Mesoporous Materials for Drug Delivery

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Since the discovery of ordered mesoporous silica materials in 1990s, synthesis and applications of mesoporous solids have received intensive attention due to their highly ordered structures, larger pore size, and high surface area. In the past decade, mesoporous materials have found a lot of applications in separation, catalysis, sensors and devices. Due to stable mesoporous structure, well-defined surface properties and non-toxic nature, mesoporous silica materials seem ideal for encapsulation of pharmaceutical drug, proteins and other biogenic molecules. In recent years, employing mesoporous silica materials for hosting and further delivering of a variety of molecules of pharmaceutical interest has been appeared. It has been shown that both small and large molecular drugs can be entrapped within the mesopores by an impregnation process and liberated via a diffusion-controlled mechanism.

Since the report by Vallet-Regi et al. in 2001 using MCM-41 as a new drug delivery system, a lot of investigations have been done in this area, developing different types of mesoporous materials with varying porous structure and functionality for sustained drug release and stimuli-responsive release. The studies showed that the mesoporous silica spheres with hollow core/mesoporous shell provide much higher drug loading capacity than the conventional mesoporous silica such as MCM-41 and SBA-15. Furthermore, microspheres are widely accepted as useful drug delivery systems because they can be ingested or injected and present a homogeneous morphology. Here, we will show several examples of this novel application of mesoporous materials as carriers for drug delivery.