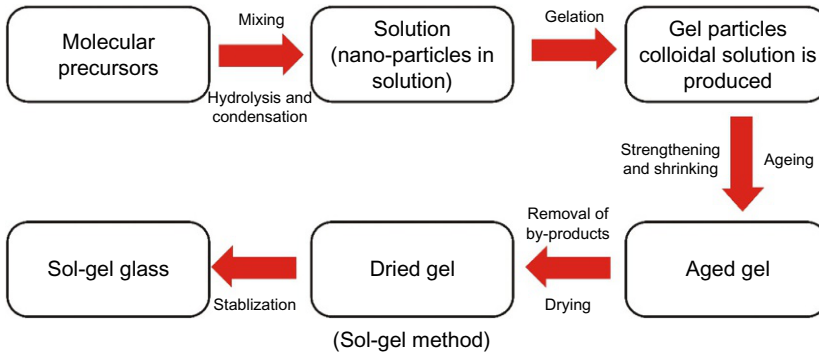

FIG. 18.2 Schematic representation of the sol-gel method for the development of glass.

reduced connectivity of sol-gel glasses in contrast to glasses prepared via the melt quenched method contribute to higher dissolution rates and concurrently bioactivity. Therefore, this method is credited with providing high purity glasses with more homogeneity but processing should be done at lower temperatures. Although scaffolds derived from sol-gel method may exhibit low strength values, the process is found to be highly versatile in that particle size and morphology can be significantly altered by fine tuning of parameters such as the water/alcohol ratio, type of alcohol and precursor, and/or the concentration and type of catalyst. Thus it can be stated that the bioactivity of glasses can be controlled by both composition and the process when harnessing sol-gel chemistry (Schubert, 2015). Sol-gel method derived bioactive glass are considered near ideal materials for substituting defects in low-load bearing sites and have enhanced bioactivity, compared to melt derived glasses because of the highly porous nature of this material (Kaur et al., 2014; Ignatius et al., 2001) (Fig. 18.2).

18.5.3 Mesoporous Bioactive Glass Scaffolds

The design of mesoporous structures for fabricating bioactive glass scaffolds is an attractive prospect given the innumerable advantages associated with it. These include an ordered mesoporous structure, the ability to customize pore size, pore volume, and surface properties (Zhu et al., 2008). For many tissue engineering applications, scaffolds possessing a macroporous structure with an average pore size of 100 μm or larger are deemed adequate for facilitating nutrient delivery and concomitantly tissue in growth toward the center of the regenerated tissue (Okii et al., 2001). However, this is not to imply that scaffolds with an average pore size at the nanoscale level have had a falling out of late. On the contrary, mesoporous nanoscale scaffold materials having pore size ranging between 2 and 50 nm are center stage when it comes to addressing pitfalls associated with drug delivery and bone regeneration. The logic in the latter case being clear documented advantages in terms of enhanced levels of cell adhesion