

A New Route to Light Emitting Organic Materials Based on Triazine Derivatives

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Abstract Novel light-emitting organic materials comprising conjugated oligomers chemically attached *via* a flexible spacer to an electron- or hole-conducting core were synthesized by *Stille* cross-coupling methodology and designed for tunable charge injection and optical properties. The hyperbranched structures have been characterized by ^1H NMR, ^{13}C NMR, and UV-VIS spectroscopy. The obtained structures show good stability in common organic solvents such as CHCl_3 , toluene, and CH_2Cl_2 and exhibit excellent thermal stability. A preliminary electroluminescence properties were also investigated. This class of materials will help to balance charge injection and transport and to spread out the charge recombination zone, thereby significantly improving the device efficiency and lifetime of unpolarized and polarized OLEDs.

Keywords Triazine derivatives · *Stille* coupling · Fluorescence properties · Luminescence · Electroluminescence

Introduction

Since the discovery of efficient electroluminescence at a relatively low voltage using organic materials, including

low molar-mass fluorescent dyes [1] and π -conjugated polymers [2], intensive efforts have been devoted to improving the efficiency and lifetime of organic light-emitting materials (OLEDs).

Whereas low-molar-mass materials can be deposited as thin films by sublimation, conjugated polymers can be readily processed into large-area thin films by spin-coating from dilute solutions. In principle, electrons and holes are injected from the cathode and anode, respectively, for the formation of excitons in the emissive layer where radiative decay takes place.

In most conjugated polymers, holes are preferentially transported over electrons. Electron transport has been improved by incorporating π -electron-deficient moieties, such as oxadiazole, triazole, triazine, and quinoxaline, as part of the polymer backbone, as the pendant, or as the end cap. The triazine units are expected to play an important role in conjugated systems due to their high electron affinity [3]. In the case of blue OLEDs, hole injection is also a limiting factor because of the high ionization potentials of most blue-emitting materials. This difficulty can be overcome in part by adding a layer of poly(3,4-ethylenedioxythiophene)/poly(styrene sulfonate) (PEDOT/PSS) between the indium tin oxide (ITO) anode and the emissive polymer layer [4]. Because of its acidic nature, PEDOT/PSS was found to etch ITO, causing device instability [5]. This problem has been addressed using an alternative hole-injection material [6] or a self-assembled monolayer on the ITO anode [7].

Recently, has been reported the examples of conjugated oligomers for the demonstration of linear triazine units as a conjugate linker (π -center) [8]. The electrochemical results of structure-property relationship increase with chain length and planarity of the π -center. Due to these results, we present here our efforts toward combining a molecule of

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2,6-bis(arylene)-1,3,5-triazine derivatives with a few tails as branched structures (Chart 1).

Triazines usually have high luminescence quantum yields and are known as efficient laser dyes. The emission maximum of triazine is around 310–325 nm. Furthermore, the chemical structure of triazine is widely used as a hole-transporting organic material. In this case triazine-based materials could thus be promising conducting and fluorescent materials (Fig. 1). Here we have synthesized triazine derivatives (Chart 1) by coupling reactions.

The electrochemical–optical properties of these compounds were measured, with attempts made correlate to their respective π -electron conjugation lengths as well as their molecular conformations. The most efficient optical materials seem to be the ones with various electron-donor (D) and electron-acceptor (A) moieties attached symmetrically to a conjugate linker. Molecule **2** is a typical D- π -A chromophore with 1,3,5-triazine linker.

Experimental section

General procedures

All chemicals, reagents, and solvents were used as received from commercial sources (Aldrich) without further purification, except tetrahydrofuran (THF) and toluene, which were distilled over sodium/benzophenone. ^1H NMR and ^{13}C NMR spectra were recorded in CDCl_3 on a Bruker 300 spectrometer (Germany). Chemical shifts are denoted in δ unit (ppm) and were referenced to internal tetramethylsilane (0.0 ppm). The splitting patterns are designated as follows: s (singlet), d (doublet), t (triplet), quin (quintet), and m (multiplet), and the assignments are Ph (phenyl) and TRA (triazine). Preparative column chromatography was carried out on glass columns of different sizes packed with silica gel Merck 60 (0.035–0.070 mm). Absorption spectra were gathered with UV-VIS HP 8452A diode array spectropho-

