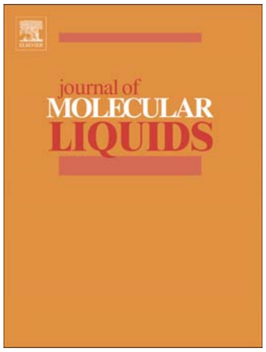

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Conventional spectroscopic identification of *N*-alkylated triazolo-quinazolinones and its antioxidant, solvatochromism studies

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Abstract: A new and highly efficient microwave promoted *N*-alkylation of triazolo-quinazolinones was developed by treating various phenyl-substituted heterocyclic amines with benzyl chloride using K_2CO_3 as a base in the presence of DMF. Also the heterocyclic amines were synthesized by condensing the 3-amino-1,2,4-triazole substituted benzaldehydes and 1,3-cyclohexanedione in the presence of microwave irradiation under solvent free condition. The synthesized heterocycles **4a-o** and **6a-o** were further confirmed by using different spectroscopic techniques such as NMR and HRMS. The compounds **6a-o** was studied for their solvatochromic property with increasing polarity of solvents. The determinations of 2,2-diphenyl-1-picrylhydrazyl radical (DPPH) scavenging effect of the scaffolds **6a-o** were carried out by UV-Vis spectrometer. In terms of IC_{50} all the compounds have shown remarkable antioxidant property compared with Ascorbic acid.

Keywords: Microwave irradiation, *N*-alkylation, Antioxidant activity, Solvatochromism.

1. Introduction

Ring junction heterocyclic compounds have been considered as important moiety in organic chemistry due to its availableness in nature and their arrangement of pharmacological properties [1-10]. A major adventure of modern drug discovery will lead highly proficient chemical reaction. It provides molecules possessing maximum complexity and structural diversity with interesting bioactivities with less number of synthetic reaction steps. Over few decades, researchers have put their efforts on the design, synthesis and the utilization of unreported ring junction nitrogen heterocycles for therapeutic applications [11, 12]. Over recent years, microwave-enhanced synthesis has been attracted potentials as an alternative to traditional methods [13]. Application of microwave source in synthetic chemistry leads to a significant improvement in isolated yields, high selectivity of the product and decrease in the reaction time [14, 15]. Anxiolytic drugs, namely RU 33203, RU 32698 and Taniplon were contained *N*-ring junction in their core structure and are currently used in the clinical treatments [16]. Camptothecin, Luotonin A and Mappicine were also examples of ring junction heterocycles containing nitrogen [17, 18].

Among the highly functionalized heterocyclic compounds quinazolinones and triazolo-quinazolinones exhibits a broad spectrum of applications in research, medicinal and industrial societies [19-23]. Triazolo-quinazolinones possess a significant role in biological field such as antihypertensive [24], anti-inflammatory [25], analgesic [26], antioxidant [27], anticancer [28], antiviral [29], antihistaminic [30], antimicrobial [31, 32] and antifungal [33] activities. Hence, there is a growing demand for the synthetic pathway to construct *N*-heterocyclic units for the biosynthetic natural compounds. Based on the survey we have found a limited number report on *N*-alkylation of triazolo-quinazolinones and it is consider as one of the challenging tool to design an efficient methodology for *N*-alkylation of triazolo-quinazolinones [34, 35]. Herein, a method to overcome these limitations we have synthesized a series of novel *N*-alkylated scaffolds **6a-o** using highly efficient and fast synthetic protocols**.** The synthesized higher membered ring junction *N*-heterocycles **6a-o** was fully characterized by NMR and HRMS data.

2. Experimental

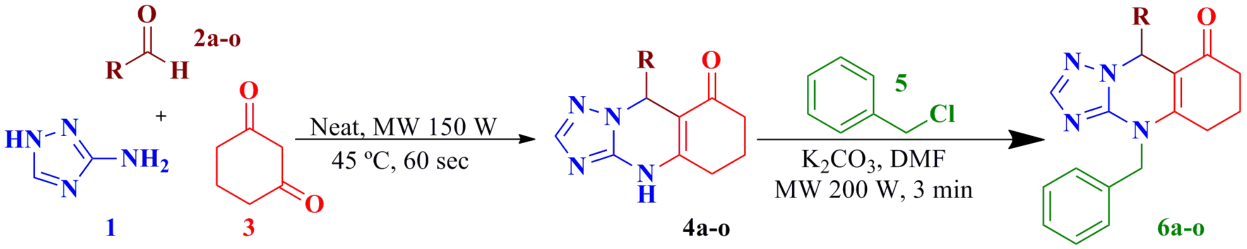
2.1. Materials and methods

The commercially procured materials were used with no purification and the reaction process was monitored by TLC. Product purification was carried out by chromatography by using 60-120 mesh silica gel (E. Merck). NMR was recorded using a Bruker Avance spectrometer (400 MHz) in DMSO-d_6 or $CDCl_3$ solvent. Chemical shift values (δ) were indicated in ppm (parts per million). The symbols are singlet (s), doublet (d), triplet (t) and multiplet (m). Compounds melting points were explored in open capillary tube, rectified with benzoic acid. Compounds mass was measured using Thermo Fleet ionization ESI-MS.

2.2. *Synthesis*

2.2.1. *Synthetic protocol for the synthesis of compounds* ***4a-o***

A mixture of 1,2,4-triazol-3-amine **1** (1 mmol), aromatic aldehydes **2a-o** (1 mmol) and 1,3-cyclohexanedione **3** (1 mmol) were taken in to a RB flask, irradiated under MW at 150 W for 60 sec. The progress of the reaction was observed by TLC. After cooling, the reaction mass became gummy, washed thoroughly with 1:1 hexane and ethyl ethanoate to afford the compounds **4a-o** (Scheme 1).



R = Ph, 4-NO_2Ph, 3-NO_2Ph, 2-NO_2Ph, 4-$CH(CH_3)_2$, 4-Me, 3,4-di-OMe, 2,4-di-OMe, 4-OMe, 3-OMe, 4-Br, 3-Br, 2-Br, 4-Cl, 2-Cl.

Scheme 1: *N*-alkylation of triazolo-quinazolinones (**6a-o**).

2.2.2. *Synthetic protocol for N-alkylation (**6a-o**)*

The compounds **4a-o** (1 mmol), benzyl chloride **5** (1.2 mmol), K_2CO_3 (1.5 mmol) and DMF were placed in a clean dry round quartz glass vessel. The reaction mixture was irradiated with microwave (200 W) for 3 min. TLC was performed to monitor the completion of the reaction status. Filter the reaction mass to remove the K_2CO_3 and the filtrate was concentrate to get solid. The solids were further subjected to column chromatography to isolate the alkylated compounds **6a-o** (Scheme 1).

2.3. *Scavenging assay by DPPH method*

The DPPH scavenging activity was studied as per earlier report [36]. Briefly, 0.1 mM of 1 mL DPPH in dimethyl sulfoxide was added to 3 mL of the synthesized compounds **6a-o** at four concentrations (0.001-0.004 mM) and incubates at room temperature for 30 min. The absorbance of samples and control were measured in UV-visible spectrophotometer at 517 nm. All the tested samples, expressed as percentage inhibition of DPPH were calculated as follows:

$$\text{Percentage of inhibition} = [A_0 - A_{t/}\ A_0] \times 100$$

The abbreviations are absorbance of control (A_0) and absorbance of tested samples (A_t).

2.4. *Effect of solvents on absorption spectra*

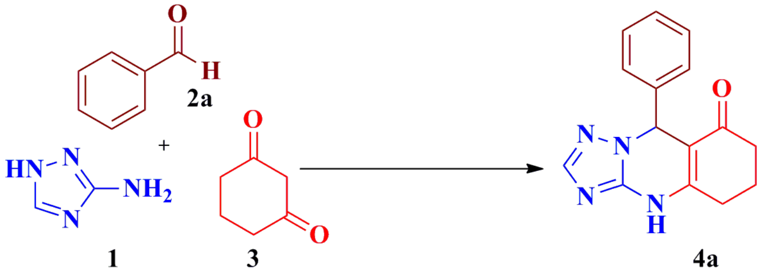
Absorption spectra for the compounds **6a-o** were measured in three different solvents such as 1,4-dioxane, methanol and dimethyl sulfoxide. The absorbance was measured using UV-visible spectrophotometer at a concentration of 0.01 mM [37].

