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Thermally and chemically assisted electrospinning of gelatin aqueous solution: An innovative approach toward biocompatible scaffold

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Electrospinning of gelatin aqueous solutions has been the ultimate goal of enormous studies over the last decade because of bio-related advantages of using water. In order to achieve optimal gelatin nanofibers in aqueous systems, both the syringe and the chamber temperatures, which have not been investigated thoroughly in the related literature, must be considered as they determine whether electrospinning process is accessible. In this study, we designed and utilized two thermal devices (a chamber heater and a syringe dressing heater) to simultaneously achieve perfect morphology and efficient production rate. In spite of our endeavors to optimize process of spinning by heating, an efficient, steady process could not be obtained due to immediate occurrence of material gelation. By and large, exceeding over 50 °C inspired the assumption that the high viscosity is not the sole reason to disrupt the process. To prove it, we present two hypotheses based on effects of solution viscosity and surface tension on the process. Rheological investigation revealed that initial gelation temperature plummeted about 2 °C while pH was increased 6.5 units. Also, control on ion content of the solution was necessary to investigate the role of surface tension (monitored by contact angle measurements) in gelation. In conclusion, although viscosity should be controlled by heating procedures, window of efficient spinning was opened by proper surface tension adjustment of solution, which permits molecules to jet and prevents clogging at nozzle. This approach leads to a continuous and perfect process of spinning and formation of 3D scaffolds for biomedical purposes.

Biography

Sadegh Golie has completed his Master's degree from Iran Polymer and Petrochemical Institute. He had a Polymer Material's background in the Bachelor degree and has changed it to the Biomaterial Interdisciplinary field. He has focused on the corneal tissue engineering by using the bioplymers and novel fabrication methods and he is also currently studying renaturation of the gelatin to collagen.

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