COUMARIN-3-OXOACETIC ACID METHYL ESTERS: PHOTOINITIATORS FOR UV-VISIBLE FREE RADICAL AND CATIONIC PHOTOPOLYMERIZATIONS

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The high electron-transfer quantum yields of coumarins make them attractive candidates for designing efficient PIs.[1,2] In this study, three coumarin-3-oxoacetic acid methyl esters (COAEs) which exhibited strong ultraviolet visible absorption in the range 300–500 nm were synthesized and studied. Real-time fourier transform infrared (RT-FTIR) and photo-differential scanning calorimetry (photo-DSC) experiments showed that these PIs could be used as Norrish I photoinitiators and Norrish II photoinitiators to initiate free radical polymerization (FRP) of acrylate monomers, and they also can be used as photosensitizers of iodonium salts and sulfonium salts for cationic photopolymerization (CP) of epoxy and oxetane monomers. Furthermore, they can initiate the deep curing of Tri-(propylene glycol) diacrylate (TPGDA) at acceptable low concentrations of 0.01 wt% and approached to a depth of 9 cm after irradiation with a 415 nm or 450 nm LED light source for 5 minutes. Moreover, the COAEs exhibited acceptable photobleaching, which is in favourable of colourless applications of photopolymerization. The photochemical and photophysical properties of the COAEs were also studied with absorption and fluorescence spectroscopy, electron spin resonance, cyclic voltammetry experiments and photoinduced decarboxylation experiments to determine the photoinitiation mechanism. Additionally, cytotoxicity experiments were carried out, and the results showed that the COAE-N had good cytocompatibility. Therefore, the exceptional polymerization properties of COAEs offer promising prospects for FRP and CP applications. Additionally, their efficient photobleaching characteristics make them highly suitable for deep photopolymerization applications. Moreover, the low cytotoxicity of COAEs suggests significant potential for biomedical applications such as dental restoration.

Keywords: coumarin derivatives, free radical polymerization, cationic photopolymerization, photobleaching, sulfonium salts, deep curing

References

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