3. Results and Discussion

3.1. *Microwave assisted N-alkylation*

The schematic representation of compounds **4a-o** and **6a-o** synthesis was illustrated in Scheme 1. The optimized reaction parameters for compound **4a** with different methods were given in Table 1. Initially, the reactions were carried out under conventional routes at 50, 70, 100 and 150 ºC for 60 min; the reaction was not progressed in positive manner. Then we have chosen non-conventional sources like Microwave (MW) irradiation, Ultraviolet (UV) energy and Ultrasonic (US) energy. Our experimental outcomes are summarized in Table 1; it demonstrated that under microwave irradiation (300 W) at 80 ºC in 60 sec we observed the formation of triazolo-quinazolinones. To enlarge the yield of **4a** we have decided to fine tune the reaction parameters with various microwave conditions (Table 2, entry 3). However, the same reaction was carried out with 150 W at 55 °C for 60 sec; compound **4a** was procured in 92 % isolated yield. The outcomes were summarized in Table 3.

Table 1
Optimization of synthetic methodologies for compound **4a**.



Entry	Conventional method		Non-conventional method					Reaction Status
	Time (h)	Temperature (°C)	MW (W)	UV (nm)	US (Hz)	Time (min)	Temperature (°C)	
1	1	50	-	-	-	-	-	NR
2	1	70	-	-	-	-	-	NR

3	1	100	-	-	-	-	-	NR
4	1	150	-	-	-	-	-	NR
5	**-**	**-**	**300**	**-**	**-**	**1**	**80**	**EP**
6	-	-	-	365	-	20	-	NR
7	-	-	-	312	-	20	-	NR
8	-	-	-	262	-	20	-	NR
9	-	-	-	-	800	20	-	NR

[a] EP = Expected product, NR = No reaction, MW = Microwave, UV = Ultraviolet, US = Ultrasound. The optimized conditions are mentioned in bold letters.

Table 2

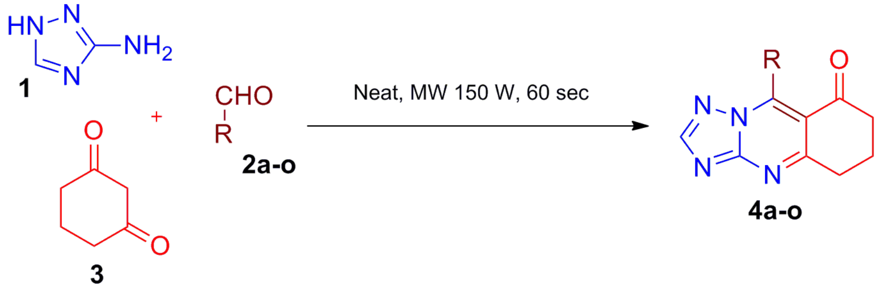
Optimized microwave reaction conditions for the preparation compound **4a**

Entry	Power (W)	Time (min)	Temperature (°C)	Yield (%)[a]
1	50	10	45	55
2	100	5	50	76
3	**150**	**1**	**55**	**92**
4	200	1	64	87
5	250	1	77	84

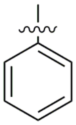
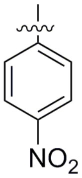
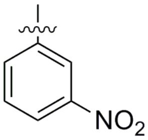
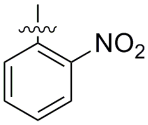
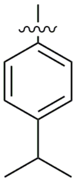
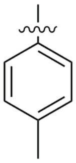
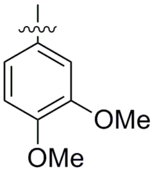
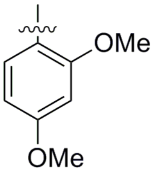
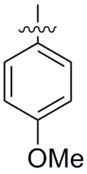
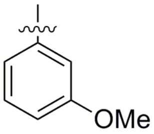
[a] Isolated yields. The optimized reaction parameters are highlighted in bold letters.

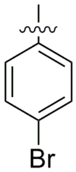
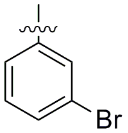
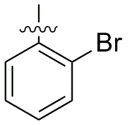
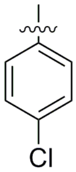
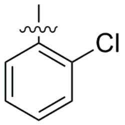
Table 3

Synthesis of 9-(substituted-phenyl)-5,6,7,9-tetrahydro-[1,2,4]triazolo[5,1-b]quinazolin-8(4H)-one, **4a-o**.



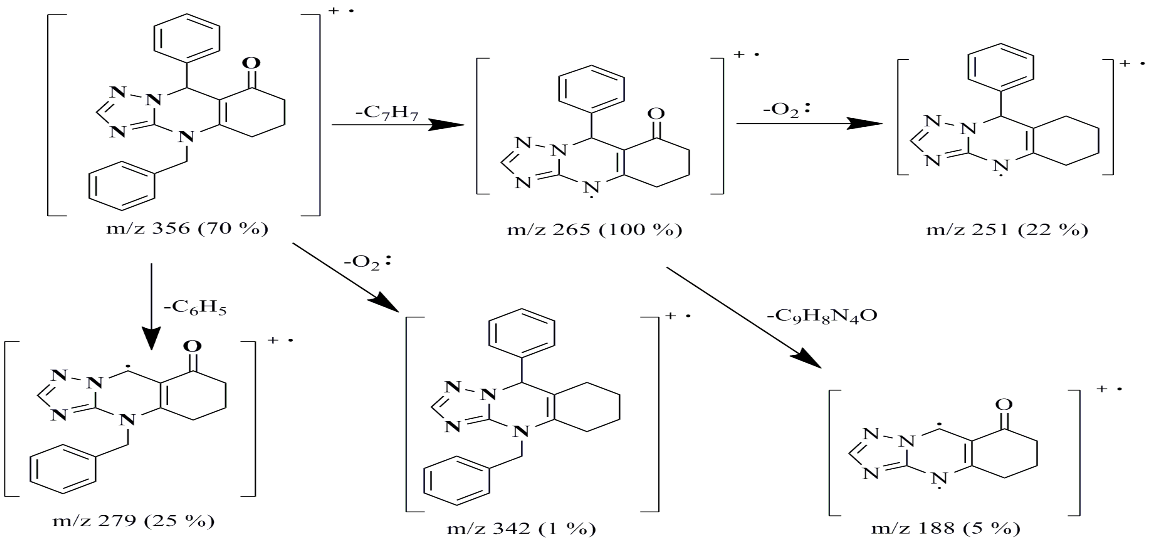
Compound code	R	Yield (%)[a]	MP (°C)

4a		92	316-318
4b		92	342-344
4c		91	322-324
4d		92	284-286
4e		93	288-290
4f		91	316-318
4g		91	248-250
4h		93	252-254
4i		91	336-338
4j		90	258-260

4k		92	312-314
4l		93	272-276
4m		91	318-320
4n		92	324-326
4o		92	316-318

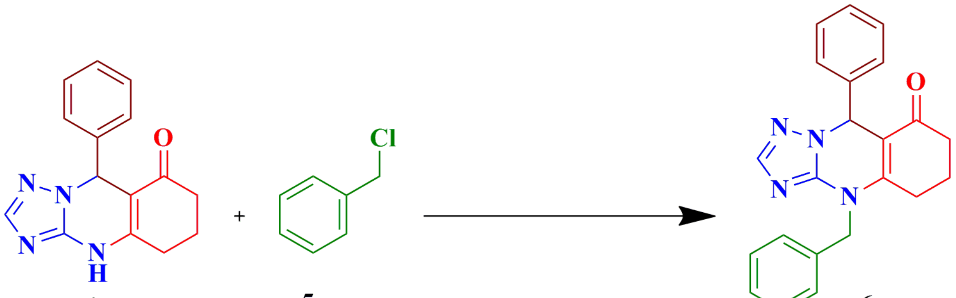
[a] Isolated yields.

In continuation to the formation of triazolo-quinazolin-8(4*H*)-ones **4a-o** we have carried out the reactions of triazolo-quinazolinones **4a-o** with benzyl chloride **5** in presence of potassium carbonate to get *N*-alkylated triazolo-quinazolinones **6a-o**. Various microwave conditions were subjected to the formation of *N*-alkylated triazolo-quinazolinone **6a** (Table 4). From the observed results (Table 4), we have found that potassium carbonate (1.5 eq) in the presence of DMF provides the compound **6a** with 94 % isolated yield (Table 4, entry 7). Much lower yields of *N*-alkylated triazolo-quinazolinones were obtained under stirring condition at room temperatures. Also at the end of the reaction, the desired product was not identified in the absence of either base or solvent (Table 4, entries 9 and 10). To establish the positive effect of this method, the extent of the synthetic methodology with different substrates was investigated under optimal parameters. The outcomes were summarized in Table 5**.** All the desired products, provides good to excellent yield (isolated) which indicates that steric hindrance will not affect the desired product formation **6a-o.** Synthesized higher membered ring junction *N*-heterocycles were well characterized by NMR, melting point and HRMS data. The mass fragmentation of compound **6a** was summarized in Scheme 2.



