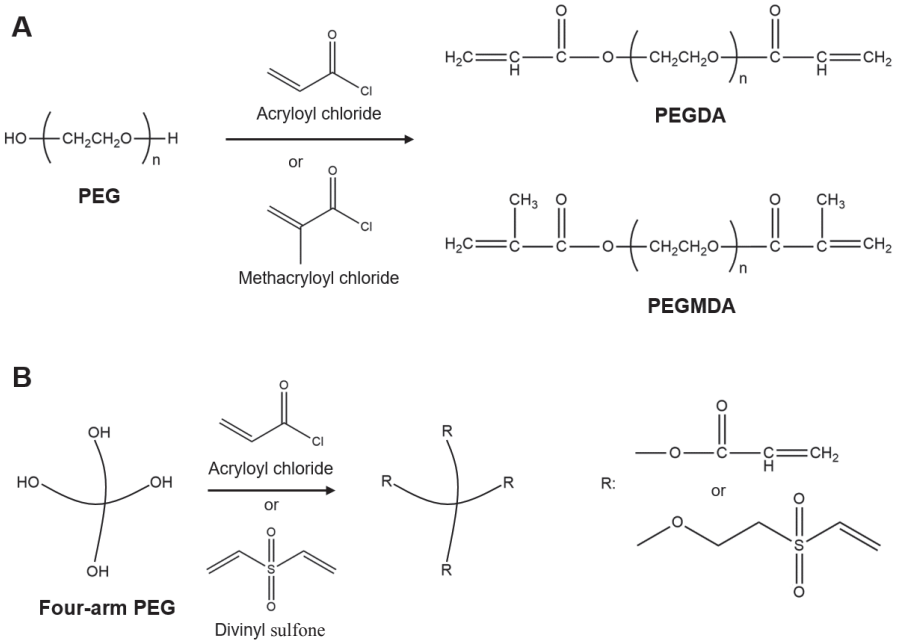

Fig. 3. Photocurable PEG-based materials (A) PEG diacrylate (PEGDA) and PEG dimethacrylate (PEGDMA) (B) 4-arm PEG acrylate and 4-arm PEG vinyl sulfone.

methacrylate > fumarate) (Husar and Liska 2012; Nguyen et al. 2015). Mechanical properties of photocurable PEG-based hydrogels can be turned by their molecular weights and concentrations. The use of multi-arm PEG derivatives (cf. Fig. 3B) is another option to enhance mechanical properties and can also offer a wide range of functionalization capability (Fairbanks et al. 2009b; Lee et al. 2016b; Wang et al. 2017). In addition, photocrosslinkable multi-arm PEG derivatives can form hydrogels through reaction with multifunctional thiols in a step growth mode upon light exposure without the presence of cytotoxic photoinitiators. This thiol-ene photopolymerization could overcome the light attenuation through the thickness of photocurable hydrogel samples and managed to cure even 10 cm thick samples (Fairbanks et al. 2009b; Rydholm et al. 2005).

PEG hydrogels undergo slow hydrolysis by the cleavage of the ester bonds over time in aqueous solutions. In an attempt to control degradation of PEG-based hydrogels, poly(α-hydroxy acid) as a biodegradable moiety was incorporated into PEG chains (Moeinzadeh et al. 2013). The degradation of PEG-co-poly(α-hydroxy acid) diacrylate hydrogels can be modulated by the length and composition of α-hydroxy acid block (Sawhney et al. 1993a; Sawhney et al. 1994). Their swelling and mechanical properties are influenced by the length of PEG block and the concentration of copolymers. Multi-arm PEG-based hydrogels containing MMP (matrix metalloproteinase) moieties can be degraded by enzymes secreted from cells as presented in Fig. 4 (Mhanna et al. 2014). Cell adhesion onto PEG hydrogels can be enhanced by the incorporation of cell attachment peptides, such as RGD (Arg-Gly-Asp) (Beamish et al. 2009; Yang et al.