FORMATION OF THIN FILM NANOFIBRE OF POLYACRYLIC ACID (PEO) - CARBOXYMETHYLCELLULOSE (CMC) – POLYETHYLENE OXIDE (PEO) BY USING ELECTROSPINNING TECHNIQUE

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ABSTRACT

Formation of thin film nanofibre of PAA-CMC-PEO was conducted via electrospinning technique. The purpose of this study is to study the electrospun film after blending the polymer of PAA-CMC-PEO. The purpose of this study is to determine the possibility of the polymer blended solution to be electrospun and secondly to characterize the electrospun nanofibre polymer blended of PAA-CMC-PEO. Three different solutions were prepared namely PAA-ethanol, PEO-water-ethanol and CMC-water before vigorously mixed together forming polymer blend solution at the ratio of 68:21:11. The blended solution of PAA-CMC-PEO was measured the viscosity and conductivity of the solution in order to determine the suitability of the solution to be electrospun. Morphology of the electrospun film was determined by using Field Emission Scanning Microscope (FESEM) and the diameter of the electrospun nanofibers was determined by using Image J software. The hydrophilic properties of the electrospun and pure conventional films were determined by using contact angle. Fourier Transform Infrared Spectroscopy (FTIR) was used to analyze the compound exist in the electrospun film after electrospinning. Based on the experimental result, it can be concluded that the electrospun nanofibre has successfully produced by using electrospinning technique with the ratio of blended solution of PAA-CMC-PEO, 68:21:11. The morphology of electrospun nanofibre was analyzed. The averafediameter of electrospun nanofibre is 400 ± 65 nm. The hydrophilic properties of the electrospun nanofibers was determined and it can be concluded the hydrophilic properties of PAA influence the hydrophilicity of the polymer blended electrospun nanofibers. The contact angle of electrospun nanofibre is 20.20°. All characteristic of polymers was exist in the electrospun nanofibre in the FTIR analysis with the finding of RC=O, OH, cellulose,C-O-C, CH_3 and C-O-H. It is proven that all three polymer exist in the polymer blended solution of PAA-CMC-PEO. Both objective achieved.

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CHAPTER ONE

INTRODUCTION

The material used in electrospinning is important to be determined because it will influence in the production of fibre. The usage of biodegradable material such as carboxymethylcellulose (CMC) alone without blend with other material to be electrospun is quite challenging. Biodegradable polymer is the one that undergo biodegradation. Biodegradation is decomposition process of carbon contained chemical compound by using enzymes secreted by living organisms (Nambiar et al, 2010). There are several researches has been done to electrospin the CMC but in the addition of polyethylene oxide (PEO) such as research performed by (Esmaieli et al, 2017) and (Poulami et al, 2017). However, there is no research yet to be done in the electrospinning of the blend of three polymers involving polyacrylic acid (PAA), polyethylene oxide (PEO) and carboxymethylcellulose (CMC). Polymer could be divided into natural and synthetic polymer. CMC is in the class of natural polymer whereas PEO and PAA are synthetic polymers (Othman, 2014).

There are three polymer involved which are PEO, PAA and CMC. These three polymers are different in characteristics. All properties of each polymer are important because it will affect the conductivity and viscosity of the solution before electrospinning. There are many researchers use conductive polymer such as poly aniline for electrospinning because the higher the conductivity of the polymer solution the smaller the diameter of the fibre produced (Zhong et al, 2002).

PAA and CMC is polyelectrolyte polymers. According to IUPAC definition, polyelectrolyte is a polymer that comprised of macromolecules in which some portion of it units contains ionic or ionisable group (Ratna et al, 2017). PAA is ionic polymer that is soluble in water and many organic solvent. PAA could be function as a stabilizer for nanoparticles synthesis and also could be used as a binder of the interaction between organic and inorganic materials as it have carboxyl functional group. PAA applicable in many application including sensors researches by (Youngtang et al, 2017) and (Bin Ding et al, 2005), as a binder for lithium-sulfur