UNIVERSITI TEKNOLOGI MARA

FORMULATION DEVELOPMENT OF CARRAGEENAN BASED NANOFIBERS VIA ELECTROSPINNING TECHNIQUE

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Thesis submitted in partial fulfillment
of the requirements for the degree of
Bachelor of Engineering (Hons.) Chemical

Faculty of Chemical Engineering

July 2019

ABSTRACT

Production of nanofiber carrageenan (CAR) based biopolymer using electrospinning was investigated. Two types of PVA polymers i.e, fully hydrolyzed (FH) and partially hydrolyzed (PH) PVA types were used as cross-link agent or co-polymer. Concentration of CAR was prepared with 1.0 w/v% in distilled water while the concentration of 10,11,12 & 13 w/v % of PVA in distilled water for 5 hours under 90°C and without heat for FH PVA and PH PVA respectively. The cross-link ratio of 70:30 (PVA: CAR) were mixed, prior to electrospinning. After cross-link, the spinning solution properties were at range of 35.93-91.90 cP in viscosity and 413-492 μS/cm for the CAR with PH PVA (10,11,12 & 13 w/v%). Meanwhile, for the CAR with FH PVA (10,11,12 & 13 w/v %) the viscosity and conductivity range were at 315.33-739.31 cP and 275-297 μS/cm respectively. The electrospun nanofibers were successfully fabricated and the effect of different PVA types on the nanofibers characteristics were investigated through SEM (Scanning Electron Microscopy) and Contact Angle analysis. Nanofibers with FH PVA and CAR blend produced uniform and smooth nanofiber at 12 w/v % FH PVA concentration with mean fiber diameter of 285.55 nm. In the contrary, nanofibers with PH PVA and CAR solution produced poor electrospun nanofiber quality with obvious beads formation and non-smooth appearance due to its lower molecular weight that yield unsuitable viscosity properties prior to electrospinning. Meanwhile, both PVA type promotes the hydrophilicity of the nanofiber because all contact angle yield value lower than 65° and less than 20 seconds equilibrium time with slight better absorption rate for PH PVA nanofiber blends due to lower hydrolysis degree properties. The results obtained from this work improve the applications of carrageenan in advancing the biomedical application especially in drug and nutrient delivery system.

ACKNOWLEDGEMENT

First and foremost, I would like to convey my deepest grateful to Allah S.W.T for allowing, me to have the opportunity, strength and interest to accomplish all of my final year project work. I also want to say thank you to research supervisor PM Dr. Noor Fitrah Abu Bakar and Universiti Teknologi MARA for providing unprecedented guidance and insight throughout this research journey. Gratitude and acknowledgement also to PM Dr. Fatmawati Adam and Universiti Malaysia Pahang for provide assistance in carried out the analysis and also provide financial support through grant fund, RDU 1803187.

Then I also want to express my sincere gratitude towards my family especially my parents and my friends because providing me with unprecedented morale support by giving numerous advice and positive opinions, so that I could improve myself even better. All of their sincere support really help me a lot in sustaining a good and steady work in order to finish my final year project.

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CHAPTER ONE

INTRODUCTION TO RESEARCH

1.1 Title of Research

Formulation Development of Carrageenan Based Nanofiber Via Electrospinning Technique.

1.2 Research Background

Nowadays, the chronic diseases such as cancer, heart problems, diabetes and other inflammatory diseases have emerged in becoming major death and disabilities cause around the globe. These situations give great impact and major challenges to the medical practitioners in treating these diseases (Y Luo, 2014). In the treatment high and multiple dosage of drugs were administered to the patients to reduce the severity of these diseases. But due to the prolong and repetitive usage of drugs to the body has yield serious side effects to the patients. Nowadays, the emerging of nutrients compound usage to replace the drugs have spark interest of many researchers in the treatment of chronic diseases. Nutrients that derived from foods are the bioactive compounds that have minimal side effects and various biological activities. In addition, due to its natural origins, nutrients display poor stability, low bioavailability and hence made it more delicate or labile than drugs (Y Luo, 2014).

Oral cavity is one of the site option available for the drug and nutrient delivery purposes. According to (Garsuch, 2009), about 60% of drugs dosage administered through oral route and solid drug forms are commonly used such as capsules or tablets due to ease of administration (Garsuch, 2009). But for pediatric and geriatric patients, the solid drugs cannot be swallowed due to choke feared (S, A, S, & M, 2010). Hence, the (OFDDS) oral fast dissolving drug delivery system is more favorable options for these patients. Other than that, this option also favors to younger children that normally difficult to accept any drugs or nutrients medication either in liquid or solid dosage form. The thin orodispersible film is fabricated from hydrophilic polymers (natural or synthetic) with nutrients