FINAL REPORT

FUNDAMENTAL RESEARCH GRANT SCHEME

SYNTHESIS AND DEVELOPMENT OF POLYOL FROM REFINED PALM OIL AND THEIR EFFCT IN THE FORMATION OF POLYURETHANE CELLULAR STRUCTURE

FRGS0211-TK-1/2010

BY

ASSOC. PROF. DR. COSWALD STEPHEN SIPAUT (PROJECT LEADER)

MURNI SUNDANG (CO-RESEARCHER)

SARIAH SAALAH (CO-RESEARCHER)

FEB 2010-30 APR 2011

UNIVERSITY MALAYSIA SABAH

RESEARCH SYNOPSIS

In this study, synthesized polyols from refined palm oil, one of the ingredients in producing polyurethane (PU) foam, were investigated. The effects of reaction time, pH and type of solvents used on the properties of the polyols were characterized by using gas chromatography mass spectrometry (GC-MS), fourier transform infrared (FTIR) spectroscopy and gel permeation chromatography (GPC). Further studies were carried out by using the synthesized polyols in combination with other chemicals for PU foam formation. The characterizations of the PU foams were performed through chemical, morphological and thermal analyses. The results showed that the polyols were synthesized successfully from refined palm oil by using epoxidation and the hydroxylation process. 50 % of the unsaturated fatty acids in the refined palm oil were converted to saturated fatty acids and hydroxyl compounds as the reaction time increased up to five hours. However, the chemical contents in the polyols did not show significant changes as the pH value increased from pH 3 to pH 7. Using different types of solvent in the process showed that the hydroxyl content of the polyols ranged between 57 to 69 mg KOH/ g, with $\overline{M}_w$ in the range of 15325 to 19320 g mol^{-1}. The results also revealed that not all the synthesized polyols were suitable for PU foam formation. It is recommended that the minimum hydroxyl content and molecular weight of the synthesized polyol required for PU foam formation is 69 mg KOH/ g and 19320 g mol^{-1} respectively. The properties of PU foam are highly dependent on the polyol and the water (blowing agent) content.

SINOPSIS KAJIAN

Dalam kajian ini, poliol yang disintesis daripada minyak kelapa sawit bertapis satu daripada bahan-bahan dalam penghasilan busa polyurethane (PU), telah dikaji. Kesan masa tindak balas, pH dan jenis pelarut digunakan terhadap sifat poliol telah dicirikan dengan menggunakan kromatografi gas spektrometri jisim (GC-MS), spektroskopi penukaran Fourier infra merah (FTIR) dan kromatografi peresapan gel (GPC). Kajian seterusnya dijalankan dengan menggunakan campuran poliol yang disintesis dengan bahan kimia lain untuk pembentukan busa poliuretana. Pencirian busa poliuretana dijalankan dari segi kimia, morfologi dan terma. Keputusan menunjukkan bahawa poliol telah berjaya disintesis dari minyak kelapa sawit bertapis dengan menggunakan proses pengepoksidaan dan hidrolisis. 50 % daripada asid lemak tidak tepu dalam minyak masak ditukar kepada asid lemak tepu dan hidrosil apabila masa tindakbalas ditingkatkan kepada 5 jam. Walau bagaimanapun, kandungan kimia dalam poliol tidak menunjukkan perubahan signifikan apabila nilai pH dinaikan daripada pH 3 ke pH 7. Dengan menggunakan jenis pelarut yang berbeza dalam proses menunjukkan bahawa kandungan hidroksil daripada poliol dalam julat antara 57 hingga 69 mg KOH/g, dengan $\overline{M}_w$ dalam julat 15325 hingga 19320 g mol^{-1}. Keputusan juga menunjukkan bahawa bukan semua poliol yang disintesis adalah sesuai digunakan untuk pembentukan busa poliuretana. Dicadangkan kandungan hidroksil minimum dan berat molekul bagi poliol yang disintesis untuk pembentukan busa poliuretana adalah 69 mg KOH/ g dan 19320 g mol^{-1} masing-masing. Ciri-ciri busa poliuretana banyak bergantung kepada jenis poliol dan kandungan air (bahan peniup) yang digunakan.