Scheme 2: Mass fragmentation of compound **6a**.

Table 4
Optimized reaction conditions for the compound **6a**.



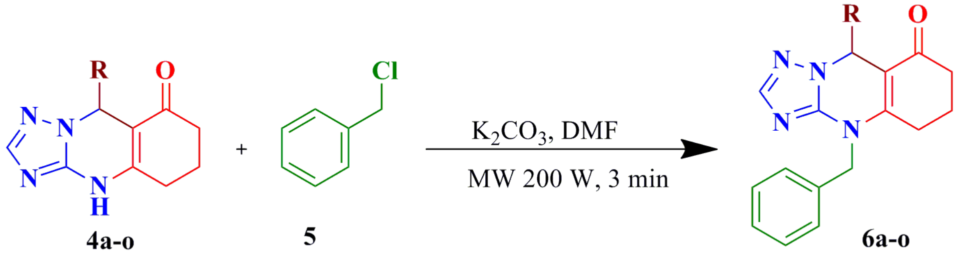
4a **5** **6a**

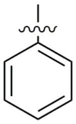
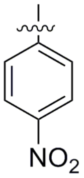
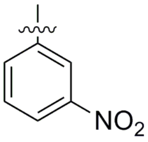
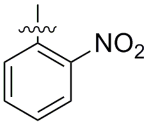
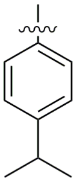
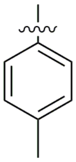
Entry	Base /No. of equiv	Solvent	Microwave		Conventional (rt)	
			watts/min	Yield (%)	Time (h)	Yield (%)^b
1	K_2CO_3/1	THF	300/10	32	3	24
2	K_2CO_3/1	MeCN	300/10	61	3	44
3	K_2CO_3/1	1,4-Dioxane	300/10	41	3	28
4	K_2CO_3/1	DMF	300/8	76	2.5	54
5	K_2CO_3/1.5	DMF	300/3	88	1.5	78
6	K_2CO_3/2	DMF	300/3	88	1.5	78
7	**K_2CO_3/1.5**	**DMF**	**200/3**	**94**	-	-
8	K_2CO_3/1.5	DMF	150/10	79	-	-

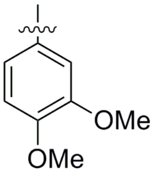
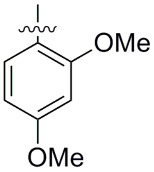
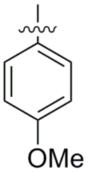
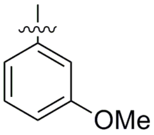
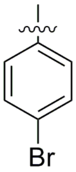
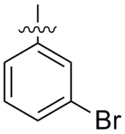
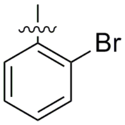
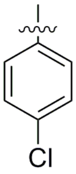
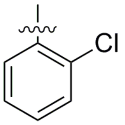
9	-	DMF	200/10	-	5	-
10	K_2CO_3/1.5	-	200/10	-	5	-

[a] Reaction Conditions: compound **4a** (1 mmol), benzyl chloride **5** (1 mmol).
[b] Isolated yields. The optimized reaction parameters are highlighted in bold letters.

Table 5
Synthesis of 4-benzyl-9-(substituted-phenyl)-5,6,7,9-tetrahydro-[1,2,4]triazolo[5,1-*b*]quinazolin-8(4*H*)-ones, **6a-o**.



Compound code	R	Yield (%)[a]	MP (°C)
6a		94	175-177
6b		82	219-221
6c		84	203-205
6d		81	182-184
6e		95	145-147
6f		94	158-160

6g		89	153-155
6h		90	204-206
6i		93	166-168
6j		92	148-150
6k		88	207-209
6l		90	197-199
6m		89	174-176
6n		91	208-210
6o		85	173-175

[a] Isolated yields.

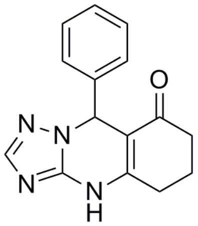
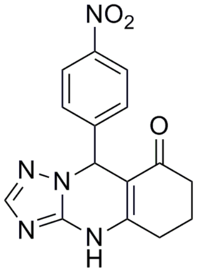
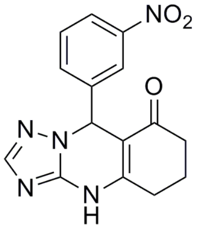
3.2. Spectral analysis

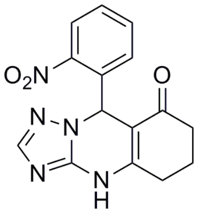
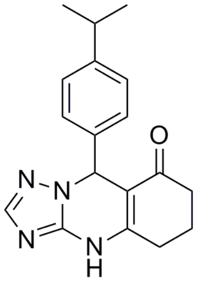
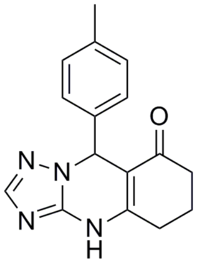
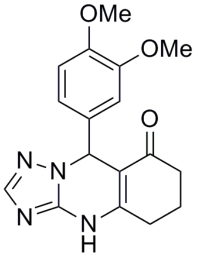
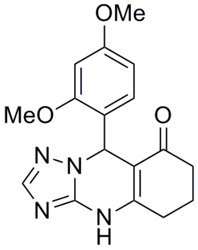
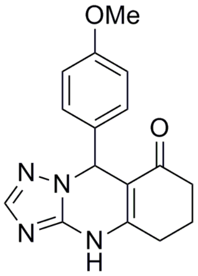
Spectral data of the synthesized compounds **4a-o** and **6a-o** were illustrated in Table 6. Fig. 1 represents the numbering of compound **6a**. The spectral pattern of the reactants and products

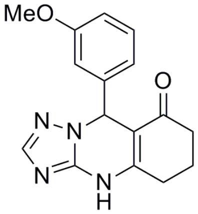
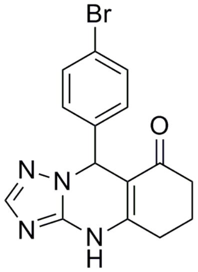
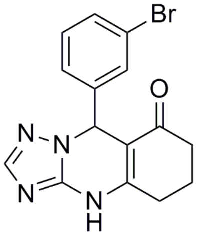
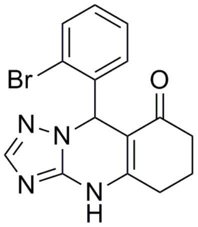
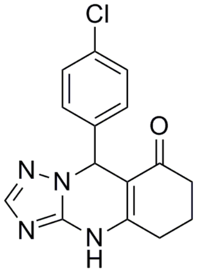
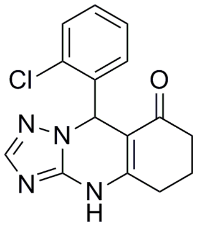
(**4a**, **5** and **6a**) were illustrated in Fig. 2-5. All spectrums were recorded in Bruker Avance 400 Mz spectrometer in $CDCl_3$ and DMSO-d_6 as solvent. The ^{1}H NMR of the compound **4a** has totally 14 protons, out of these methylene protons (3 x CH_2) were appears at the range of 1.7-2.7 ppm, other methine proton (-CH) appear as singlet at 6.3 ppm, 6 aromatic protons were appear at the range of 7.2-7.7 ppm and –NH proton appears as singlet at 11.2 ppm. Compound **5** has totally 7 protons, 2 aliphatic protons (CH_2) appears at 4.5 ppm and 5 aromatic protons were appears at the range of 7.2-7.32 ppm. In case of compound **6a** totally 20 protons were present, 6 aliphatic protons (3*CH_2) were appeared at the range of 1.8-2.8 ppm, 2 benzyl protons (-CH_2) were appears at 5.2-5.6 ppm, other aliphatic proton (-CH) appeared as singlet at 6.6 ppm, and 11 aromatic protons were appears at the range of 7.2-7.7 ppm (Fig. 2). The absence of –NH peak and the presence of benzyl -CH_2 peak is illustrated in Fig. 2, it clearly confirms the formation of *N*-alkylated compound **6a** from the reaction between compound **4a** and compound **5**.

