Engineering size and release rate of mono-disperse core/shell particles via co-axial electrospraying for protein drug delivery

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Polymeric micro-/nanoparticles have widely been used in drug delivery systems. To control the release rate of proteins and improve the efficacy, the modification of particle dimension and morphology has been an important research topic. Although many technologies (i.e., emulsion, suspension, spraying drying, etc) have been developed to fabricate the polymeric particles, there are severe drawbacks in each method. Electrospraying has been recognized as an attractive technology to feasibly tune particle size and morphology. However, the consolidation mechanism of polymeric solutions has never been fully established in electrospraying. Theoretical and experimental understanding has been developed for liquid droplet formation. After we investigated the electrospraying mechanisms of polymeric solutions, we designed the co-axial electrospraying systems for protein drug delivery. The size of core/shell particles was easily controlled by the flow rate of outer solutions. The use of various inner solutions of different water-soluble polymers resulted in various core/shell structures having unique release properties.