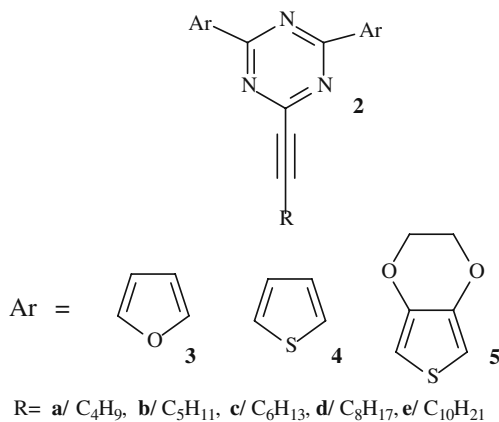


Chart 1 Chemical structures of the compounds under investigation

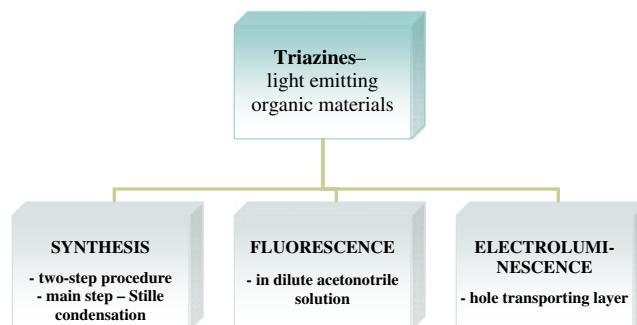


Fig. 1 General application of derivatives of triazine

tometer (USA). Fluorescence spectra were collected with a Hitachi F-2500 fluorescence spectrophotometer (USA).

Synthesis

The procedure for preparation of **3a,c-e**

2-(Tributylstannyl)-furan (3.87 g, 10.84 mmol) under a nitrogen atmosphere, was added to 2,4,6-trichloro-1,3,5-triazine (1.0 g, 5.42 mmol) in presence of tetrakis(triphenylphosphine)palladium (0.35 g, 0.30 mmol) as catalyst in dry toluene. The mixture was stirred at 100°C for 3 days to get 2,4-bis(furan-2-yl)-6-chloro-1,3,5-triazine. Solvent was evaporated and compound without isolation was used to next step. To a solution of an alkyne (5.42 mmol) in dry THF (50 mL), 1.6 M n-BuLi in hexane (3.40 mL, 5.42 mmol) was added at -78°C , after 1 h to reaction mixture was added crude 2,4-bis(furan-2-yl)-6-chloro-1,3,5-triazine. The mixture was stirred for 12 h at the temperature 20°C . After quenching with water (50 mL) and extracted with AcOEt (3×50 mL), the combined organic layer was washed with water (40 mL) and dried over MgSO_4 and the solvent was evaporated. The oil residue was purified by column chromatography (eluent hexane / AcOEt 10:1).

3a: 2,4-Bis(furan-2-yl)-6-(hex-1-yn)-1,3,5-triazine. $Y = 85\%$ (1.35 g), yellow crystals, mp $79\text{--}80^\circ\text{C}$, Selected data: ^1H NMR (CDCl_3) δ : 7.60 (d, $J = 1.6$ Hz, 2H); 7.48 (d, $J = 3.5$ Hz, 2H); 6.49 (dd, $J = 3.5, 1.7$ Hz, 2H); 2.39 (t, $J = 7.1$ Hz, 2H); 1.59–1.49 (m, 2H); 1.43–1.31 (m, 2H); 0.82 (t, $J = 7.4$ Hz, 3H). ^{13}C NMR (CDCl_3) δ : 163.6, 160.5, 149.8, 147.1, 117.9, 112.7, 95.1, 79.3, 29.7, 22.0, 19.2, 13.5. Elemental analysis for: $\text{C}_{17}\text{H}_{15}\text{N}_3\text{O}_2$ Calc.: C, 69.61; H, 5.15; N, 14.33. Found: C, 69.72; H, 5.17; N, 14.28.