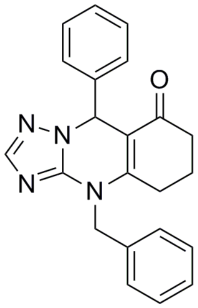
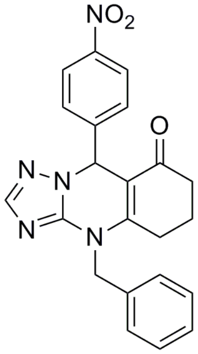
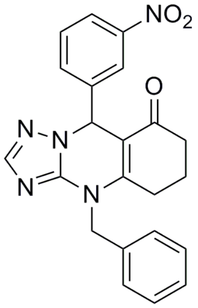
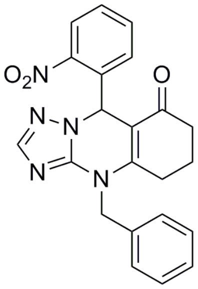
Table 6

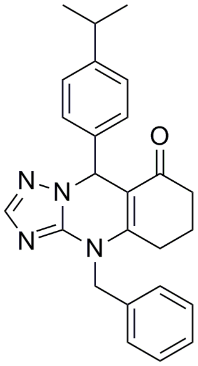
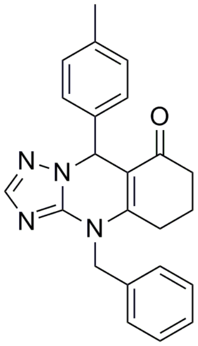
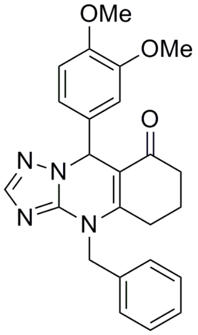
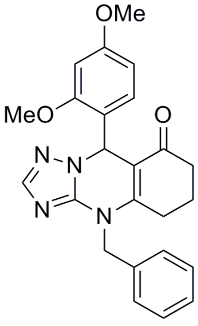
Spectral data of compounds **4a-o** and **6a-o**.

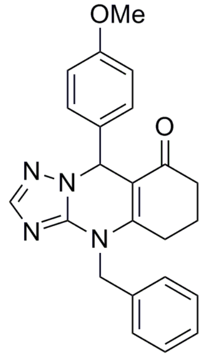
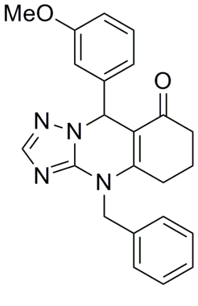
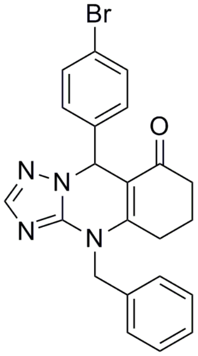
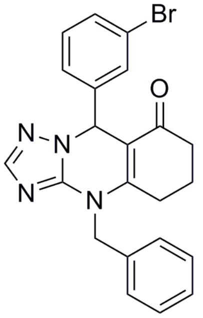
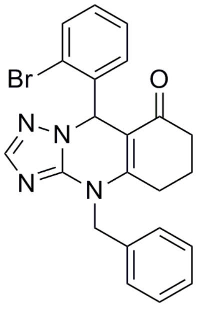
Compound structure	^{1}H-NMR (400 MHz; DMSO-d_6 or $CDCl_3$; δ ppm)	^{13}C-NMR (100 MHz; DMSO-d_6 or $CDCl_3$; δ ppm)	HR-MS or reference
	1.88-2.01 (m, C$\underline{H}_2$, 2H), 2.20-2.34 (m, C$\underline{H}_2$, 2H), 2.60-2.73 (m, C$\underline{H}_2$, 2H), 6.23 (s, C$\underline{H}$, 1H), 7.20-7.30 (m, Ar-$\underline{H}$, 5H), 7.69 (s, Ar-$\underline{H}$, 1H), 11.15 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 26.3 ($\underline{C}H_2$), 36.2 ($\underline{C}H_2$), 57.6 ($\underline{C}$H), 106.5, 126.9, 2 x 127.6, 2 x 128.2, 141.4, 146.7, 150.0 (N=$\underline{C}$H-N), 152.5, 193.2 ($\underline{C}$=O)	[38, 39]
	1.88-2.01 (m, C$\underline{H}_2$, 2H), 2.22-2.31 (m, C$\underline{H}_2$, 2H), 2.66-2.69 (m, C$\underline{H}_2$, 2H), 6.38 (s, C$\underline{H}$, 1H), 7.51 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 7.40 (s, Ar-$\underline{H}$, 1H), 8.15 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 11.32 (s, N$\underline{H}$, 1H)	20.5 ($\underline{C}H_2$), 26.4 ($\underline{C}H_2$), 36.1 ($\underline{C}H_2$), 57.3 ($\underline{C}$H), 105.7, 2 x 123.5, 2 x 128.4, 146.7, 146.9, 148.3, 150.3 (N=$\underline{C}$H-N), 153.1, 193.3 ($\underline{C}$=O)	[38, 39]
	1.88-2.02 (m, C$\underline{H}_2$, 2H), 2.21-2.38 (m, C$\underline{H}_2$, 2H), 2.62-2.75 (m, C$\underline{H}_2$, 2H), 6.43 (s, C$\underline{H}$, 1H), 7.58-7.68 (m, Ar-$\underline{H}$, 2H), 7.74 (s, Ar-$\underline{H}$, 1H), 8.07-8.12 (m, Ar-$\underline{H}$, 2H), 11.31 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 26.4 ($\underline{C}H_2$), 36.2 ($\underline{C}H_2$), 57.2 ($\underline{C}$H), 105.6, 121.7, 122.7, 130.0, 133.6, 143.4, 146.7, 147.6, 150.4 (N=$\underline{C}$H-N), 153.2, 193.4 ($\underline{C}$=O)	[38, 39]

