

Preparation of Pharmaceutical Nanobeads and Nanofibers via Electrospinning Method

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Novel drug delivery systems have attracted the interest of many researchers because of some advantages such as targeting the drug to the special tissues, less toxicity, patient compliance and convenience as well as improvement of the drug physicochemical properties and pharmacokinetics [1,2]. In the recent years, nanoformulations have become a major concept of modern drug delivery due to their increased surface area, [3,4] and improved dissolution rate of the less water-soluble drugs [5]. There are different technologies applied for preparation of the nanoparticles such as emulsification solvent evaporation, self-assembly, nanoprecipitation, drawing template synthesis [6], aerosol flow reactor [7] and electrospinning methods [8].

At the end of twentieth century electrostatic spinning namely electrospinning attracted interest of the researchers owing to its capability to produce ultrafine fibers [9]. This method could be benefitted in large scales due to its simplicity and cost effectiveness [10]. Electrospinning has three important components including high voltage supplier, syringe and collector [11]. A high voltage electrical field is used in this technique to form solid beads or fibers from liquid drug-polymer solution [12]. Different parameters such as distance between needle and collector, voltage, drug-polymer ratio and solution concentration could influence the characteristics of the obtained nanostructures [13]. Electrospinning has also been applied in nanocatalysis [14], tissue engineering scaffolds [15], protective clothing [16], filtration [17], biomedicine, optical electronics [18], biotechnology and environmental engineering [19]. This process has recently been used in the pharmaceutical science to improve the physicochemical characteristics of naproxen [20], ibuprofen [21,22], doxycycline [23], mebeverine, sumatriptan [25], indomethacin [3], and β -estradiol [26].

The electric charge on the surface of the liquid resulted by the high voltage/electric-field induces electrostatic repulsion forces which in turn create a liquid jet. The nanobeads are normally obtained when the low solution concentrations is injected to the collector; however, enhancing the solution viscosity -when sufficient enough- by increasing its concentration will typically cause the formation of the beads-on-string or uniform nanofibers [27]. It could be concluded that, the adjustable formulation parameters together with the simplicity of electrospinning technique make it a promising technique for being industrialized.

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