelling, FTIR, TGA, DSC and AFM. The testing was carried out to study the effect of acrylate monomer and UV irradiation time to NR latex. It was found that formulation NR/HDDA expose to UV radiation for 180 minutes has the highest tensile strength, M700 and crosslink density at 13.9 MPa,3.75 MPa and 6.5 x 10^{-6} mole/g, respectively. The absorption and contact angle test is carried to study the diffusion and wetting effecting of acrylate monomer to NR. It was found that n-BA has highest diffusion and wetting effect to NR. NR/HDDA had highest tensile due to HDDA has 2 functional group in chemical structure contribute to better crosslink efficiency. The FTIR spectra show that the C=C peak in NR disappear with presence of acrylate monomer and the appearing of new peak of C=O, ring C-C and vibration aromatic ring indicate that the acrylate monomer strongly attached to NR. The NR/HDDA formulation was chosen to study the effect of oxygen on UV vulcanization NR latex. The NR/HDDA formulation was exposed to UV radiation under inert atmosphere at 90 and 180 minutes. The irradiated NR/HDDA was formed to rubber film and subjected to tensile, swelling and AFM test. It was found that the tensile and crosslink density of NR/HDDA film increases when the UV irradiation of NR latex process carried out under inert atmosphere. The tensile strength of NR/HDDA films expose to UV irradiation for 3h under inert atmosphere is 20.3 MPa. The surface topology of formulated NR films show that the reaction of monomer to form crosslink, grafting and polymer is faster than diffusion of monomer into interior NR latex particles. This indicates that the vulcanization process only occur at surface of NR latex particles meanwhile the core of NR latex particles remain unvulcanised.The ability of acrylate monomer diffuse in particle and number of functional group in acrylate monomer influence crosslink efficiency. The formation of polyacrylate and grafted polyacrylate to NR chain increases the physical crosslink in NR contribute to the enhancement of tensile properties.

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