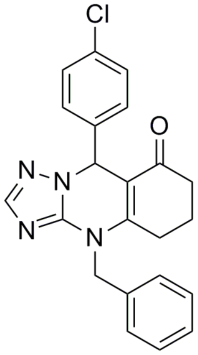
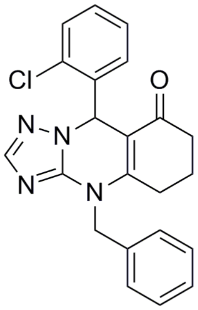
	1.82-1.97 (m, C$\underline{H}_2$, 2H), 2.13-2.28 (m, C$\underline{H}_2$, 2H), 2.63-2.64 (m, C$\underline{H}_2$, 2H), 6.95 (s, C$\underline{H}$, 1H), 7.27 (d, *J* = 0.8 Hz, Ar-$\underline{H}$, 1H), 7.44-7.48 (m, Ar-$\underline{H}$, 1H), 7.56-7.60 (m, Ar-$\underline{H}$, 1H), 7.70 (s, Ar-$\underline{H}$, 1H), 7.82-7.84 (m, Ar-$\underline{H}$, 1H), 11.29 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 26.3 ($\underline{C}H_2$), 35.9 ($\underline{C}H_2$), 52.9 ($\underline{C}$H), 105.6, 123.9, 128.9, 129.3, 133.3, 134.8, 146.7, 148.5, 150.3 (N=$\underline{C}$H-N), 153.2, 193.4 ($\underline{C}$=O)	311.1018
	1.15 (d, *J* = 6.8 Hz, 2 x C$\underline{H}_3$, 6H), 1.88-2.09 (m, C$\underline{H}_2$, 2H), 2.25-2-30 (m, C$\underline{H}_2$, 2H), 2.64-2.68 (m, C$\underline{H}_2$, 2H), 2.79-2.86 (m, C$\underline{H}$, 1H), 6.19 (s, C$\underline{H}$, 1H), 7.10-7.16 (m, Ar-$\underline{H}$, 4H), 7.68 (s, Ar-$\underline{H}$, 1H), 11.12 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 2 x 23.7 ($\underline{C}H_3$), 26.3 ($\underline{C}H_2$), 33.0 ($\underline{C}$H), 36.3 ($\underline{C}H_2$), 57.3 ($\underline{C}$H), 106.6, 2 x 126.1, 2 x 126.9, 139.0, 146.7, 147.7, 149.9 (N=$\underline{C}$H-N), 152.4, 193.2 ($\underline{C}$=O).	306.1637
	1.84-2.00 (m, C$\underline{H}_2$, 2H), 2.19-2.33 (m, C$\underline{H}_3$, CH_2, 5H), 2.60-2.70 (m, C$\underline{H}_2$, 2H), 6.18 (s, C$\underline{H}$, 1H), 7.08 (s, Ar-$\underline{H}$, 4H), 7.67 (s, Ar-$\underline{H}$, 1H), 11.12 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 21.7 ($\underline{C}H_3$), 26.3 ($\underline{C}H_2$), 36.3 ($\underline{C}H_2$), 57.4 ($\underline{C}$H), 106.7, 2 x 126.8, 2 x 128.7, 136.9, 138.6, 146.7, 149.9 (N=$\underline{C}$H-N), 152.3, 193.2 ($\underline{C}$=O)	[38, 39]
	1.86-2.02 (m, C$\underline{H}_2$, 2H), 2.26-2.30 (m, C$\underline{H}_2$, 2H), 2.61-2.72 (m, C$\underline{H}_2$, 2H), 3.70 (d, *J* = 4.8 Hz, 2 x OC$\underline{H}_3$, 6H), 6.18 (s, C$\underline{H}$, 1H), 6.45-6.67 (m, Ar-$\underline{H}$, 1H), 6.83-6.85 (m, Ar-$\underline{H}$, 2H), 7.69 (s, Ar-$\underline{H}$, 1H), 11.10 (s, N$\underline{H}$, 1H)	20.7 ($\underline{C}H_2$), 26.3 ($\underline{C}H_2$), 36.3 ($\underline{C}H_2$), 2 x 55.4 (O$\underline{C}H_3$), 57.2 ($\underline{C}$H), 106.6, 111.2, 111.6, 118.9, 134.0, 146.6, 148.3, 148.3, 149.8 (N=$\underline{C}$H-N), 152.3, 193.2 ($\underline{C}$=O)	326.1379
	1.83-1.99 (m, C$\underline{H}_2$, 2H), 2.14-2.29 (m, C$\underline{H}_2$, 2H), 2.57-2.66 (m, C$\underline{H}_2$, 2H), 3.69 (d, *J* = 20 Hz, 2 x OC$\underline{H}_3$, 6H), 6.33 (s, C$\underline{H}$, 1H), 6.41-6.47 (m, Ar-$\underline{H}$, 2H), 7.12 (d, *J* = 8.4 Hz, Ar-$\underline{H}$, 1H), 7.58 (s, Ar-$\underline{H}$, 1H), 10.97 (s, N$\underline{H}$, 1H)	20.7 ($\underline{C}H_2$), 26.3 ($\underline{C}H_2$), 36.4 ($\underline{C}H_2$), 54.2 ($\underline{C}$H), 55.1 (O$\underline{C}H_3$), 55.7 (O$\underline{C}H_3$), 98.8, 104.6, 106.1, 121.9, 130.0, 147.1, 149.3 (N=$\underline{C}$H-N), 152.4, 158.2, 160.1, 193.0 ($\underline{C}$=O)	326.1378
	1.85-2.01 (m, C$\underline{H}_2$, 2H), 2.20-2.33 (m, C$\underline{H}_2$, 2H), 2.59-2.72 (m, C$\underline{H}_2$, 2H), 3.70 (s, OC$\underline{H}_3$, 3H), 6.18 (s, C$\underline{H}$, 1H), 6.83 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 7.12 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 7.67 (s, Ar-$\underline{H}$, 1H), 11.10 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}H_2$), 26.3 ($\underline{C}H_2$), 36.3 ($\underline{C}H_2$), 55.0 (O$\underline{C}H_3$), 57.0 ($\underline{C}$H), 106.7, 2 x 113.5, 2 x 128.1, 133.7, 146.6, 149.9 (N=$\underline{C}$H-N), 152.2, 158.7, 193.2 ($\underline{C}$=O)	[38, 39]

	1.88-2.01 (m, C$\underline{H}_2$, 2H), 2.22-2.34 (m, C$\underline{H}_2$, 2H), 2.59-2.73 (m, C$\underline{H}_2$, 2H), 3.71 (s, OC$\underline{H}_3$, 3H), 6.21 (s, C$\underline{H}$, 1H), 6.73-6.82 (m, Ar-$\underline{H}$, 2H), 7.20 (t, *J* = 8 Hz, Ar-$\underline{H}$, 2H), 7.69 (s, Ar-$\underline{H}$, 1H), 11.13 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}$H$_2$), 26.3 ($\underline{C}$H$_2$), 36.2 ($\underline{C}$H$_2$), 54.9 (O$\underline{C}$H$_3$), 57.4 ($\underline{C}$H), 106.4, 112.5, 113.2, 118.9, 129.4, 142.9, 146.7, 150.0 (N=$\underline{C}$H-N), 152.5, 159.0, 193.2 ($\underline{C}$=O)	296.1273
	1.88-2.01 (m, C$\underline{H}_2$, 2H), 2.20-2.34 (m, C$\underline{H}_2$, 2H), 2.60-2.72 (m, C$\underline{H}_2$, 2H), 6.22 (s, C$\underline{H}$, 1H), 7.18(d, *J* = 7.6 Hz, Ar-$\underline{H}$, 2H), 7.48 (d, *J* = 7.6 Hz, Ar-$\underline{H}$, 2H), 7.70 (s, Ar-$\underline{H}$, 1H), 11.19 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}$H$_2$), 26.3 ($\underline{C}$H$_2$), 36.5 ($\underline{C}$H$_2$), 57.2 ($\underline{C}$H), 106.1, 120.8, 2 x 129.2, 2 x 131.1, 140.8, 146.6, 150.1 (N=$\underline{C}$H-N), 152.7, 193.3 ($\underline{C}$=O)	[38, 39]
	1.87-2.01 (m, C$\underline{H}_2$, 2H), 2.23-2.33 (m, C$\underline{H}_2$, 2H), 2.60-2.74 (m, C$\underline{H}_2$, 2H), 6.24 (s, C$\underline{H}$, 1H), 7.17-7.28(m, Ar-$\underline{H}$, 2H), 7.42-7.45 (m, Ar-$\underline{H}$, 2H), 7.72 (s, Ar-$\underline{H}$, 1H), 11.22 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}$H$_2$), 26.4 ($\underline{C}$H$_2$), 36.2 ($\underline{C}$H$_2$), 57.2 ($\underline{C}$H), 105.9, 121.4, 126.0, 129.9, 130.5, 130.6, 143.9, 146.6, 150.2 (N=$\underline{C}$H-N), 152.9, 193.3 ($\underline{C}$=O)	344.0273
	1.87-1.99 (m, C$\underline{H}_2$, 2H), 2.14-2.29 (m, C$\underline{H}_2$, 2H), 2.60-2.70 (m, C$\underline{H}_2$, 2H), 6.56 (s, C$\underline{H}$, 1H), 7.13-7.17 (m, Ar-$\underline{H}$, 1H), 7.27(d, *J* = 8 Hz, Ar-$\underline{H}$, 2H), 7.52 (d, *J* = 7.6 Hz, Ar-$\underline{H}$, 1H), 7.63 (s, Ar-$\underline{H}$, 1H), 11.19 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}$H$_2$), 26.4 ($\underline{C}$H$_2$), 36.3 ($\underline{C}$H$_2$), 58.0 ($\underline{C}$H), 105.9, 122.7, 127.9, 129.6, 130.1, 132.7, 139.9, 146.5, 150.0 (N=$\underline{C}$H-N), 153.1, 193.1 ($\underline{C}$=O)	344.2114
	1.88-1.99 (m, C$\underline{H}_2$, 2H), 2.20-2.34 (m, C$\underline{H}_2$, 2H), 2.64-2.71 (m, C$\underline{H}_2$, 2H), 6.24 (s, C$\underline{H}$, 1H), 7.24 (d, *J* = 8.4 Hz, Ar-$\underline{H}$, 2H), 7.35 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 7.71 (s, Ar-$\underline{H}$, 1H), 11.20 (s, N$\underline{H}$, 1H)	20.6 ($\underline{C}$H$_2$), 26.3 ($\underline{C}$H$_2$), 36.2 ($\underline{C}$H$_2$), 57.17 ($\underline{C}$H), 106.1, 2 x 128.2, 2 x 128.9, 132.2, 140.4, 146.6, 150.1 (N=$\underline{C}$H-N), 152.7, 193.2 ($\underline{C}$=O)	[38, 39]
	1.87-2.01 (m, C$\underline{H}_2$, 2H), 2.18-2.29 (m, C$\underline{H}_2$, 2H), 2.65-2.69 (m, C$\underline{H}_2$, 2H), 6.58 (s, C$\underline{H}$, 1H), 7.24-7.38 (m, Ar-$\underline{H}$, 4H), 7.66 (s, Ar-$\underline{H}$, 1H), 11.23 (s, N$\underline{H}$, 1H)	20.7 ($\underline{C}$H$_2$), 26.4 ($\underline{C}$H$_2$), 36.3 ($\underline{C}$H$_2$), 55.9 ($\underline{C}$H), 105.6, 127.2, 129.3, 129.4, 130.2, 132.3, 138.3, 146.6, 150.0 (N=$\underline{C}$H-N), 153.1, 193.1 ($\underline{C}$=O)	300.0778

