

**BIODEGRADABLE CELLULOSE-BASED AEROGEL
FROM RECYCLED PAPER**



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5. Report

5.1 Proposed Executive Summary

One of the focus areas in the second thrust of the eleventh Malaysia plan which is improving well-being for all. In order to achieve a comfortable standard of living and quality of life, environmental risk should be lowered. Every year, large amount of paper being used in UiTM Terengganu for academic and administrative purposes. The large amount of paper-related waste generated annually causes environmental pollution. Therefore, this study will focus on developing a eco-friendlier process to convert paper waste into usable products, namely as cellulose-based aerogel that can contribute towards environmental protection.

Papers that made from lignocellulosoic fibers consist of a high percentage of cellulose. In addition, cellulose is well-known the most abundant biopolymer. Aerogels are porous and lightweight materials. Aerogels are formed by replacing the liquid within the gel with gas, resulting in low density solids. Traditionally, aerogels are made from silica gels or carbon gels. Therefore, producing cellulose-based aerogel from recycled paper is environmentally friendly alternative material for further applications.

Cellulose from recycled paper will be extracted by using dissolution in deep eutectic solvent (DES) containing choline chloride and urea. Then, colloidal suspension of cellulose will be frozen. Later, freeze drying will be carried out to obtain the desired cellulose aerogel. Optimization also will be carried out in order to determine the optimum condition in preparing recycled paper cellulose aerogel.

In this study, a simple, cost-effective and fast method will be proposed to convert paper waste into cellulose-based aerogel. It is expected that the produced material has the biodegradability and high absorbency properties. Thus, the produced materials will be potentially used in some applications such as to replace non-biodegradable super absorbent polymers and as super high oil absorption.

5.2 Enhanced Executive Summary

The increasing amount of recycled paper generated around the world has caused disposal problems to the environment. Valuable material such as cellulose can be extracted from these recycled papers. Then, cellulose-based hydrogel and cellulose-based aerogel will be prepared since most of the available hydrogel and aerogel are made from non-renewable and non-biodegradable materials.

Hydrogel is a material exhibit the three-dimensional hydrophilic polymer structure that can absorb and hold great amount of water, saline or physiological solutions and have been generally utilized as part of agricultural, biomedical field, tissue building. Aerogel is a highly porous solid material, exhibit a several of unique characteristics including ultralow density, high specific surface area as well as high porosity. In this study, cellulose from recycled paper was extracted using deep eutectic solvent (DES), which composed choline chloride and urea. Then, hydrogels was prepared from extracted cellulose in NaOH/Urea solvent by using epichlorohydrin (ECH) as a cross-linker. The cellulose-based aerogels from recycled paper also was prepared using NaOH/Urea solvent.

Characterization and chemical analysis of extracted and produced materials were carried out with Fourier Transform Infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA). Furthermore, optimum condition to produce cellulose-based hydrogel and aerogel not widely been discussed yet. To perform the optimization process, software named Design-expert was utilized in order to use the technique of response surface methodology (RSM). Central composite design (CCD), which is one of the methods in RSM was used to analyzed the response in order to optimize the hydrogel and aerogel. Based on the results of this experiment, it is expected optimum condition can be achieved.

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