3.5 Monomer ratios

PLGA is a copolymer of lactic acid and glycolic acid monomers and is available for purchase in a variety of monomer ratios. The number of lactic acid monomers is inextricably linked to the hydrophobicity of the polymer. An increase in the number of lactic acid monomers results in a reduced water uptake into the system. The bulky, hydrophobic methyl side groups of the lactic acid monomers reduce water uptake and therefore dampen the rate of phase inversion (Göpferich 1996b).

3.6 Polymer crystallinity

There is a growing body of work investigating the effect of t polymer crystallinity on drug release. A model injectable implant system that employs a crystallisable polymer should initially be amorphous to permit easy injection but should then crystallise swiftly after injection (DesNoyer and McHugh 2001). Systems with limited crystallinity result in more uniformly, dense morphologies, which lack micropores. This is a result of mild liquid–liquid demixing and therefore slower release rates of drugs. Conversely, a more crystalline system will result in more rapid release due to porous morphologies forming through phase inversion after the lag period during which crystallisation occurs. Two distinct regions are apparent in the release profiles of systems based on crystallisable polymers. Firstly a lag phase followed by burst release. Knowledge about this important polymer parameter therefore permits tailoring of drug release profiles by altering the semi-crystalline: amorphous polymer ratios (DesNoyer and McHugh 2001; Miyajima et al. 1997).

4. Biodegradation of SPI Hydrogel Implants

Biodegradation of injectable implants is essential so as to accommodate a follow on injection. Ideally, degradation should take place in parallel to drug release so that the implant is reabsorbed upon complete drug release. This will avoid any surgical intervention for implant extraction or issues with follow on administration. Thankfully, most of polymeric implants are utilized in SPI-based systems are biodegradable—through hydrolysis or oxidation mechanism. The degradation by hydrolysis is rather a fast process that can be influenced by a number of factors such as pH, type of chemical bond, copolymer composition, drug type, and water uptake (Gopferich 1996a). The degradation by oxidation is intrinsically very slow processes (Acemoglu 2004). It is also important to take into consideration polymers physical and physico-mechanical properties (e.g., molecular weight, polydispersity, melting point), as well as morphology of the formed implant. Overall, biodegradation of SPI implants is dependent upon the polymer type, molecular weight, co-polymer ratio, polydispersity and drug type and concentration. It is also dependent upon the site of administration, as the locally available micronutrients and enzymes further effect the overall biodegradation. Table 4 provides degradation characteristics of polymers that have been commonly used in SPI systems.