	1.90-2.06 (m, C*H*$_2$, 2H), 2.25-2.42 (m, C*H*$_2$, 2H), 2.52-2.60 (m, C*H*$_2$, 1H), 2.73-2.80 (m, C*H*$_2$, 1H), 5.23 (d, *J* = 16.8 Hz, C*H*$_2$, 1H), 5.41 (d, *J* = 16.8 Hz, C*H*$_2$, 1H), 6.54 (s, C*H*, 1H), 7.23-7.38 (m, Ar-*H*, 10H), 7.67 (s, Ar-*H*, 1H)	20.8 (CH$_2$), 25.7 (CH$_2$), 36.0 (CH$_2$), 49.1 (CH$_2$), 57.7 (CH), 110.3, 126.2, 126.9, 2 x 128.1, 2 x 128.2, 2 x 128.6, 2 x 129.2, 136.1, 140.7, 149.2, 150.2 (N=CH-N), 151.8, 193.9 (C=O)	356.1630
	1.88-2.11 (m, C*H*$_2$, 2H), 2.28-2.43 (m, C*H*$_2$, 2H), 2.57-2.65 (m, C*H*$_2$, 1H), 2.78-2.85 (m, C*H*$_2$, 1H), 5.28 (d, *J* = 16.8 Hz, C*H*$_2$, 1H), 5.41 (d, *J* = 16.8 Hz, C*H*$_2$, 1H), 6.61 (s, C*H*, 1H), 7.25-7.41 (m, Ar-*H*, 7H), 7.69 (s, Ar-*H*, 1H) 8.13 (d, *J* = 16.8 Hz, Ar-*H*, 2H)	20.8 (CH$_2$), 25.8 (CH$_2$), 35.9 (CH$_2$), 49.3 (CH$_2$), 57.3 (CH), 109.3, 2 x 123.9, 126.2, 2 x 128.0, 2 x 128.3, 2 x 129.3, 135.8, 147.4, 147.5, 149.3, 150.6 (N=CH-N), 152.5, 193.9 (C=O)	401.1487
	1.90-2.11 (m, C*H*$_2$, 2H), 2.28-2.43 (m, C*H*$_2$, 2H), 2.59-2.67 (m, C*H*$_2$, 1H), 2.78-2.85 (m, C*H*$_2$, 1H), 5.25 (d, *J* = 16.8 Hz, C*H*$_2$, 1H), 5.49 (d, *J* = 16.4 Hz, C*H*$_2$, 1H), 6.61 (s, C*H*, 1H), 7.26-7.52 (m, Ar-*H*, 6H), 7.68 (s, Ar-*H*, 1H), 7.80 (d, *J* = 7.6 Hz, Ar-*H*, 1H), 8.01 (t, *J* = 1.6 Hz, Ar-*H*, 1H), 8.10-8.11 (m, Ar-*H*, 1H)	20.8 (CH$_2$), 25.8 (CH$_2$), 35.9 (CH$_2$), 49.3 (CH$_2$), 57.4 (CH), 109.1, 121.5, 123.2, 126.1, 2 x 128.3, 2 x 129.4, 129.5, 134.0, 135.8, 142.7, 148.5, 149.1, 150.6 (N=CH-N), 152.6, 193.9 (C=O)	401.1488
	1.85-2.05 (m, C*H*$_2$, 2H), 2.22-2.35 (m, C*H*$_2$, 2H)s, 2.53-2.61 (m, C*H*$_2$, 1H), 2.74-2.81 (m, C*H*$_2$, 1H), 5.29-5.39 (m, C*H*$_2$, 2H), 7.16 (s, C*H*, 1H), 7.25-7.50 (m, Ar-*H*, 8H), 7.69 (s, Ar-*H*, 1H), 7.79 (d, *J* = 1.2 Hz, Ar-*H*, 1H)	20.9 (CH$_2$), 25.7 (CH$_2$), 35.6(CH$_2$), 49.4 (CH$_2$), 54.3 (CH), 109.0, 124.4, 126.2, 128.1, 2 x 129.0, 2 x 129.2, 129.9, 132.6, 134.5, 136.0, 149.2, 149.3, 150.4 (N=CH-N), 152.8, 193.9 (C=O)	401.1488

	1.19 (d, *J* = 6.8 Hz, 2 x C$\underline{H}_3$, 6H), 1.88-2.05 (m, C$\underline{H}_2$, 2H), 2.25-2.43 (m, C$\underline{H}_2$, 2H), 2.52-2.60 (m, C$\underline{H}$, 1H), 2.73-2. 85 (m, C$\underline{H}_2$, 2H), 5.22 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 5.41 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 6.51 (s, C$\underline{H}$, 1H), 7.11-7.18 (m, Ar-$\underline{H}$, 4H), 7.25-7.27 (m, Ar-$\underline{H}$, 2H), 7.38-7.40 (m, Ar-$\underline{H}$, 3H), 7.65 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 2 x 23.8 ($\underline{C}$H$_3$), 25.7 ($\underline{C}$H$_2$), 33.7 ($\underline{C}$H), 36.0 ($\underline{C}$H$_2$), 49.1 ($\underline{C}$H$_2$), 57.5 ($\underline{C}$H), 110.5, 2 x 12.19, 126.7, 2 x 126.8, 2 x 128.0, 2 x 129.2, 136.23, 138.1, 148.6, 149.2, 150.1 (N=$\underline{C}$H-N), 151.6, 194.0 ($\underline{C}$=O)	398.2105
	1.88-2.06 (m, C$\underline{H}_2$, 2H), 2.25-2.40 (m, C$\underline{H}_2$, C$\underline{H}_3$, 5H), 2.52-2.60 (m, C$\underline{H}_2$, 1H), 2.73-2.80 (m, C$\underline{H}_2$, 1H), 5.22 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 5.41 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 6.50 (s, C$\underline{H}$, 1H), 7.08 (d, *J* = 8 Hz, Ar-$\underline{H}$, 2H), 7.15 (d, *J* = 8 Hz, Ar-$\underline{H}$, 2H), 7.25 (t, *J* = 3.6 Hz, Ar-$\underline{H}$, 2H), 7.31-7.40 (m, Ar-$\underline{H}$, 3H), 7.64 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 21.1 ($\underline{C}$H$_3$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.1 ($\underline{C}$H$_2$), 57.6 ($\underline{C}$H), 110.4, 126.2, 2 x 126.8, 2 x 128.0, 2 x 129.2, 2 x 129.3, 136.2, 137.9, 137.9, 149.2, 150.1 (N=$\underline{C}$H-N), 151.6, 193.9 ($\underline{C}$=O)	370.1790
	1.90-2.03 (m, C$\underline{H}_2$, 2H), 2.27-2.43 (m, C$\underline{H}_2$, 2H), 2.56-2.80 (m, C$\underline{H}_2$, 2H), 3.81 (s, 2 x OC$\underline{H}_3$, 6H), 5.17 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 5.47 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 6.49 (s, C$\underline{H}$, 1H), 6.68-6.85 (m, Ar-$\underline{H}$, 3H), 7.27-7.36 (m, Ar-$\underline{H}$, 5H), 7.67 (d, *J* = 72.4 Hz, Ar-$\underline{H}$, 1H)	20.9 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.0 ($\underline{C}$H$_2$), 2 x 55.8 (O$\underline{C}$H$_3$), 57.4 ($\underline{C}$H), 110.4, 110.5, 111.0, 119.0, 126.1, 2 x 128.1, 2 x 129.2, 133.5, 136.2, 148.8, 148.9, 149.1, 150.1 (N=$\underline{C}$H-N), 151.5, 194.0 ($\underline{C}$=O)	416.8840
	1.87-2.04 (m, C$\underline{H}_2$, 2H), 2.22-2.38 (m, C$\underline{H}_2$, 2H), 2.50-2.58 (m, C$\underline{H}_2$, 1H), 2.73-2.80 (m, C$\underline{H}_2$, 1H), 3.57 (s, OC$\underline{H}_3$, 3H), 3.75 (s, OC$\underline{H}_3$, 3H), 5.25-5.36 (m, C$\underline{H}_2$, 2H), 6.37-6.45 (m, Ar-$\underline{H}$, 2H), 6.59 (s, C$\underline{H}$, 1H), 7.26-7.40 (m, Ar-$\underline{H}$, 6H), 7.61 (s, Ar-$\underline{H}$, 1H)	21.0 ($\underline{C}$H$_2$), 25.8 ($\underline{C}$H$_2$), 36.1 ($\underline{C}$H$_2$), 49.2 ($\underline{C}$H$_2$), 55.2 ($\underline{C}$H), 55.3 (O$\underline{C}$H$_3$), 55.8 (O$\underline{C}$H$_3$), 99.5, 104.5, 109.6, 121.0, 2 x 126.4, 127.9, 2 x 129.1, 131.0, 136.5, 2 x 149.6, 151.8 (N=$\underline{C}$H-N), 158.6, 160.8, 193.9 ($\underline{C}$=O)	416.8840

