

**PREPARATION AND CHARACTERISATION OF MgO NANOPARTICLE
INCORPORATED BIORESIN USING PALM OIL**

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ABSTRACT

Alkyd resins are the product derivation of polyacid and polyol modified with monobasic fatty acid through polycondensation. Over the recent years, alkyd resins are widely used as the binder for composite and film-forming agent in paints. Vegetable oils were being explored and evaluated to synthesis alkyd resin due to its biodegradability and renewability. Synthesis of alkyd resins involved the alcoholysis of the oil by the polyol (commonly glycerol) and followed by polyesterification with a polyacid (commonly phthalic anhydride). Generally, a homogeneous or heterogeneous base catalyst was used to carry out the reaction. Nanoparticles were said to be a promising catalyst and colloidal form of nanoparticles was discovered in this context. In this work, palm oil based alkyd resin was synthesized over Magnesium Oxide (MgO) nano sol. Colloidal MgO nanoparticles were synthesised in glycerol and subsequently was used in alkyd resin synthesis. The alcoholysis process was conducted in the presence of various concentration of MgO (0.01, 0.02, 0.04 and 0.06wt% w.r.t. palm oil) at 240°C. The monoglycerides yield was found to achieve up to 95% in 40 minutes reaction time for 0.04wt% MgO catalysed system. As for the polyesterification process, fusion method was used since it was seldom discovered by other researchers. The crystallized size of the nanoparticle in sol was analysed by X-ray diffraction technique (XRD). Formation of the alkyd resin was monitored by measuring the acid values at different reaction time. Alkyd resins obtained after polyesterification of the alcoholysis products with phthalic anhydride at 240°C were characterized by employing Fourier Transform Infrared (FTIR) and Nuclear magnetic resonance (NMR) spectroscopy. The antimicrobial activity of MgO incorporated alkyd resin against microorganisms was tested via the Kirby–Bauer method. The MgO incorporated in alkyd resin not only reduced the reaction time but also was also proved to be an effective antibacterial agent which added value to the alkyd resin synthesised. Overall, MgO nanoparticles incorporated alkyd resin showed outstanding performance compared to conventional homogeneous base catalyzed system.

ABSTRAK

Alkyd resin merupakan polyester dihasilkan dari dari tiga monomer iaitu polyol, polybasic acid dan minyak melalui polimerisasi kondensasi. Alkyd resin banyak digunakan dalam dalam industri cat, coating, dan pembentukan film. Penggunaan minyak sayur-sayuran untuk memproduksi alkyd resin bersifat mesra alam dan mempunyai sumber yang mencukupi. Secara dasarnya, penghasilan alkyd resin melibatkan dua reaksi iaitu alkoholisis dengan gliserol dan polikondensasi dengan phthalic anhydride pada suhu 240°C.

Logam alkali oksida atau hidroksida seperti MgO, LiOH, NaOH, KOH dan Ca(OH)₂ adalah katalis alkoholisis yang biasa digunakan oleh para penyelidik. Dalam konteks ini, MgO nano sol (0.01wt%, 0.02wt%, 0.04wt% dan 0.06wt %) akan dihasilkan dalam gliserol dan seterusnya bereaksi dengan minyak kelapa sawit. Monogliserida yang disintesis daripada alkoholisis akan diuji dengan menggunakan teknik X-ray diffraction (XRD). Penghasilan alkyd resin selepas polikondensasi akan diperhatikan dengan mendapatkan acid values pada setiap masa tertentu. Seterusnya, analisis FTIR, ¹H NMR and ¹³C NMR akan dijalankan untuk mengesahkan kewujudan alkyd resin. Berdasarkan keputusan yang didapati melalui eksperimen, hasil alkoholisis iaitu Monogliserida dapat mencapai setinggi 95%. Alkyd resin yang dihasilkan akan dianalisis dengan Fourier Transform Infrared (FTIR) dan Nuclear magnetic resonance (NMR) spectroscopy. Aktiviti alkyd resin terhadap bakteria juga diuji dengan cara Kirby–Bauer. Secara kesimpulannya, penggunaan MgO nano sol bukan sahaja dapat memendekkan masa reaksi namun juga dapat dijadikan agen antibakteria yang efektif.