The effect of temperature on the electrospinning of chitosan/PEO solutions

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Chitosan is a modified natural polymer derived from chitin, one of the most abundant renewable natural polymers in the world. Recently chitosan has attracted a great deal of attention and has been used in a broad range of applications due to its valuable properties such as biocompatibility, biodegradability and antibacterial activity. Our focus in this study is to produce chitosan in the form of films and membranes for filtration and antimicrobial packaging purposes. The nanoporous morphology of films and membranes enhances their efficiency because of the large increase in specific surface area. Therefore nanoporous chitosan mats can not only present the specific physicochemical properties of chitosan but also synergistically benefit from the physical properties of nanoporous films. The electrospinning process is a simple and efficient technique to produce polymeric nanofibers, resulting in non-woven porous mats with high specific surface area of 40-100 m2/g. Chitosan is challenging to electrospin, mainly due to its polycationic nature and rigid structure in the solution state. The viscosity of chitosan solutions is usually quite large; hence the minimum concentration range required for successful electrospinning cannot be obtained. Adding a second polymeric phase such as PVA or PEO as a co-spinning agent is an efficient way to solve the problem. In this work, preliminary trials have shown that PEO is an excellent co-spinning agent for chitosan. In addition, we modified our electrospinning setup to be able to control the electrospinning temperature and thus allow the control of the viscosity of chitosan and its blends. The impact of temperature and rheological properties on the electrospinning of chitosan solutions were investigated in order to increase the chitosan content in the final produced nanofibers. The rheological behaviour of solutions was alos characterized in shear and elongational flow. The effects of PEO content and temperature on the electrospinning process and the final produced nanofibers will be discussed.