	1.90-2.06 (m, C$\underline{H}_2$, 2H), 2.25-2.42 (m, C$\underline{H}_2$, 2H), 2.52-2.60 (m, C$\underline{H}_2$, 1H), 2.73-2.80 (m, C$\underline{H}_2$, 1H), 3.75 (s, OC$\underline{H}_3$, 3H), 5.22 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 5.40 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 6.49 (s, C$\underline{H}$, 1H), 6.80 (d, *J* = 16.4 Hz, Ar-$\underline{H}$, 2H), 7.17-7.40 (m, Ar-$\underline{H}$, 7H), 7.65 (s, Ar-$\underline{H}$, 1H)	20.9 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.1 ($\underline{C}$H$_2$), 55.2 (O$\underline{C}$H$_3$), 57.3 ($\underline{C}$H), 110.4, 2 x 113.0, 126.2, 2 x 128.0, 2 x 128.1, 2 x 129.2, 133.1, 136.2, 149.1, 150.1 (N=$\underline{C}$H-N), 151.5, 159.3, 194.0 ($\underline{C}$=O)	386.1740
	1.90-2.07 (m, C$\underline{H}_2$, 2H), 2.25-2.43 (m, C$\underline{H}_2$, 2H), 2.52-2.60 (m, C$\underline{H}_2$, 1H), 2.73-2.79 (m, C$\underline{H}_2$, 1H), 3.75 (s, OC$\underline{H}_3$, 3H), 5.22 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 5.40 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 6.51 (s, C$\underline{H}$, 1H), 6.76-6.83 (m, Ar-$\underline{H}$, 3H), 7.17-7.39 (m, Ar-$\underline{H}$, 6H), 7.66 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.1 ($\underline{C}$H$_2$), 55.1 (O$\underline{C}$H$_3$), 57.6 ($\underline{C}$H), 110.2, 112.8, 113.6, 119.2, 126.1, 2 x 128.0, 2 x 129.2, 129.5, 136.2, 142.3, 149.2, 150.1 (N=$\underline{C}$H-N), 151.7, 159.7, 193.9 ($\underline{C}$=O)	386.1743
	1.89-2.08 (m, C$\underline{H}_2$, 2H), 2.26-2.42 (m, C$\underline{H}_2$, 2H), 2.53-2.61 (m, C$\underline{H}_2$, 1H), 2.74-2.81 (m, C$\underline{H}_2$, 1H), 5.23 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 5.40 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 6.49 (s, C$\underline{H}$, 1H), 7.12 (d, *J* = 8.8 Hz, Ar-$\underline{H}$, 2H), 7.25 (t, *J* = 6.8 Hz, Ar-$\underline{H}$, 2H), 7.35-7.41 (m, Ar-$\underline{H}$, 5H), 7.66 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.2 ($\underline{C}$H$_2$), 57.3 ($\underline{C}$H), 109.9, 122.2, 126.2, 2 x 128.2, 2 x 128.7, 2 x 129.2, 2 x 131.7, 136.0, 139.7, 149.2, 150.3 (N=$\underline{C}$H-N), 151.9, 193.8 ($\underline{C}$=O)	434.0741
	1.96-2.07 (m, C$\underline{H}_2$, 2H), 2.26-2.44 (m, C$\underline{H}_2$, 2H), 2.54-2.62 (m, C$\underline{H}_2$, 1H), 2.75-2.81 (m, C$\underline{H}_2$, 1H), 5.22 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 5.44 (d, *J* = 16.4 Hz, C$\underline{H}_2$, 1H), 6.49 (s, C$\underline{H}$, 1H), 7.15-7.42 (m, Ar-$\underline{H}$, 9H), 7.67 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 35.9 ($\underline{C}$H$_2$), 49.2 ($\underline{C}$H$_2$), 57.3 ($\underline{C}$H), 109.8, 122.8, 126.1, 128.1, 2x 129.3, 2 x 129.7, 130.1, 131.3, 136.0, 142.9, 149.2, 150.4 (N=$\underline{C}$H-N), 152.0, 193.8 ($\underline{C}$=O)	435.0742
	1.91-2.06 (m, C$\underline{H}_2$, 2H), 2.24-2.38 (m, C$\underline{H}_2$, 2H), 2.55-2.63 (m, C$\underline{H}_2$, 1H), 2.78-2.85 (m, C$\underline{H}_2$, 1H), 5.28-5.38 (m, C$\underline{H}_2$, 2H), 6.81 (s, C$\underline{H}$, 1H), 7.08-7.12 (m, Ar-$\underline{H}$, 1H), 7.24 (t, *J* = 1.2 Hz, Ar-$\underline{H}$, 1H), 7.30-7.41 (m, Ar-$\underline{H}$, 6H), 7.51-7.53 (m, Ar-$\underline{H}$, 1H), 7.66 (s, Ar-$\underline{H}$, 1H)	21.0 ($\underline{C}$H$_2$), 25.8 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.4 ($\underline{C}$H$_2$), 58.9 ($\underline{C}$H), 109.1, 123.1, 126.5, 2 x 127.6, 128.1, 2 x 129.1, 129.7, 130.8, 133.6, 136.2, 138.8, 149.1, 150.2 (N=$\underline{C}$H-N), 152.7, 193.8 ($\underline{C}$=O)	434.0742

	1.89-2.08 (m, C$\underline{H}_2$, 2H), 2.26-2.42 (m, C$\underline{H}_2$, 2H), 2.53-2.61 (m, C$\underline{H}_2$, 1H), 2.74-2.81 (m, C$\underline{H}_2$, 1H), 5.23 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 5.40 (d, *J* = 16.8 Hz, C$\underline{H}_2$, 1H), 6.50 (s, C$\underline{H}$, 1H), 7.17-7.40 (m, Ar-$\underline{H}$, 9H), 7.68 (s, Ar-$\underline{H}$, 1H)	20.8 ($\underline{C}$H$_2$), 25.7 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.2 ($\underline{C}$H$_2$), 57.2 ($\underline{C}$H), 109.9, 126.2, 2 x 128.2, 2 x 128.4, 2 x 128.8, 2 x 129.2, 134.0, 136.0, 139.2, 149.2, 150.3 (N=$\underline{C}$H-N), 151.9, 193.9 ($\underline{C}$=O)	390.1245
	1.89-2.07 (m, C$\underline{H}_2$, 2H), 2.24-2.38 (m, C$\underline{H}_2$, 2H), 2.55-2.62 (m, C$\underline{H}_2$, 1H), 2.78-2.84 (m, C$\underline{H}_2$, 1H), 5.26-5.39 (m, C$\underline{H}_2$, 2H), 6.78 (s, C$\underline{H}$, 1H), 7.18-7.22 (m, Ar-$\underline{H}$, 2H), 7.29-7.43 (m, Ar-$\underline{H}$, 7H), 7.65 (s, Ar-$\underline{H}$, 1H)	21.0 ($\underline{C}$H$_2$), 25.8 ($\underline{C}$H$_2$), 36.0 ($\underline{C}$H$_2$), 49.4 ($\underline{C}$H$_2$), 57.3 ($\underline{C}$H), 108.7, 2 x 126.5, 126.9, 128.1, 2 x 129.1, 129.5, 130.3, 131.0, 133.3, 136.2, 137.1, 149.2, 150.1 (N=*C*H-N), 152.8, 193.9 ($\underline{C}$=O)	390.1245

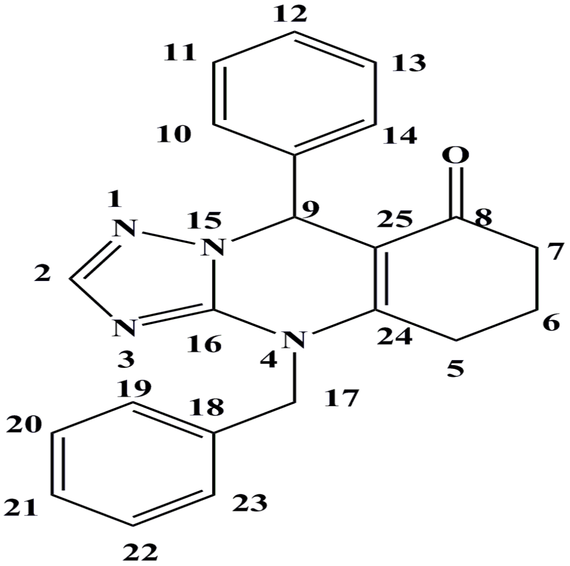


Fig. 1: Spectroscopic numbering of compound **6a**.