3c: 2,4-bis(furan-2-yl)-6-(oct-1-yn)-1,3,5-triazine. $Y = 82\%$ (1.43 g), brown crystals, mp $64\text{--}65^\circ\text{C}$, Selected data: ^1H NMR (CDCl_3) δ : 7.61 (d, $J = 1.5$ Hz, 2H); 7.48 (d, $J = 3.5$ Hz, 2H); 6.49 (dd, $J = 3.5, 1.4$ Hz, 2H); 2.38 (t, $J = 7.2$ Hz, 2H); 1.60–1.50 (m, 2H); 1.39–1.31 (m, 2H); 1.24–1.38 (m, 4H); 0.77 (t, $J = 6.9$ Hz, 3H). ^{13}C NMR (CDCl_3) δ : 163.5, 160.5, 149.8, 147.0, 117.9, 112.6, 95.2, 79.3, 31.1,

28.6, 27.7, 22.3, 19.4, 13.9. Elemental analysis for: C₁₉H₁₉N₃O₂ Calc.: C, 71.01; H, 5.96; N, 13.07. Found: C, 71.32; H, 5.84; N, 13.21.

3d: 2,4-bis(furan-2-yl)-6-(dec-1-yn)-1,3,5-triazine. *Y*=80% (1.52 g), deep brown crystals, mp 57–58°C, *Selected data:* ¹H NMR (CDCl₃) δ: 7.74 (d, *J*=1.8 Hz, 2H); 7.64 (d, *J*=3.4 Hz, 2H); 6.65 (dd, *J*=3.4, 1.7 Hz, 2H); 2.52 (t, *J*=7.3 Hz, 2H); 1.73–1.68 (m, 2H); 1.50–1.45 (m, 2H); 1.37–1.27 (m, 8H); 0.91 (t, *J*=7.0 Hz, 3H). ¹³C NMR (CDCl₃) δ: 163.8, 160.7, 150.0, 147.2, 118.1, 112.8, 95.5, 79.4, 31.8, 29.2, 29.1, 29.0, 27.8, 22.7, 19.6, 14.1. Elemental analysis for: C₂₁H₂₃N₃O₂ Calc.: C, 72.18; H, 6.63; N, 12.03. Found: C, 72.34; H, 6.55; N, 12.20.

3e: 2,4-Bis(furan-2-yl)-6-(dodec-1-yn)-1,3,5-triazine. *Y*=74% (1.51 g), deep red crystals, mp 51–53°C, *Selected data:* ¹H NMR (CDCl₃) δ: 7.74 (d, *J*=1.8 Hz, 2H); 7.64 (d, *J*=3.4 Hz, 2H); 6.64 (dd, *J*=3.4, 1.7 Hz, 2H); 2.52 (t, *J*=7.3 Hz, 2H); 1.72–1.68 (m, 2H); 1.51–1.46 (m, 2H); 1.33–1.28 (m, 12H); 0.89 (t, *J*=7.0 Hz, 3H). ¹³C NMR (CDCl₃) δ: 163.8, 160.7, 150.0; 147.2, 118.0, 112.7, 95.5, 79.4, 31.9, 29.6, 29.5, 29.3, 29.2, 29.1, 27.8, 22.7, 19.6, 14.1. Elemental analysis for: C₂₃H₂₇N₃O₂ Calc.: C, 73.18; H, 7.21; N, 11.13. Found: C, 73.24; H, 7.52; N, 11.22.

The procedure for preparation of 4b,e

2-(Tributylstannyl)-thiophene (4.05 g, 10.84 mmol) under a nitrogen atmosphere, was added to 2,4,6-trichloro-1,3,5-triazine (1.0 g, 5.42 mmol) in presence of tetrakis(triphenylphosphine)palladium (0.35 g, 0.30 mmol) as catalyst in dry toluene. The mixture was stirred at 100°C for 3 days to get 2,4-bis(thiophen-2-yl)-6-chloro-1,3,5-triazine. Solvent was evaporated and compound without isolation was used to next step. To a solution of an alkyne (5.42 mmol) in dry THF (50 mL), 1.6 M n-BuLi in hexane (3.40 mL, 5.42 mmol) was added at –78°C, next after 1 h was added crude 2,4-bis(thiophen-2-yl)-6-chloro-1,3,5-triazine. The mixture was stirred for 12 h at 20°C. After quenching with water (50 mL) and extracted with AcOEt (3×50 mL), the combined organic layer was washed with water (40 mL) and dried over MgSO₄ and then the solvent was evaporated. The oil residue was purified by column chromatography (eluent hexane / AcOEt 10:1).

