Introduction

The quinazolinone ring system forms an important class of N-heterocyclic compounds and is present in a large number of compounds with useful biological properties such as anti-cancer [1], anti-inflammatory [2,3], anti-convulsant [3], hypotensive [4], and anti-malarial [5] types. 2-Styrylquinazolinones are associated with inhibitory effects on tubulin polymerization and the growth of L1210 murine leukemia cells [6]. Some derivatives are also known to possess anti-convulsant activities [7].

Although there are several publications [8,9] describing the synthesis of functionalized 4(3H)-quinazolinones, there are only a few reports [10] on the preparation of substituted-2-styrylquinazolin-4(3H) ones. The general method for the synthesis of these heterocycles is the Knoevenagel condensation of substituted-2-methylquinazolinones with aromatic aldehydes under basic [11,12] or acidic [13] conditions. However, many of the protocols for the initial generation of the quinazolines core/or preparation of N-substituted-2-styrylquinazolinones suffer from drawbacks such as requiring multistep procedure, harsh reaction conditions, long reaction times, or low yields [14,15]. Also there is a need to develop an environmentally-friendly method for the synthesis of quinazolinones. Polyethylene glycol (PEG) has attracted increasing interest in the context of green synthesis during recent years [16]. Indeed, PEG is recognized as an attractive green solvent for various organic reactions [16]. Our interest in PEG as a green reaction medium was provoked by several factors, such as its thermal stability, commercial availability, non-volatility, immiscibility with a number of organic solvents and recyclability [17]. Furthermore, PEG-600 is an inexpensive, completely non-halogenated and easily degradable solvent that possesses low toxicity [18]. PEG has been used as a complexing solvent with unique properties of cationic coordination ability [19]. On the basis of the complexing properties of PEG, we chose it for the synthesis of quinazolinones. Tandem reactions are commonly referred to under the multistep one-pot reactions.

Tandem reactions are combinations of two or more reactions whose occurrence is in a specific order, and if they involve sequential addition of reagents the secondary reagents must be integrated into the products. Tandem reactions have several advantages over a series of individual reactions. First, they allow conductions of complex structures in as few steps as possible. Finally, employing reactions in tandem will
save on cost and amounts of reagents, solvents and reduce the amount of waste that is generated.

Results and discussion

In the first step, condensation of anthranilamide (1) with acetic anhydride in PEG-600, at 100°C for 1 hr gave the previously reported [20] 2-methyl-3H-quinoxaline-4-one (2). Its IR spectrum in KBr showed the diagnostic absorption at 3300 cm⁻¹ (broad, medium) due to -NH- stretching vibration and another at 1667 cm⁻¹ (strong, sharp) due to -CO- group and the absence of an unequal doublet at 3450, 3480 cm⁻¹ due to asymmetrical and symmetrical stretching vibrations of -NH₂ group that was there in 1. Its ¹H NMR (DMSO-d₆/TMS) spectrum showed signals at δ 3.00 (s, 3H, CH₃), 7.40–8.00 (m, 4H, phenyl ring protons), 12.33 (s, 1H, br, -NH, D₂O exchangeable). Its APCI mass spectrum showed M⁺ - 1 ion peak at 159 corresponding to a molecular mass of 160.

In the second step, treatment of 2 with benzaldehydes in PEG-600, at 100°C for 2–3 hr, gave 2-styrylquinazolinone-4-ones (3) in excellent yields. The products showed in their IR spectra (KBr) characteristic peaks at 3480 cm⁻¹ (broad, medium) due to -NH group and at 1660 cm⁻¹ (strong, sharp) due to -CO- group. In their ¹H NMR (DMSO-d₆/TMS) spectra, the products showed signals at δ 6.98–7.02 (d, J ≈ 14 Hz, 1H), 7.92–7.96 (d, J ≈ 14 Hz, 1H), due to trans disposedvinyllic protons and at δ ≈ 12.33 (s, 1H, br, D₂O exchangeable), due to the -NH-protons in addition to the signals due to aryl protons. For details, please see Experimental Section.

