Preparation and characterization of electrospun poly(butylene succinate-*co*-butylene adipate) nanofibrous nonwoven mats

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Electrospinning has gained much attention in the last decade not only due to its versatility in spinning a wide variety of polymeric fibres but also due to its consistency in producing fibres in the submicron range [1]. This technique has been developed since patented by Formhals in 1934 [2]. In electrospinning, the spinning of fibres is achieved primarily by the tensile forces created in the axial direction of the flow of the polymer by the induced charges in the presence of an electric field, as has been quite well described by other studies [3].

The manufacturing of fibrous polymeric mats, with diameters in the range from several to hundreds of nanometers, is of considerable interest for various applications, such as filtration, nanocomposites and tissue engineering [4]. The morphology of electrospun fibres depends on many factors such as (a) solution properties including solvent volatility, concentration, viscosity, surface tension and conductivity, (b) process parameters including applied voltage, flow rate, nozzle-collector distance and (c) spinning environment including relative humidity and temperature [1].

To date, electrospinning has been applied for nanofibre production of numerous polymer solutions [5,6]. In addition, aliphatic polyesters such as poly(ε-caprolactone) (PCL) [7], poly(lactic acid) (PLA) [8], poly(glycolic acid) (PGA) [9] and their copolymers [9] have also been processed by electrospinning to generate nanofibres. However, there is no study regarding the use electrospinning for the development of nanofibrous mats of aliphatic polyesters made from dimethyl esters and diols, such as poly(butylene succinate) (PBS), poly(butylene adipate) (PBA) and their copolymers (PBSA).

The aim of the present work was the development of biodegradable poly(butylene succinate-*co*-butylene adipate) (PBSA) electrospun mats with potential applications both as filters and fiber mats serving as reinforcing component in composite systems. In particular, the effect of instrument parameters including polymer concentration, solvent and applied voltage on the morphology, crystallinity and thermal properties of the electrospun nanofibres was evaluated.

The nanofibrous mats of poly(butylene succinate-*co*-butylene adipate) (PBSA) were prepared by electrospinning PBSA solutions in methylene chloride (MC) and MC / (*N,N*–dimethylformamide) DMF mixtures (Fig. 1). The morphology and the thermal properties of the electrospun mats were investigated by scanning electron microscopy (SEM), wide angle X-ray diffraction (WAXD) and differential scanning calorimetry (DSC).

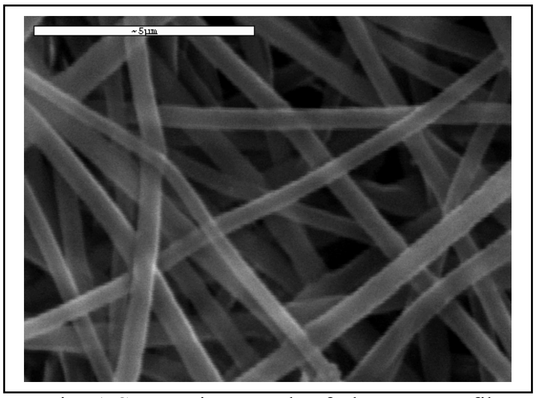

Fig. 1 SEM micrograph of electrospun fibres from a 10 wt% PBSA solution in MC/DMF (80/20).

According to the results, electrospinning procedure was certainly enhanced as well as fiber diameter decreased as increasing DMF volume fraction. In addition, increase of the concentration from 5 to 15wt% led to more uniform nanofibres without beads. Crystallinity and thermal properties of electrospun PBSA, such as melting point, heat of fusion and glass transition temperature decreased as compared to raw material.

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