

Synthesis of blue/green D- π -A dyes and their application as sensitizers in Dye-Sensitized Solar Cells

Matteo Bartolini,^c Alessio Dessì^a Ottavia Bettucci,^{a,b} Daniele Franchi,^{a,c} Alessandro Mordini,^{a,c} Adalgisa Sinicropi,^b Maurizio Peruzzini,^a Riccardo Basosi,^b Maurizio Taddei,^b Lorenzo Zani,^a Gianna Reginato,^a and Massimo Calamante,^{a,c}

^a*Istituto di Chimica dei composti organometallici (CNR-ICCOM), via Madonna del Piano 10, 50019 Sesto Fiorentino, Italy.*

^b*Dipartimento di Biotecnologie Chimica e Farmacia, Università degli Studi di Siena, via A. Moro 2, 53100 Siena, Italy.*

^c*Dipartimento di Chimica "U. Schiff" Università degli Studi di Firenze, via della Lastruccia 13, 50019 Sesto Fiorentino, Italy.*

e-mail: mcalamante@iccom.cnr.it

Dye-sensitizer solar cells (DSSC) are currently considered one of the most promising alternatives to traditional silicon solar cells¹. The research activity in this field is mostly focused on the design and synthesis of new organic dyes with potential application in this kind of devices.² The synthesis of new dyes with high molar extinction coefficient and specific color (blue and green in particular) in order to increase the aesthetic properties and ease their integration in buildings and objects are the main focus in the research in the field of DSSC.

For this purpose, some modifications have been selected to be included in the common D- π -A structure. Two approaches have been studied: modify the central core by inserting new auxiliary groups between the donor and spacer or by modifying the anchor group of the dye. The synthesis of these dyes has been optimized and its derivatization using Pd-catalysed cross-coupling reactions. The new dyes containing the (*E*)-3,3'-bifuranylidene-2,2'-dione or indigo as auxiliary acceptor groups and the dyes with thioamide, thiocarboxylic acid and dithiocarboxylic acid have been designed, synthesized, characterized and tested on DSSCs. The new dyes showed an intense from violet to blue/green color in solution and, when adsorbed on a TiO₂ electrode, a broad absorption of the red/near-infrared light between 500 and 800 nm.

1. O'Reagan, B.; Grätzel, M. *Nature* **1991**, 353, 737.

2. *Dye-sensitized solar cells* (Ed.: K. Kalyanasundaram), EPFL Press, Lausanne **2010**.