Treatment of 2 with either dimethyl sulfate (DMS), diethyl sulfate (DES), or with Ph-CH₂Cl, individually, in the presence of PEG-600 as reaction medium, at 100°C for 1–2 hr without using any base, resulted in 4(a–c) in yields of ≈80–85% on processing the reaction mixture. The products showed in their IR spectra (in KBr) absorptions at 1660 cm⁻¹ (strong, sharp) due to the -N-CO- group and absence of any absorption in the 3400–3000 cm⁻¹ due to any -NH- grouping, which was seen in the spectra of starting compounds 2. All the products 4 (a–c) showed in their ¹H NMR spectra signals due to alkyl protons in the aliphatic region in addition to aryl protons in the 7.0–8.0 region and absence of the -NH- proton signal in D₂O exchangeable which was observed prominently in the spectra of starting compounds 2.

In an alternative approach, reaction of 4 (a–c) with benzaldehydes in PEG-600, at 100°C for 1–2 hr,
without using any base, followed by simple processing resulted in 5(a–l) in yields of ≈85–90%, identical in m.p., m.m.p. Thin Layer Chromatography (TLC) and IR with that of the same products obtained in the route described above (i.e., 3→→5).

For details, please see the Experimental Section. It is obvious from the above results that PEG-600 is a very efficient solvent for the alkylation of 2 and 3 (a–d) resulting in the formation of 4 (a–c) and 5 (a–l), respectively. Mechanistic explanation [21] of these results is that, probably PEG-600 dissolves the substrates 2 (or 3 as the case may be) and the reagent (i.e., the alkylation agent, DMS, DES etc.), bringing them together thereby providing an effective means for chemical reaction to occur. Furthermore, PEG-600 is able to extract the hydrogen from the –NH of quinazolinone and is able to coordinate it through several lone pairs of electrons in its oxygen containing chain. This role of PEG-600 is very similar to that of the crown ethers or that of the proton sponge (i.e., 1, 8-dimethylaminonaphthalene). The latter acts as a very strong base due to its ability to extract hydrogen from an acidic substrate and then retain it by chelation through lone pair of electrons on the two nitrogen atoms of the two amino groups [21].

Both the sequences of reactions mentioned above (1→→2 →→3 →→5 or 1→→2 →→4 →→5) could be carried out in tandem in an efficient manner in PEG-600 without the isolation of any intermediates. Thus, treatment of 1 with AC₂O in PEG-600 at 100°C for 1 hr gives 2 in situ and subsequent alkylation of 2 (without its isolation) with DMS/DES/ Ph-CH₂Cl yields alkyl derivatives of 4 (a–c) again in situ. Subsequent treatment of the resulting reaction mixture with 1 equivalent of an aromatic aldehyde followed by heating at 100°C for 1–2 hr leads to the formation of N-substituted-2-styrylquinazolinones (5a–l), again in situ, as shown by TLC examination of reaction mixtures with authentic intermediates/products. Processing the reaction mixture leads to isolation of 5 (a–l) in good yields. Similarly, the sequence 1→→2 →→3 →→5 could be carried out in tandem in an efficient manner in PEG-600 without the isolation of any intermediates in the sequence of reactions. Thus, treatment of 1 with AC₂O in PEG-600 at 100°C for 1 hr gives 2 in situ. Subsequent treatment of the resulting reactions mixture with 1 equivalent of an aromatic aldehyde followed by heating at 100°C for 2–3 hr leads to the formation of 3 (a–d) again, in situ. Subsequent alkylation of 3 (without its isolation) with DMS/DES/ Ph-CH₂Cl gives methyl/ethyl/benzyl derivatives, respectively, of 5 (a–l), as shown by TLC examination of reaction mixtures with authentic intermediates/products.

