



**Fig. 4.** Photocured PEG-based hydrogels with cell adhesion molecules and enzyme degradable molecules.

**Table 2.** Photocurable PEG polymers for various applications.

PEG hydrogels with additional features	Functionality
PEG-co-poly( $\alpha$ -hydroxyl acid) hydrogel containing poly(glycolic acid) (PGA) or poly(lactic acid) (PLA) or PLGA	Hydrolytic degradation
MMP (matrix metalloproteinase)-immobilized PEG hydrogels	Enzymatic degradation
Adhesion peptides (RGD, YIGSR, KQAGDV, etc.)-immobilized PEG hydrogels	Cell adhesion/proliferation/differentiation
RGD- and MMP-immobilized PEG hydrogels	Control over adhesion and degradation
TGF- $\beta$ -immobilized PEG hydrogels	Cartilage regeneration/ECM production
VEGF-immobilized PEG hydrogels	Vascular growth
Phosphate-tethered PEG hydrogels	Osteogenic differentiation
t-Butyl-tethered PEG hydrogels	Adipogenic differentiation
Natural polymer (fibrinogen, gelatin)-conjugated PEG hydrogels	Control over cell adhesion and degradation

2005), a laminin-derived peptide YIGSR (Tyr-Ile-Gly-Ser-Arg) (Coburn et al. 2011), and a fibrinogen-derived KQAGDV (Lys-Gln-Ala-Gly-Asp-Val) (Peyton et al. 2006). Furthermore, PEG hydrogels with specific bioactive peptides have been explored for regenerative medicine applications; the bioactive peptides include VEGF (Vascular endothelial growth factor) and TGF-(transforming growth factor-beta), as seen in [Table 2](#) (Leslie-Barbick et al. 2011; Sridhar et al. 2014; Villanueva et al. 2009; Wacker et al. 2008). In addition, photocurable hydrogels with small chemical groups can guide stem cell fate decisions. Phosphate-tethered PEG hydrogels differentiated human mesenchymal stem cells (hMSCs) into an osteogenic lineage whereas hydrophobic t-butyl group-tethered PEG hydrogels induced adipogenic differentiation of hMSCs (Benoit et al. 2008).

### ***Poly(propylene fumarate)-based photocurable hydrogels***

Poly(propylene fumarate) (PPF) is another photocurable material, which has biodegradable properties. PPF has a chemical structure of repeating units with multiple ester groups and carbon-carbon double bonds. It is used mainly in the form of poly(propylene fumarate-co-ethylene glycol) (Poly(PF-co-EG)) or oligo(propylene fumarate-co-ethylene glycol) (oligo(PF-co-EG)) owing to the hydrophilic feature