FABRICATION AND CHARACTERISATION OF XANTHAN GUM- GELATINE BLEND NANOFIBERS/PARTICLES PRODUCED BY ELECTROSPINNING METHOD

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This study aims to obtain nanoparticles by electrospinning method using xanthan gum (XG) and gelatine (GEL) polymers. For the development of these nanoparticles, ten different groups were produced. In some groups, nanofiber was obtained instead of particles. The nanofiber formation was determined in the 10 wt% GEL, 12 wt% GEL, 3 wt% XG, 8 wt% GEL + 3 wt% XG. 12 wt% GEL + 0.1 wt% XG groups. 4 wt% GEL + 1 wt% XG and 8 wt% GEL + 3 wt% XG groups showed nanoparticles structure. To assess the nanofibers chemical properties, Fourier transform infrared spectroscopy (FTIR) were used. Scanning electron microscopy (SEM) was used to characterize mechanical and morphological properties. Physical properties and swelling behaviours were examined to analyse the samples. As a result of the swelling test, 3 wt% XG was degraded, 10 wt% and 12 wt% gelatin groups started to degrade after the fourth day. Our work deduced that GEL/XG nanoparticles could use for carrier purposes. Also, this study was beneficial in finding the right ratios in the production of nanoparticles and nanofibers from the XG/GEL mixture by electrospinning. In addition, proper electrospinning parameters in nanofiber and nanoparticles production are also important results of the study and will be further used in developing composite nanostructures with regenerative or drug release capability.

Keywords: *gelatin; xanthan gum; electrospinning; particle; fiber*

1. Introduction

Nanofibers produced by the electrospinning method allows polymer fibers to form between a few nanometers and a few microns. This technique has been widely used in recent years. Reasons for the preference of nanofibers are that they can be produced easily by electrospinning, which is an inexpensive technique, their surface area is large, their mechanical properties and diameters are adjustable, surface with high porosity and nanoscale dimensions, successfully employed in a variety of medical applications, including antibacterial dressing (1), wound dressing (2), scaffolds and artificial organ (3). Fibrous structures are not as good for drug delivery systems as nanoparticles. Therefore, a uniform beadless nanofiber structure can be used in protective clothing, drug delivery systems, or additive (4). Drug loading capacity can be regulated by particle sizes. In this way, the nanoparticles can be used as drug carriers (5).

With the electrospinning method, nanofibers can be produced different morphologies and smooth from different polymers (6, 7, 8). In this method, nanofibers are obtained from polymers by applying an electric field. In the electrospinning technique, nanofibers with different morphologies can be produced by changing parameters such as voltage, distance, feed rate and concentration (9, 10). Nanofiber diameters are also one of the critical parameters in the electrospinning technique. As the viscosity increased, it was determined that a larger nanofiber diameter was obtained (11, 12).

Gelatine (gel), which is a natural polymer and has hydrophilic properties, is a commercially produced polypeptide from the hydrolysis of collagen, and it is simple to obtain and inexpensive (13, 14). Also, gelatine and its derivatives have properties such as non-toxic, biocompatibility and biodegradability. Due to these properties, gelatine can be used in the scaffold in tissue engineering, in synthesizing bio composites containing a variety of chemicals, including medicines and nanoparticles (15). In a study, it was reported that fibroblasts grow well on gelatine nanofibers. According to these results, it was stated that gelatine predicted to provide important structural and chemical hints and valuable in tissue engineering and regenerative medicine (16). In addition to these areas, gelatine has been used in drug delivery applications (17, 18,19).

Xanthan gum (XG) is a heteropolysaccharide obtained from the bacterium *Xanthomonas campestris* (20, 21). XG consists of the main chain with β1-4-linked and repeating D-glucose units and a side chain of D-mannose and D-glucuronic acid. It can be compatible with metallic salts, showing stability at different pH levels, temperatures and high viscosity at low concentrations (21). XG, which can be used in medicine and pharmacology thanks to its biocompatibility, bio-adhesiveness and wound healing properties, has been approved by the FDA thanks to these properties (22). XG is growingly employed for the development and enhancement of drug delivery systems due to its physicochemical features (23). XG has been used for many biomedical and pharmaceutical purposes such as antiviral carriers, antibacterial carriers, anticancer

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