4b: 2,4-Bis(thiophen-2-yl)-6-(hept-1-yn)-1,3,5-triazine. *Y*=89% (1.64 g), white crystals, mp 68–69°C, *Selected data:* ¹H NMR (CDCl₃) δ: 8.23 (dd, *J*=3.8, 1.2 Hz, 2H); 7.61 (dd, *J*=5.0, 1.2 Hz, 2H); 7.17 (dd, *J*=4.9, 3.8 Hz, 2H); 2.51 (t, *J*=7.3 Hz, 2H); 1.75–1.66 (m, 2H); 1.49–1.33 (m, 4H); 0.93 (t, *J*=7.2 Hz, 3H). ¹³C NMR (CDCl₃) δ: 167.6, 160.5, 140.6, 132.9, 132.2, 128.5, 94.7, 79.5, 31.2, 27.6, 22.2, 19.6, 13.9. Elemental analysis for: C₁₈H₁₇N₃S₂ Calc.: C, 63.69; H, 5.05; N, 12.38. Found: C, 63.74; H, 5.32; N, 12.25.

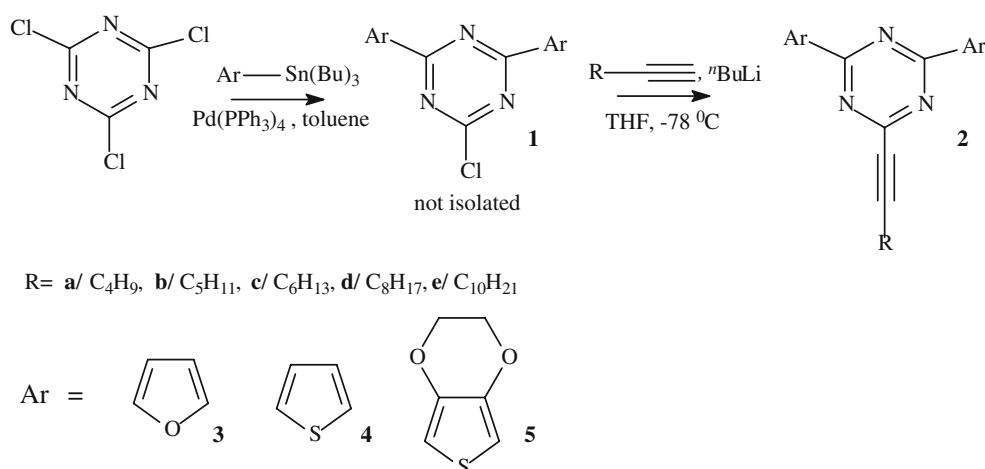
4e: 2,4-Bis(thiophen-2-yl)-6-(dodec-1-yn)-1,3,5-triazine. *Y*=81% (1.80 g), deep brown crystals, mp 60–61°C, *Selected data:* ¹H NMR (CDCl₃) δ: 8.21 (dd, *J*=3.8, 1.2 Hz, 2H); 7.59 (dd, *J*=5.0, 1.2 Hz, 2H); 7.15 (dd, *J*=4.9, 3.8 Hz, 2H); 2.50 (t, *J*=7.2 Hz, 2H); 1.71–1.60 (m, 2H); 1.47–1.40 (m, 2H); 1.38–1.17 (m, 12H); 0.86 (t, *J*=6.4 Hz, 3H). ¹³C NMR (CDCl₃) δ: 167.7, 160.6, 140.7, 132.9, 132.2, 128.6, 94.8, 79.6, 31.9, 29.6, 29.5, 29.4, 29.2, 29.1, 27.9, 22.8, 19.7, 14.2. Elemental analysis for: C₂₃H₂₇N₃S₂ Calc.: C, 67.44; H, 6.64; N, 10.26. Found: C, 67.74; H, 6.35; N, 10.35.

