

**Table 1.** Photoinitiators commonly used for photocrosslinking.

Initiators	Name	Type	Wavelength for curing	Curing time	Intensity	Solubility	Concentration for cell encapsulation
Irgacure 2959 (I2959)	2-Hydroxy-4'-(2-hydroxyethoxy)-2-methylpropiophenone	1	365 nm	5~15 min	1~20 mW/cm <sup>2</sup>	Water (≤ 0.5%), ethanol (10%)	~0.1%
VA-086	2,2'-Azobis[2-methyl-N-(2-hydroxyethyl)propionamide]	1	365 nm			Water (≤ 5%)	~1.5%
LAP	Lithium phenyl-2,4,6-trimethylbenzoyl phosphinate	1	365 or 405 nm			Water (≤ 8.5%)	~0.1%
Eosin Y	2-(2,4,5,7-Tetrabromo-6-oxido-3-oxo-3H-xanthen-9-yl)benzoate	2	519 nm			Water (≤ 5%)	~0.01%

## Synthetic Polymer-based Photocurable Hydrogels

Photocurable synthetic polymer-based hydrogels have been utilized for various bio-applications owing to following advantages: They can be mass-produced at a low cost, their mechanical properties can be easily tailored by some parameters such as their molecular weights and degrees of modification (methacryloylation or acryloylation), and in addition, their biological features can be provided via incorporation of biological molecules. Typical synthetic photocurable hydrogel precursors are poly(ethylene glycol) and poly(vinyl alcohol).

### *Poly(ethylene glycol)-based photocurable hydrogels*

Poly(ethylene glycol) (PEG) is a highly water soluble synthetic polymer which is composed of repeating ethylene glycol (-OCH<sub>2</sub>CH<sub>2</sub>-) units. It has been utilized for bio-applications such as drug delivery systems, bio-printing, and tissue engineering because PEG has prominent features such as hydrophilicity, biocompatibility, non-immunogenicity, and anti-fouling properties (Amer et al. 2015; Lee et al. 2016b; Peyton et al. 2006; Turturro and Papavasiliou 2012). PEG has hydroxyl groups at both ends, which can be modified with functional molecules for specific applications (Sawhney et al. 1993b). For photocurable PEG, it is normally modified in the form of PEG diacrylate (PEGDA) or PEG dimethacrylate (PEGDMA) as seen in Fig. 3. PEGDA or PEGDMA can be prepared through the reaction with a small molar excess of acryloyl chloride or methacryloyl chloride in tetrahydrofuran or methylene chloride containing the equimolar triethylamine in an ice bath for overnight (Lee et al. 2004; Li et al. 2010). PEGDA or PEGDMA can be photocrosslinked in the presence of photoinitiators upon light exposure at their corresponding wave lengths (e.g., upon 365 nm UV light exposure in the presence of I2959). PEGDA is faster reactive to light exposure than PEGDMA probably because acrylate radicals are sterically less hindered than methacrylate radicals (reactivity: acrylate > vinyl ester >