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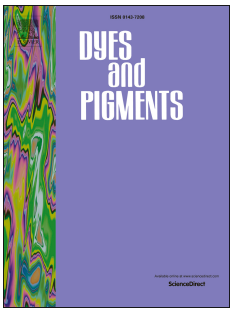

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Lanqi Huang, Pin Ma, Guowei Deng, Kai Zhang, Ting Ou, Yuan Lin, Man Shing Wong

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Novel Electron-Deficient Quinoxalinedithienothiophene- and Phenazinedithienothiophene-Based Photosensitizers: the Effect of Conjugation Expansion on DSSC Performance

Lanqi Huang,[a] Pin Ma,[b] Guowei Deng,[c] Kai Zhang, [a,d] Ting Ou,[e] Yuan Lin,[b,*] and Man Shing Wong[a,*]

[a]Institute of Molecular Functional Materials, Department of Chemistry and Institute of Advanced Materials, Hong Kong Baptist University, Kowloon Tong, Hong Kong SAR, China.

[b]Institute of Photo-functional Materials and Photo-electrochemistry, Institute of Chemistry, Chinese Academy of Science, Haidian, Beijing, China.

[c]College of Chemistry and Life Science, Chengdu Normal University, China, Sichuan, China.

[d]College of Preclinical Medicine, Southwest Medical University, Luzhou 646000, Sichuan, China.

[e]Nanocluster Laboratory, Institute of Molecular Science, Shanxi University, Taiyuan 030006, China.

Abstract:

Two novel electron-deficient π-conjugated moieties, quinoxalinedithienothiophene (QBTT) and phenazinedithieno-thiophene (PBTT) were designed and synthesized as the π-bridge for the construction of D-π-A and D-A_1-π-A configured photosensitizers for DSSC applications. Five new metal free photosensitizers, namely QC5-m and PC5-n where m = 1-2 and n = 1-3 were designed and synthesized using carbazole as an electron-donor, benzothiadiazole (BTZ) as an auxiliary group and cyanoacylic acid as an electron-acceptor. Despite only lateral π-conjugation expansion of PBTT π-bridge, PC5-n based dyes show broader spectral absorption than those of QC5-m counterparts. Both electron-deficient QBTT and PBTT moieties are found to be a useful π-conjugated bridge to achieve broad spectral absorption and strong charge transfer of a photosensitizer. DSSCs based on these photosensitizers were fabricated and investigated which exhibited power conversion efficiency (*PCE*) in the range of 5.23-7.77% with a simple sandwich structure under AM 1.5 irradiation, 100 mW cm^{-1}. Among DSSCs fabricated, PC5-1 based device afforded the best photovoltaic performance with *PCE* up to 7.77%, V_{oc} = 692 mV, J_{sc} = 15.6 mA cm^{-2} and FF = 72%. Consistently, the EIS and IMVS studies showed that PC5-1 based device exhibited the most efficient