Conclusion

In summary, we have developed efficient, mild, and convenient tandem syntheses of N-substituted-2-styryl-4(3H)-quinazolinones (5a–l) in PEG-600 in two routes (i.e., 1→→2 →→3 →→5 or 1→→2 →→4 →→5). Probably, this is the first case of two variable but identical end-products- giving tandem syntheses, under green conditions, of substituted-2-styryl-4(3H)-quinazolinones. Obviously, as figures pointed out, tandem routes gave good yields compared to the stepwise routes.

Experimental section

General

Melting points are uncorrected and were determined in open capillary tubes in sulfuric acid bath. TLC was performed on silica gel-G and spotting was done using iodine or UV-light. IR spectra were recorded with Perkin-Elmer 1000 instrument in KBr phase, ¹H-NMR on VARIAN 400 MHz instrument and Mass spectra on Agilent-LC-MS instrument giving only M⁺ values using Q + 1 or Q-1 mode.

Preparation of 2 from 1 (general procedure)

A mixture of 1 (2.74 g, 20 mmol), acetic anhydride (2.5 mL, 30 mmol) and PEG-600 (40 mL), was heated at 100°C for 1 hr. After completion of reaction (as indicated by TLC using hexane:ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed with water (2 × 10 mL) and dried. Yield = 2.75 gm (85%). The crude product was recrystallized from ethanol to obtain pure 2. M.P. = 228–230°C (Lit.¹⁰ M.P. 230–232°C).

Preparation of 3 from 2 (general procedure)

A mixture of 2 (2.74 g, 15 mmol), aromatic aldehyde (15 mmol) and PEG-600 (40 mL) was heated at 100°C for 1–2 hr. After completion of reaction (as indicated by TLC using hexane:ethyl acetate, 8:2 as eluent) water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed with water (2 × 10 mL) and dried. The crude product was recrystallized from ethanol to obtain pure 3.

3a: Yield = 3.40 g (80%); M.P. 251°C (Lit.¹⁰ M.P. 252°C); IR (KBr): ≈ 3400 cm⁻¹ (broad, medium – NH⁻), 1667 cm⁻¹ (strong, sharp, –CO⁻). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 6.98–7.02 (d, 1H, J = 14 Hz, vinyl proton), 7.40–7.4 (m, 4H, aromatic ring protons), 7.64–8.11 (m, 6H, four quinazolinone ring protons + one aromatic benzene ring proton + one
vinylic proton). 12.33 (s, 1H, br, −NH, D₂O exchangeable). MS: m/z 249 (M⁺ + 1).

3b: Yield = 3.90 g (82%); M.P. 259°C (Lit.¹⁰ M.P. 260°C); IR (KBr): ≈ 3400 cm⁻¹ (broad, medium −NH), 1667 cm⁻¹ (strong, sharp, −CO−). ¹H NMR (400 MHz, DMSO/d₆/TMS): δ 3.80 (s, 3H, OCH₃), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7.00–8.21 (m, 9H, four quinazolinone ring protons + four aromatic benzene ring + one vinyllic proton), 12.33 (s, 1H, br, −NH, D₂O exchangeable). MS m/z 279 (M⁺ + 1).

3c: Yield = 4.50 g (81%); M.P. 253°C (Lit.¹⁰ M.P. 255°C); IR (KBr): ≈ 3400 cm⁻¹ (broad, medium −NH−), 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 3.80 (s, 3H, OCH₃), 4.20 (t, 3H, −CH₂), 4.50 (m, 2H, −CH₂), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7.00–8.21 (m, 8H, four quinazolinone ring protons + three aromatic benzene ring + one vinyllic proton), 12.33 (s, 1H, br, −NH, D₂O exchangeable). MS m/z 323 (M⁺ + 1).