The procedure for preparation of 5c,e

5-(Tributylstannyl)-2,3-dihydro-thieno[3,4-b][1, 4]dioxin (4.67 g, 10.84 mmol) under a nitrogen atmosphere, was added to 2,4,6-trichloro-1,3,5-triazine (1.0 g, 5.42 mmol) in presence of tetrakis(triphenylphosphine)palladium (0.35 g, 0.30 mmol) as catalyst in dry toluene. The mixture was stirred at 100°C for 3 days to get 2,4-bis(2,3-dihydro-thieno[3,4-b][1, 4]dioxin-5-yl)-6-chloro-1,3,5-triazine. Solvent was evaporated and compound without isolation was used to next step. To a solution of an alkyne (5.42 mmol) in dry THF (50 mL), 1.6 M n-BuLi in hexane (3.40 mL, 5.42 mmol) was added at –78°C. After 1 h to reaction mixture was added crude 2,4-bis(2,3-dihydro-thieno[3,4-b][1, 4]dioxin-5-yl)-6-chloro-1,3,5-triazine. The mixture was stirred for 12 h at 20°C. After quenching with water (50 mL) and extracted with AcOEt (3×50 mL), the combined organic layers were washed with water (40 mL) and dried over MgSO₄ and the solvent was evaporated. The oil residue was purified by column chromatography (eluent hexane / AcOEt 10:1).

5c: 2,4-Bis(2,3-dihydro-thieno[3,4-b][1, 4]dioxin-5-yl)-6-(oct-1-yn)-1,3,5-triazine. *Y*=86% (2.19 g), yellow crystals, mp 111–112°C, *Selected data:* ¹H NMR (CDCl₃) δ: 6.65 (s, 2H); 4.47–4.45 (m, 4H); 4.27–4.24 (m, 4H); 2.46 (t, *J*=7.3 Hz, 2H); 1.69–1.60 (m, 2H); 1.48–1.39 (m, 2H); 1.33–1.24 (m, 4H); 0.88 (t, *J*=6.5 Hz, 3H). ¹³C NMR (CDCl₃) δ: 166.8, 160.1, 145.6, 142.4, 115.1, 107.7, 94.7, 79.7, 65.6, 64.1, 31.3, 28.8, 27.7, 22.5, 19.7, 14.1. Elemental analysis for: C₂₃H₂₃N₃O₄S₂ Calc.: C, 58.83; H, 4.94; N, 8.95. Found: C, 58.71; H, 4.66; N, 8.99.

5e: 2,4-Bis(2,3-dihydro-thieno[3,4-b][1, 4]dioxin-5-yl)-6-(dodec-1-yn)-1,3,5-triazine. *Y*=80% (2.28 g), deep red crystals, mp 99–101°C, *Selected data:* ¹H NMR (CDCl₃) δ: 6.63 (s, 2H); 4.45–4.42 (m, 4H); 4.25–4.22 (m, 4H); 2.43 (t, *J*=7.3 Hz, 2H); 1.67–1.58 (m, 2H); 1.44–1.36 (m, 2H); 1.31–1.01 (m, 12H); 0.84 (t, *J*=6.6 Hz, 3H). ¹³C NMR (CDCl₃) δ: 166.7, 160.0, 145.5, 142.3, 114.9, 107.6, 94.5, 79.6, 65.5, 64.0, 31.8, 29.4, 29.3, 29.2, 29.1, 29.0, 27.7, 22.6, 19.6, 14.0. Elemental analysis for: C₂₇H₃₁N₃O₄S₂ Calc.: C, 61.69; H, 5.94; N, 7.99. Found: C, 61.58; H, 5.89; N, 8.08.

Scheme 1 Synthesis of substituted 1,3,5-triazines

Absorption and fluorescence spectra in dilute solutions

Dilute solutions of derivatives of triazine in acetonitrile were prepared in the concentration range between 0.25 mM–1.0 μ M. Absorption spectra were gathered with UV-VIS HP 8452A diode array spectrophotometer. Fluorescence spectra were collected with a Hitachi F-2500 fluorescence spectrophotometer.

