FORMATION OF LIGHTWEIGHT MATERIALS OF POLYURETHANE

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ABSTRACT

Lightweight materials, made up from either from natural and/or derived from the industrial process can be used to solve problems in construction for civil or even road as it is lower in density contrasting to the volume, but possess high strength in mechanical properties. The highlight in this study is the impact strength of rigid polyurethanes (RPUs) using different composition of water content in formulation and the relations to the pore size and density properties of the RPUs. The diphenylmethane 4,4-Diisocyanate (p-MDI) was reacted with formulated polyol with water as blowing agent in presence of catalyst and surfactant. The sample of the Polyurethane foam was made of formulated polyol of 1%, 2% and 3% of water content produced difference in viscosity of mixture affecting their cell morphology and mechanical strength of impact strength. Results focus on the possibility of the formulation of RPUs foam to reach adequate perfomance, in terms of low density with high excellent outcome allowing lightweight materials of RPUs to be used in future application for construction.

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CHAPTER 1

INTRODUCTION

1.0 Research background

Lightweight material history covered up from the 18th and 19th century over the wide uses of basic materials. Improved lightweight materials such as aluminum, magnesium, beryllium, titanium, titanium aluminides, engineering plastics, structural ceramics, and composites with polymer, metal, and ceramic matrices began an interest in the 20th century (Campbell, 2012). A lightweight material can be referred to bio-composites formed by natural fibers and polymer matrices. The distinguishing feature of the materials having lightweight properties is that they all have low densities. Densities range from polymers which have the low density, to titanium and also alloys rather than the basic materials. Other than that, lightweight materials covered wide range of properties and as a result, full fill a wide range of applications.

Polyurethanes (PU) are the most well-known polymers used to make foams and are the single most versatile family of polymers exist. Polyurethanes can be elastomers, fibers and they can be adhesives. Polyurethanes are made by reacting di-isocyanates with di-alcohols. As an example, the Polyurethanes was used in rigid foam for construction and insulation, flexible foam for mattresses, cushions and car seats and also elastomer (Lazonby, 2017) Great efforts have been made to develop lightweight materials from abundant natural resources and agricultural by-products, including biofibers, biopolymers and biocomposites.

Increasing study in developing novel bio-based materials from renewable agricultural and natural resources started as the organization has a concern on the aspect of the non-renewability of petroleum resources and environmental issues (D. Zhang, 2014). Some researches has been circulating around Polyurethane as