3d: Yield = 3.60 g (80%); M.P. 255°C (Lit.¹⁰ M.P. 258°C); IR (KBr): ≈ 3400 cm⁻¹ (broad, medium −NH−), 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 6.87–8.21 (m, 9H, four quinazolinone ring protons + four aromatic benzene ring proton + one vinyllic proton), 10.22 (s, 1H, br, −OH, D₂O exchangeable), 12.33 (s, 1H, br, −NH, D₂O exchangeable). MS m/z 265 (M⁺ + 1).

**Preparation of 4 from 2 (general procedure)**

A mixture of 2 (2.74 g, 15 mmol), DMS/DES/ Ph-CH₂Cl (15 mmol) and PEG-600 (40 mL), was heated at 100°C for 1–2 hr. After completion of reaction (as indicated by TLC using hexane:ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed (2 × 10 mL) with water and dried. The crude product was recrystallized from ethanol to obtain pure 4.

4a: Yield = 2.50 g (84%); M.P. 63°C (Lit.²² M.P. 65°C); IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 2.5 (s, 3H, −CH₃), 3.50 (s, 3H, −CH₃), 7.5–8 (m, 4H, aromatic benzene ring proton). MS m/z 175 (M⁺ + 1).

4b: Yield = 2.60 g (81%); M.P. 85°C (Lit.²² M.P. 87°C); IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 2.5 (s, 3H, −CH₃), 4.20 (t, 3H, −CH₂), 4.50 (m, 2H, −CH₂), 7.5–8 (m, 4H, aromatic benzene ring). MS m/z 189 (M⁺ + 1).

4c: Yield = 3.50 g (81%); M.P. 95°C (Lit.²² M.P. 97°C); IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 2.5 (s, 3H, −CH₃), 4.50 (s, 2H, −CH₂−), 7–7.5 (m, 5H, aromatic benzene ring protons), 7.5–8 (m, 4H, quinazolinone ring protons). MS: m/z 251 (M⁺ + 1).

**Preparation of 5 from 3 (general procedure)**

A mixture of 3 (2.48 g, 10 mmol), DMS/DES/ Ph-CH₂Cl (10 mmol) and PEG-600 (40 mL) was heated for 1–2 hr at 100°C. After completion of reaction (as indicated by TLC using hexane:ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed with water (2 × 10 mL) and dried. The crude product was recrystallized from ethanol to obtain pure 5.

5a: Yield = 2.27 g (87%); M.P. 120–22°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 3.50 (s, 3H, −CH₃), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7.40–7.4 (m, 4H, aromatic benzene ring), 7.64–8.1 (m, 6H, four quinazolinone ring protons + one aromatic benzene ring + one vinyllic proton). MS: m/z 263 (M⁺ + 1). [Found: C: 77.83, H: 5.36, N: 10.68, C₁₇H₁₄N₂O requires C: 77.84, H: 5.38, N: 10.68%].

5b: Yield = 2.62 g (90%); M.P. 125–26°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 3.70 (s, 3H, −CH₃), 3.80 (s, 3H, OCH₃), 6.98–7.02 (d, 2H, J = 16 Hz, vinylic protons), 7.28–8.11 (m, 8H, four quinazolinone ring protons + four aryl protons). MS m/z 293 (M⁺ + 1). [Found: C: 73.85, H: 5.50, N: 9.55, C₁₈H₁₆N₂O₂ requires C: 73.95, H: 5.52, N: 9.58%].

5c: Yield = 2.95 g (88%); M.P. 120–22°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 3.70 (s, 3H, −CH₃), 3.80 (s, 3H, OCH₃), 4.20 (t, 3H, −CH₂), 4.50 (m, 2H, −CH₂), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7.00–8.21 (m, 8H, four quinazolinone ring protons + three aromatic benzene ring + one vinyllic proton). MS m/z 337 (M⁺ + 1). [Found: C: 71.39, H: 5.95, N: 8.30, C₂₀H₂₀N₂O₃ requires C: 71.41, H: 5.99, N: 8.33%].