EL characterization

ITO-coated glass plates was washed with standard procedure and the substrate was covered by spin-coating with poly(*N*-vinylcarbazole)-PVK, Mw: 280,000, 40 nm was deposited, then the substrate was covered with 20-layers triazine film by the Langmuir-Blodgett technique. The Langmuir-Blodgett films were obtained by means of a commercial LB trough (KSV, System 5000, Helsinki). The amphiphilic 2,4-Bis(2,3-dihydro-thieno[3,4-*b*][1, 4]dioxin-5-yl)-6-(oct-1-yn)-1,3,5-triazine and stearic acid were dis-

solved in chloroform (Aldrich, HPLC grade) and mixed in equimolar proportions. Concentration of each solution was maintained at *ca.* 1 mg ml⁻¹. About 50 μ l of the mixture was spread on a water subphase (22°C) and the monolayer was compressed with a movable barriers at 50 mm min⁻¹. The deposition was Y-type with a transfer ratio very close unity. Layers were transferred at withdrawing speed of 5.0 mm min⁻¹ and dipping speed of 20 mm min⁻¹, allowing 15 min of drying time between dipping cycles.

A 120 nm thick Li:Al-alloy cathode was then vacuum deposited on the triazine derivative layer at 5 \cdot 10⁻⁶Torr.

The electrical and luminescence characteristics of the device were measured by using a current/voltage source measurement unit (Keithley 236, USA) and an optical power meter (Newport 1830C, GB) connected to photodiode (Newport 818-UV, GB). EL spectra were obtained by using ISS PCI photon-counting spectrofluorometer as a detector.

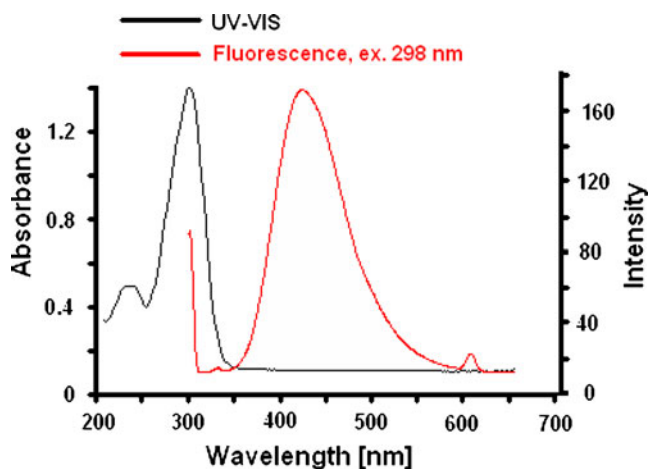


Fig. 2 UV-VIS spectrum of 0.25 mM **3c** in acetonitrile and fluorescence spectrum of 5 μ M **3c** collected at maximum absorption wavelength (298 nm)

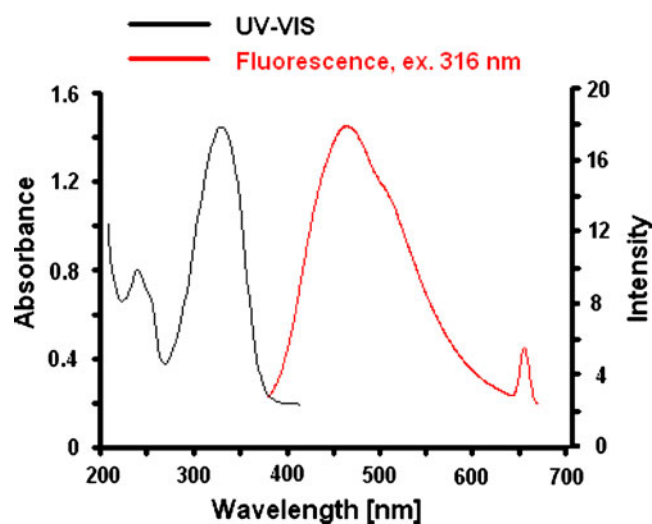


Fig. 3 UV-VIS spectrum of 0.25 mM **5c** in acetonitrile and fluorescence spectrum of 5 μ M **5c** collected at maximum absorption wavelength (316 nm)

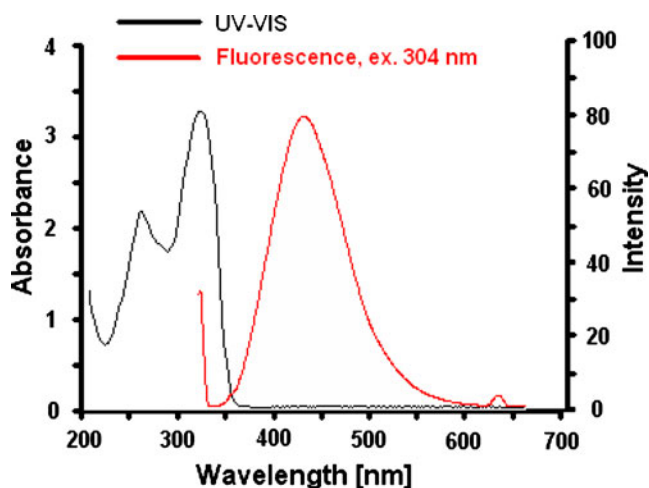


Fig. 4 UV-VIS spectrum of 0.25 mM **4b** in acetonitrile and fluorescence spectrum of 5 μ M **4b** collected at maximum absorption wavelength (304 nm)

