to that in the use of 45S5 glass. The chemical composition of commonly tested boron-containing glasses for scientific purposes is shown in Table 8.1.

The human body shows tolerance to high doses of boron (Weir and Fisher, 1972; Agency, 2004). Inorganic borate compounds are present mainly as boric acid $B(OH)_3$ in biological fluids and approximately 90% of ingested boron is excreted in urine. Boron compounds, especially boric acid, have been used in many medicinal purposes and preparations such as: antiseptics, antibiotics, cosmetics, and insecticides. In dermatology, boric acid is still used for the disinfection of wounds, leg ulcers, and small skin injuries. Borosilicate compounds are widely used in cosmetics (Becker et al., 2013). Boron may have a preventive or therapeutic effect that helps to diminish bone mineral loss in susceptible populations (Meacham et al., 1994). Poisoning with boron can occur through several means, including direct skin contact, inhalation, ingestion, or a combination of these mechanisms. Borate poisoning produces gastrointestinal, central nervous system, skin, renal, and hepatic toxicity and can lead to death (Jiráková et al., 2015; Webb et al., 2013; Farfán-García et al., 2016).

The most common methods to produce boron-containing bioactive glass materials are melt quenching routes and the sol-gel technique (Kaur et al., 2016). The comparative studies of sol-gel derived and melt quenched glasses showed that the synthesis technique causes differences in the texture and the glass structure. With increasing amounts of B_2O_3 in the silicate glass, the melting point decreases and thermal stability increases (Gharbi et al., 2016). Melt quenching techniques require to be performed in covered crucibles to prevent evaporation of individual components: alkalis, boron, phosphorus, and fluorides (Gharbi et al., 2016; Hench, 2013). The sol-gel derived glasses showed a more polymerized structure, higher porosity, and specific surface area values, enhancing the solubility. The advantages of the sol-gel method are the low temperature processing, the purity and homogeneous distribution of the components, higher porosity, and specific surface area values and the possibility of particle size control. Increasing the specific surface area and pore volume of bioactive glasses greatly accelerates its dissolution and HAP formation on the surface and therefore enhances the bioactive behavior.

8.2 GLASS STRUCTURE

Bioactive glasses are built from network formers, network modifiers, and intermediate oxides. The primary network formers in bioactive glasses are silica (SiO_2), boric acid (B_2O_3), and phosphoric oxide (P_2O_5), which can form single-component glasses. The generic name of glass is generally derived from its network former. Bioactive glasses are amorphous solids. The basic building unit of silicate glasses is the SiO_4 tetrahedron, which is interconnected to the adjacent tetrahedra by common bridging oxygen atoms (BO) to form a three-dimensional connected network (Brauer, 2015). These tetrahedra are commonly referred to as Q_{Si}^n ($n=0$–4) units, where "n" represents the number of BO per tetrahedron (Fig. 8.1). The presence of network modifying oxides, such as: Na_2O, K_2O,