5d: Yield = 2.50 g (90%); M.P. 121–23°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 3.70 (s, 3H, −CH₃), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 6.87–8.21 (m, 9H, four quinazolinone ring protons + four aromatic benzene ring + one vinyllic proton), 10.22 (s, 1H, br, OH, D₂O exchangeable). MS m/z 279 (M⁺ + 1). [Found: C: 73.35, H: 5.04, N: 10.04, C₁₇H₁₄N₂O₂ requires C: 73.37, H: 5.07, N: 10.07%].

5e: Yield = 2.34 g (85%); M.P. 121–23°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, −CO−). ¹H NMR (400 MHz, DMSO/d₆/TMS): 1.60 (t, 3H, −CH₂), 4.50 (s, 2H, −CH₂−), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7.40–7.4 (m, 4H, aromatic benzene...
ring) 7.64–8.11 (m, 6H, four quinazoline ring protons + one aromatic benzene ring + one vinylic proton); MS m/z 277 (M⁺ + 1). [Found: C: 78.20, H: 5.80, N: 10.10, C₁₅H₁₆N₂O₂ requires C: 78.24, H: 5.84, N: 10.14\%].

5f: Yield = 2.69 g. (88\%); M.P. 120–22°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, –CO–); ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 1.60 (t, 3H, –CH₃), 4.50 (s, 2H, –CH₂–), 3.80 (s, 3H, OCH₃), 6.98–7.02 (d, 2H, J = 16 Hz, vinylic protons), 7.28–8.11 (m, 8H, four quinazoline ring protons + four aromatic benzene ring). MS m/z 307 (M⁺ + 1). [Found: C: 75.65, H: 5.90, N: 7.80, C₂₆H₂₄N₂O₃ requires C: 75.71, H: 5.86, N: 7.69\%].

5i: Yield = 2.93 g. (83\%); M.P. 118–20°C; IR (KBr): 1667 cm⁻¹ (strong, sharp, –CO–); ¹H-NMR (400 MHz, DMSO/d₆/TMS): δ 4.50 (s, 2H, –CH₂–), 6.98–7.02 (d, 1H, J = 14 Hz, vinylic proton), 7–7.5 (m, 5H, phenyl ring protons), 6.87–8.21 (m, 9H, four quinazoline ring protons + four aromatic benzene ring + one vinylic proton), 10.22 (s, 1H, br, OH, D₂O exchangeable). MS m/z 355 (M⁺ + 1). [Found: C: 77.90, H: 5.05, N: 7.80, C₂₃H₁₈N₂O₂ requires C: 77.95, H: 5.12, N: 7.90\%].

Preparation of 5 from 4 (general procedure)
A mixture of 4 (1.74 g, 10 mmol), aromatic aldehydes (10 mmol) and PEG-600 (40 mL), heated at 100°C for 1–2 hr. After completion of reaction (as indicated by TLC using hexane: ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed (2 × 10 mL) with water and dried. The crude product was recrystallized from ethanol to obtain pure 5.

5a: Yield = 2.35 g. (90\%).
5b: Yield = 2.65 g. (91\%).
5c: Yield = 3.05 g. (91\%).
5d: Yield = 2.50 gm. (90\%).
5e: Yield = 2.40 g. (87\%).
5f: Yield = 2.75 g. (90\%).
5g: Yield = 3.08 g. (88\%).
5h: Yield = 2.62 g. (90\%).
5i: Yield = 2.90 g. (86\%).
5j: Yield = 3.12 g. (85\%).
5k: Yield = 3.62 g. (88\%).
5l: Yield = 2.93 g. (83\%).