Result and discussion

Synthesis

We have designed the molecular structures of a group of monomers containing 1,3,5-triazine block and elaborated two-steps reaction routes for their synthesis (Scheme 1).

The 2,6-bis(arylene)-4-alkyne-1,3,5-triazines (**3-5 a-e**) were obtained by *Stille* coupling [9] of 2-(tributylstannyl) furane, -thiophene, and -3,4-ethylenedioxythiophene, respectively with 2,4,6-trichloro-1,3,5-triazine in tetrahydrofuran at 20°C.

Alkylation of non isolated 2,6-bis(arylene)-4-chloro-1,3,5-triazine (**1**) with hexyl-, heptyl-, octyl-, decyl-, or dodecylchloride (after lithation reaction in THF at -78°C), gave the appropriate derivatives of triazine (**3,4,5-a-e**). These compounds were isolated and purified by column chromatography on silica gel, with good yield and high purity. ^1H and ^{13}C NMR and elemental analysis were employed to confirm the chemical structures of above mentioned compounds as described in the experimental section.

Table 1 UV-Vis spectroscopic data of derivatives of triazine (λ_{max} [nm], $\lambda_{\text{max}}^{\text{f}}$ [nm]—fluorescence)

Compound	Solvent	λ_{max} [nm]	$\lambda_{\text{max}}^{\text{f}}$ [nm]
2,4-Bis(thiophen-2-yl)-6-(hept-1-yn)-1,3,5-triazine- 4b	Acetonitrile	304	412
2,4-bis(furan-2-yl)-6-(oct-1-yn)-1,3,5-triazine- 3c	Acetonitrile	298	420
2,4-Bis(2,3-dihydrothieno[3,4-b][1,4]dioxin-5-yl)-6-(oct-1-yn)-1,3,5-triazine- 5c	Acetonitrile	316	448

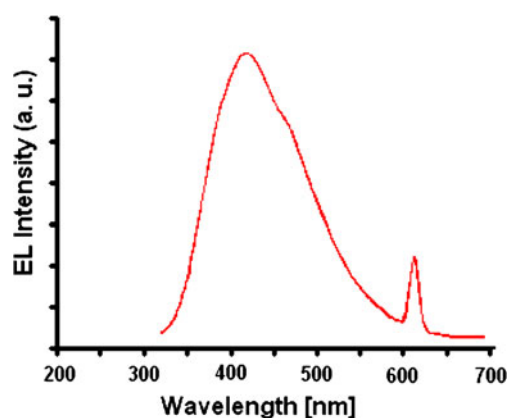


Fig. 5 EL spectra of **5c**

All the monomers were obtained as colorful crystals and characterized by spectroscopic methods, from satisfied spectral data corresponding to their molecular structures.

Optical moieties of triazine derivatives. Absorption and luminescence characteristic

Different type of conjugated oligomers have been demonstrated for OLED devices, which are potentially useful as an efficient light source for liquid-crystal displays, electroluminescent displays with improved viewing quality, protections displays etc. These types of oligomers could be chemically bonded to a volume-excluding core to form stable layers for promising materials for OLED. The selection of a hole- and electron-conducting core is dedicated to the charge-carrier mobility. The photophysical properties of the synthesized compounds (**3c**, **5c**, **4b**) were investigated by UV-VIS and fluorescence spectroscopy in diluted acetonitrile solution (0.25 mM). The UV-VIS absorption and luminescence properties of hyperbranched blocks were summarized in Figs. 2, 3 and 4 and in Table 1.

