Developing Electrospinning for Continuous Manufacturing of Pharmaceuticals

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***Abstract*— The current manufacturing platform for pharmaceutical industry is batch processing from powdered ingredients which entails a huge cost due to storage and transfer between the disconnected steps along with the agglomeration and wastage problems associated with powder handling. The recent drive towards continuous manufacturing in pharmaceutical industry promises lower footprint, very fast turnover time and significant reduction in cost. Moreover, solution processing on continuous manufacturing allows one to utilize many new flow-chemistries as well as avoid powder handling. One of the efficient ways to convert solution or suspension to solid matrix is to use electrospinning. In this talk, I will be discussing the development of electrospinning on a continuous manufacturing platform for producing oral fast-dissolving tablets. Electrospinning is a technique by which a viscoelastic solution (generally polymeric) can be converted to solid nanofibers by stretching of the fluid under the application of an electric field. Electrospinning has several advantages over current technologies including very fast drying time without application of heat, lower footprint, lower cost and no powder handling step. However, the main advantage of electrospinning is to produce nanofibrous material with very high surface-tovolume ratio. This makes electrospun materials a great candidate for delivering poorly water-soluble drugs into the human body via a fast dissolution mechanism. Free-surface electrospinning offers a way to scale-up for industry use of this technique. Free surface electrospinning of aqueous solutions of polyvinyl alcohol (PVA) have been performed using a wire electrode. The challenges of spinning and achieving a high-throughput from these solutions will be discussed. A model for productivity rate that was previously developed for an ethanolic polymer solution has been successfully applied to the aqueous systems as well, thereby demonstrating the robustness of the model. This model emphasizes two operating regimes, namely, entrainment-limited and field-limited. The highest productivity occurs at high applied potential and a relatively low rotation rate, due to the high viscosity of these solutions.**