Preparation of 5 from 1: (i.e., 1→2→3→5).
(First route)
A mixture of 1 (2.74 g, 20 mmol), acetic anhydride (2.5 mL, 30 mmol) and PEG-600 (40 mL), was heated at 100°C. After 1 hr, the reaction mixture was cooled to room temperature, aromatic aldehyde (20 mmol) was added to the mixture, the reaction mixture heated again to 100°C and maintained at this temperature for 1–2 hr. Then, the reaction mixture was cooled to room temperature, DMSO/DES/ Ph-CH₂Cl (20 mM) was added to the mixture, the reaction mixture heated...
Table 1. Synthesis of N-substituted-2-styrylquinazolinones (5a–l).

| Product | R        | –Ar                   | Routes                  |
|---------|----------|-----------------------|-------------------------|
|         |          |                       | STEP WISE -I            | STEP WISE -II           | TANDEM-I            | TANDEM-II           |
|         |          |                       | 1 2 3 5 Total Over all | 1 2 3 5 Total Over all | 1 [2] [3] 5 Total Over all | 1 [2] [4] 5 Total Over all |
| 5a      | –CH₃     | –C₆H₅                 | 5 59 5 64               |                       |                       |                       |
| 5b      | –CH₃     | –C₆H₄(4-OCH₃)         | 5 63 5 65               |                       |                       |                       |
| 5c      | –CH₃     | –C₆H₃(3-OC₂H₅)(4-OCH₃) | 5 61 5 65               |                       |                       |                       |
| 5d      | –CH₃     | –C₆H₄(2-OH)           | 5 61 5 64               |                       |                       |                       |
| 5e      | –C₂H₅    | –C₆H₅                 | 4.5 58 4.5 60           |                       |                       |                       |
| 5f      | –C₂H₅    | –C₆H₄(4-OCH₃)         | 4.5 61 4.5 62           |                       |                       |                       |
| 5g      | –C₂H₅    | –C₆H₃(3-OC₂H₅)(4-OCH₃) | 4.5 55 4.5 60           |                       |                       |                       |
| 5h      | –C₂H₅    | –C₆H₄(2-OH)           | 4.5 60 4.5 62           |                       |                       |                       |
| 5i      | –C(CH₂-C₆H₅) | –C₆H₅               | 4.5 61 4.5 59           |                       |                       |                       |
| 5j      | –CH₂-C₆H₅ | –C₆H₄(4-OCH₃)         | 4.5 60 4.5 58           |                       |                       |                       |
| 5k      | –CH₂-C₆H₅ | –C₆H₃(3-OC₂H₅)(4-OCH₃) | 4.5 58 4.5 60           |                       |                       |                       |
| 5l      | –CH₂-C₆H₅ | –C₆H₄(2-OH)           | 4.5 56 4.5 57           |                       |                       |                       |
once again to 100°C and maintained at this temperature for 1–2 hr. After completion of reaction (as indicated by TLC using hexane: ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed with water (2 × 10 mL) and dried. The crude product was recrystallized from ethanol to obtain pure 5. For yields Please see Table 1.

Preparation of 5 from 1: (i.e., 1→2→4→5). (tandem synthesis) (second route)
A mixture of 1 (2.74 g, 20 mmol), acetic anhydride (2.5 mL, 30 mmol) and PEG-600 (40 mL), was heated at 100°C. After 1 hr the reaction mixture was cooled to room temperature, DMS/DES/Ph-CH2Cl2 (20 mmol) was added to the reaction mixture and the mixture was heated again to 100°C and maintained at this temperature for 1–2 hr. Then, the reaction mixture was cooled to room temperature, aromatic aldehyde (20 mmol) was added to the mixture and the mixture heated once again to 100°C and maintained at this temperature for 1–2 hr. After completion of reaction (as indicated by TLC using hexane: ethyl acetate, 8:2 as eluent), water (2 × 40 mL) was added to the reaction mixture and the separated solid was filtered, washed with water (2 × 10 mL) and dried. The crude product was recrystallized from ethanol to obtain pure 5. For yields Please see Table 1.

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