Nanoporous Silica and Its Application in Drug Delivery

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ABSTRACT

Nanoporous silica was prepared and tested for its application in drug delivery. In the synthesis, tetraethyl orthosilicate (TEOS) was employed as a silica source and pluronic (P123) was chosen as a structure directing agent. The mixture was heated at various temperatures (30°C -60°C) and reaction times (2-4 hours). The obtained product was treated by hydrothermal and dried in hot air oven. Finally, it was calcined at 600°C to yield nanoporous silica of different physical properties. Indigo carmine was subsequently loaded by soaking the silica in the solution of indigo carmine for 48 hours. The releasing rate of the model drug was evidently affected by the physical properties of the nanoporous silica prepared. At the condition of 60°C for 4 hours, the releasing was high because the pore size of the silica was too large comparing with the molecular size of indigo carmine. Furthermore, high temperature also increased the polymerization resulting in a reduction of silanol group (Si-OH) need for binding with the model drug. At temperature of 30°C, the pore size was too small for indigo carmine. However, after hydrothermal step the pore diameter was enhanced which is suitable for indigo carmine.

Key words: Nanoporous silica, Drug releasing, Drug delivery system

INTRODUCTION

Mesoporous silica is a material which have pore diameter in the range of 2-50 nm. It has attractive features, such as large pore volume, uniform pore size distribution, and large surface area. Furthermore, it is also non-toxic and biocompatibility material. All these properties promote many research themes. Mesoporous silica is used versatile such as catalyst support (Subrahmanyam, 2004; Ooi et al., 2005), CO_2 capture (Khatri et al., 2005), remove of heavy metal in waste water (Sayari et al., 2005), and template of carbon nanotube synthesis (Zhu et al., 2002).

Application in drug delivery of mesoporous silica is very interesting because the uniform of pore size can control the releasing rate of drug. Moreover, silica has