of Ca^{2+} ions and Si-OH groups on the MBG surfaces. Drug molecules can be chelated with the Ca^{2+} ions on the mesopore walls, and thus can increase the drug capture performance and controlled drug-release property (Zhao et al., 2008). In addition, a large number of Si-OH groups in MBGs play a positive role in attracting drugs or growth factors via the hydrogen bonding or electrostatic attraction between them (Xia and Chang, 2006).

The kinetics of drugs released from MBGs can be described by a semiempirical power-law expression (Kim and Fassihi, 1997):

$$Q = a + b \cdot t^k \tag{4.1}$$

where Q is the amount of drug released from drug carriers; t is the time; and a, b, and k are constants. The power-law function of Eq. (4.1) is related to the Weibull function, which has been used as a universal tool for expressing drug release from Euclidian and fractal systems (Hong et al., 2010; Villalobos et al., 2006). The constant a is related to initial delay or burst effects, the kinetic constant b, and the power-law exponent k can well characterize the drug diffusion process (Kim and Fassihi, 1997). Hong et al. have fabricated the gentamicin sulfate (GS)-loaded MBG hollow fibers (MBHFs) with different lengths of MBGHFs (5–10, 2–2.5, and 0.2–0.3 mm), and investigated the release behavior of the GS-loaded MBGHFs (Hong et al., 2010). The release behavior of the GS-loaded MBGHFs is put into Eq. (4.1) when $k = 0.5$; the profiles of both the 5–10 and 2–2.5 mm MBGHFs can be linearized, suggesting that the release behaviors of both samples abided by the Higuchi model, a Fickian diffusion of Case I (Villalobos et al., 2006; Kim and Fassihi, 1997). The kinetic constant (b) of the 2–2.5 mm MBGHFs is approximately 2 times larger than that of the 5–10 mm MBGHFs. However, the release behavior of the MBGTs can be linearized only when $k = 1/3$ rather than the Higuchi model (Hong et al., 2010).

4.3.2 Drug-Loaded MBGs for Enhanced Bactericidal Property

In orthopedic surgery, artificial bone implants are widely used for the treatment of bone defects, but the implant-associated infection may result in prolonged antimicrobial treatment, failure of implant, extensive bone debridement, and increased patient morbidity (Liu et al., 2014; Zimmerli et al., 2004). The common method is a systemic antibiotic administration, such as injection of a dose or taking of a pill as a conventional therapy. The main disadvantage of the above method is the risk of systemic toxicity because of the limited effective local antibiotic concentrations (Donlan and Costerton, 2002). Fortunately, an alternative strategy has been developed by introducing a controllable antibiotic delivery system into artificial bone implants (Polo et al., 2017; Li et al., 2013; Zhu et al., 2011a; Ye et al., 2014; Garg et al., 2017).

In previous work, we fabricated gentamicin-loaded MBGs (Gent-MBG) (Li et al., 2013). The MBG possess a high surface area and mesoporous structure,