leaching properties can be quantified and subsequently realized in terms of a clinically viable release profile.

18.5.3.2 One-Pot Synthesis Method for Synthesis of Magnetic and MMBGCs

Synthesis of magnetic mesoporous materials is another technique gaining significant traction in terms of multiple biomedical applications. The system basically comprises magnetic particles suspended in a matrix of materials such as polymer (Zhang et al., 2007), lipid (Cinteza et al., 2006), and silica (Kim et al., 2006) for tissue engineering purposes in general and for fabricating bioactive glass composite scaffolds in particular. MMBGCs have been drawing center stage attention of late owing to substantial head ways in the realms of drug delivery (Ruiz-Hernandez et al., 2007), tumor therapy (Veverka et al., 2007), and imaging techniques (Bull et al., 2005). These applications are predicated on the aggregation and subsequent rapid biodegradation of magnetic nanoparticles at the target site. Based on these principles, magnetic and MMBGCs have been successfully synthesized by Li et al. (2008). They made use of a novel one-pot synthesis technique to inculcate all precursors into the composite via simultaneous EISA process.

The basic technique for synthesizing MMBGCs using the one-pot synthesis route involves making use of a block copolymer template ($EO_{20}PO_{70}EO_{20}$) (P123) and the precursors P123, tetra ethyl orthosilicate (TEOS), $Ca(NO_3)_2{\cdot}4H_2O$, $Fe(NO_3)_3{\cdot}9H_2O$, and tetraethyl phosphate (TEP). A solution of these additives is made with 1.0 g of 0.5 M HCl after dissolution in 60 g of ethanol. The solution is then stirred at room temperature for at least 24 h. The resultant sol is subjected to the EISA process. The dried gel is calcined at 700°C for 3 h in air followed by further calcination at 380°C for 3 h in a hydrogen/argon atmosphere in order to yield the final products. These scaffolds were further assessed for potential applications in drug delivery. For drug loading, ibuprofen solutions were prepared in determined concentrations derived from ibuprofen hexane solutions with 1-g MMBGCs with a concentration of 40 mg mL^{-1} at room temperature. Separation of the ibuprofen samples from solution by centrifugation preceded vacuum drying at 60°C. The synthesized MMBGC-based drug storage materials were then compacted into disks for a simultaneous assessment of bioactivity (in terms of HCA-forming ability)—visible as phosphate, carbonate, and hydroxyl absorption bands on FTIR spectra (Rehman and Bonfield, 1997), and drug release profile after performing SBF immersion studies. SBF solution preparation with tris-(hydroxymethyl)-aminomethane and HCl was performed. Based on deductions made from EDX, XRD, and TEM results, the synthesized MMBGCs boasted an ordered mesoporous structure with a homogenous distribution of Fe_3O_4 nanoparticles suspended in an amorphous silicate matrix comprising Ca and P. The primary elemental composition of the MMBGCs was Si, O, Ca, and Fe with the chemical composition of the final product corresponding with the values of the precursors.