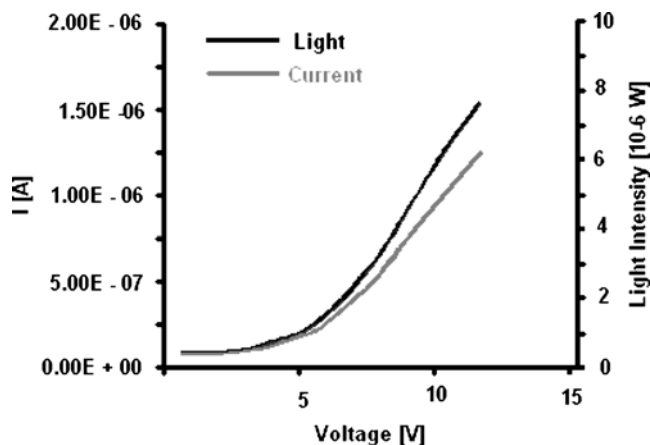


Fig. 6 I-V-L characteristic of **5c**

Figure 2, 3 and 4 show the UV-VIS absorption spectra of **3c**, **5c** and **4b**.

The absorption bands characteristic for triazine are localized at about 310–325 nm, and in the longer wavelength region absorption (390 nm), which has considerable charge-transfer character [10]. In case of our derivatives region about 390 nm is not observed, probably is covered by aliphatic chains or five member rings. The absence of the emission due to triazine units at 390 nm when excited at 270 nm suggests that the energy transfer from the excited state of the triazine to the side rings is efficient, which is further corroborated by the spectral overlap between the emission of the triazine unit (donor) and the absorption of side ring moiety (acceptor).

For triazine derivatives, the first absorption peak in the shorter wavelength region at 230 nm was attributed to the $n-\pi^*$ absorption bands of the triazine moiety. The second absorption peaks at 290 nm (for **3c**) and at 310 nm (for **5c**) were ascribed to the $\pi-\pi^*$ transition bands of the centre core. The absorption edge of derivatives of **3c** and **5c** red-shifted about 20 nm.

The fluorescence spectra were recorded at several excitation wavelengths in the range 270–320 nm. No emission was detected when the sample was excited with $\lambda_{exc}=270$ nm, which is in connection with the absorption of the triazine core [11, 12]. However, when excited at 298 nm, **3c** shows an emission centered at 420 nm and a much smaller peak at 600 nm (Fig. 2). In case of **5c**, when excited at 316 nm, the emission centre was observed at 448 nm and small band at 635 nm (Fig. 3). The small peaks found in all fluorescence spectra (near 600 nm) of triazines are scattering ones.

Considering, we assume that there are probably exciting the triazine and side five-member ring because of the observed clear red shift between **3c** and **5c**. Very similar results we obtained also for compound **4b**. In these case we found maximum band at 304 nm (Fig. 4). When **4b** excited at 304 nm it has emission centred at 420 nm (Fig. 4). Similarly as in case **3c**, **5c** we found much smaller peak at 610 nm (Fig. 4).

Almost planar triazine ring is a good building block for materials with fluorescence properties.

Electroluminescence properties

The EL spectra of **5c** (Fig. 5) were obtained by PVK as a hole transporting layer, that is ITO/PVK/**5c**/Al:Li. The film thickness was controlled by LB technique. The EL spectra of the film are similar to the corresponding luminescence ones with emission maximum 450 nm (Fig. 5).

Figure 6 shows the current–voltage–luminescence characteristic (I-V-L) curves for the **5c** LB film. The turn-on voltages for **5c** was 2.5 V. The external quantum

efficiency was 0.029 %. Higher efficiencies would be expected with optimization of the device structure.

Conclusion

We have synthesized new molecular 1,3,5-triazine derivatives as the accepting core and examined their optical properties. The synthesized compounds with their long-chain substituents have been characterized by UV-VIS, fluorescence and electroluminescence spectroscopy. The linear spectra of these compounds regularly vary: the spectral position (λ_{max} values) of the linear absorption, the one photon excited fluorescence shown regular red shifts for two different triazine derivatives (**3c**, **5c**).

From these studies, we conclude also that novel molecular systems were designed to incorporate the following features: (1) an electron- and hole-conducting core; (2) derivatives of triazine pendants for emission. Future work is in progress to exploit these promising materials for the fabrication of highly efficient OLEDs with long-term stability, and the results will be the subject of a future publication.

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