

Fig. 12. Porous poly(HEMA) gels with macroporosity (A) 62 μm and (B) 147 μm (Adapted from Annabi 2010).

Several techniques (Wake et al. 1993) have been used to obtain macroporous materials, for instance rapid prototyping techniques (e.g., 3D printing and stereolithography) use software to plot the porous networks which are precisely sculpted in three dimensions by a method suitable to the polymer of interest (Yang et al. 2002) or the use of a particulate leaching strategy such as leaching of salt crystals or microspheres from crosslinked polymer scaffolds (Mikos et al. 1994). The freeze-drying is one of the most widely used methods (Cho et al. 2008). This technique produces matrices with porosity greater than 90% and the pore sizes depend on the growth rate of ice crystals during the freeze-drying process (Dore 2000; Gun'ko et al. 2005). A new technique was developed starting from the already synthesized hydrogel and guaranteeing control of the size of the pores (Barbucci and Leone 2004) (Fig. 13). The porous structure was obtained by stratifying the hydrogels into a cell culture strainer with a defined and controlled drilling. The filter was placed on a beaker containing a porogen salt (NaHCO_3) at the bottom. By adding a 0.1 M HCl solution a violent effervescence was produced. The formation of CO_2 bubbles and their passage through the filter, first, and the matrix of hydrogel, second, induced the hydrogel to assume a porous morphology (Table 2).

The degree of porosity generally has a substantial effect on the mechanical properties, with the stiffness of the scaffold decreasing as porosity increases (Gerecht et al. 2007), and the mechanical characteristics varying greatly with fluid flux caused by deformation (Martin et al. 2000). On the contrary the microporous polysaccharide hydrogels obtained starting from the preformed hydrogel, shows a decreased water

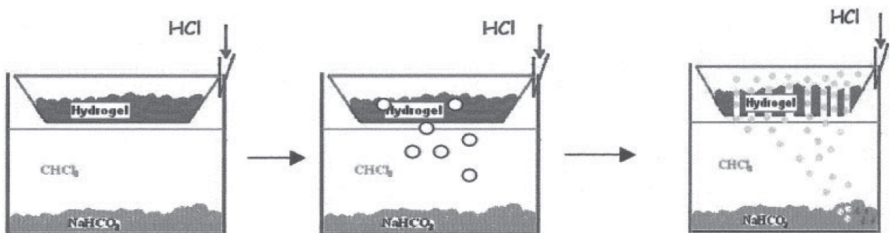


Fig. 13. Disposal and mechanism for the formation of porous hydrogel starting from a preformed hydrogel (Barbucci and Leone 2004).