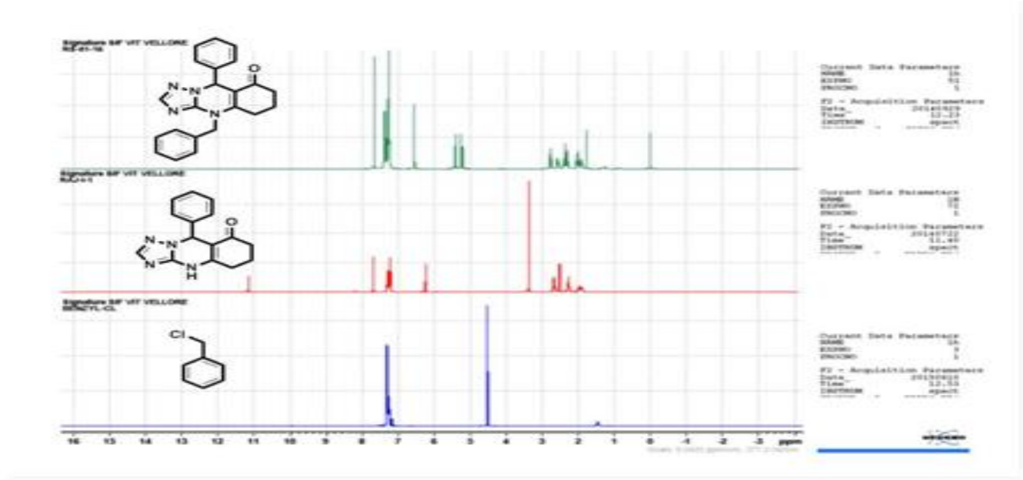


Fig. 2: Comparative ^{1}H NMR spectra of compounds **4a**, **5** and **6a**.

The various types hydrogen attached to different carbons of compound **6a** were clearly observed from DEPT-135, APT-NMR and ^{13}C NMR (Fig. 3**)**. In ^{13}C NMR all the required 18 carbon signals were observed which confirms the compound **6a**. Further confirmation APT (Attached Proton Test) experiment has been carried out. It is a ^{1}D NMR experiment used to separate the assigning of carbons unattached to protons and CH_2 from CH and CH_3 signals. Eight methine (CH) carbon signals were appears as positive signals and the 6 quaternary (C), 4 methylene (CH_2) signals appears as negative also confirms the compound **6a**. Further we have recorded DEPT-135 for compound **6a** it clearly proved that protonated carbons, 8 methine (CH) signals as positive and 4 methylene (CH_2) signals as negative (Fig. 3) was further supports the confirmation of compound **6a**.

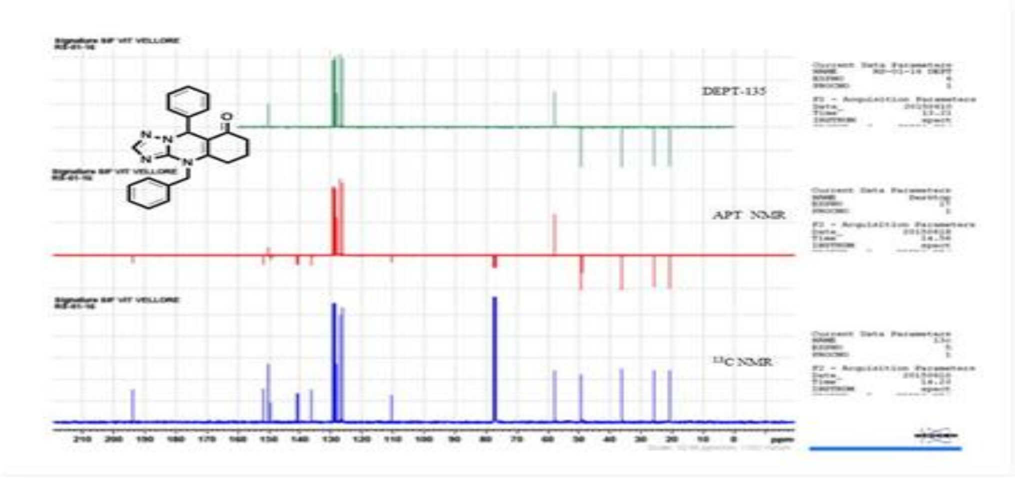


Fig. 3: ^{13}C NMR, APT NMR and DEPT-135 NMR spectra of compound **6a**.

From the ^{1}H-^{1}H COSY spectrum of compound **6a** (Fig. 4) we have observed that there is a correlation between benzyl -CH_2 protons with aromatic protons. The HSQC spectrum of compound **6a** also recorded, it's clearly states that, the H-17 proton was interact with C-17 and chiral H-9 was interact with C-9 (Fig. 5).

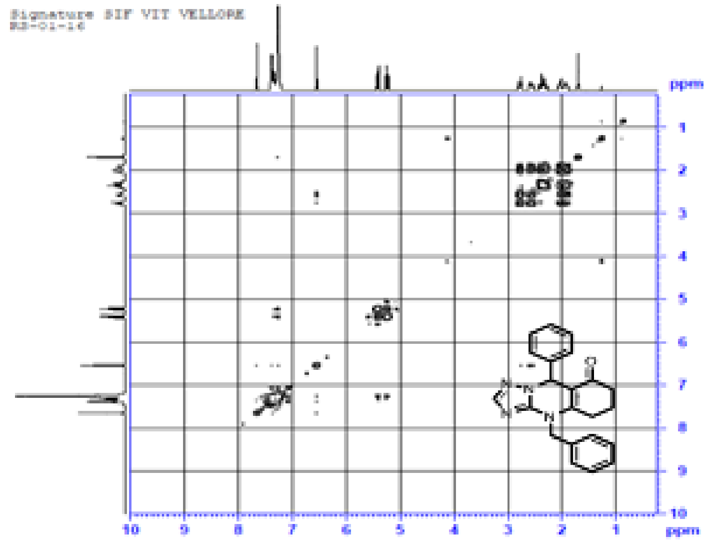


Fig. 4: ^{1}H-^{1}H COSY spectrum of compound **6a**.

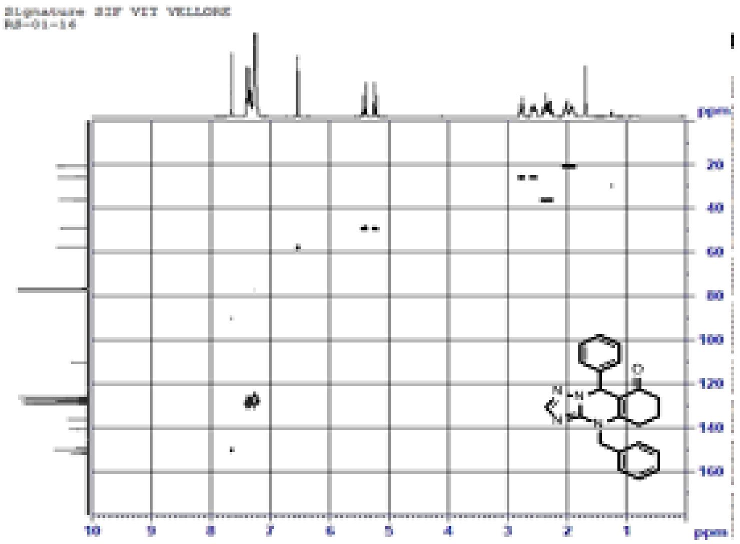


Fig. 5: HSQC spectrum of compound **6a**.

3.3. DPPH radical scavenging assay

Antioxidants are very important molecule that inhibits the oxidation stress in the body by damaging the free radicals. Free radicals are atoms or groups produced in the oxidation process and responsible for the cellular damage in the living organisms. In the recent years, researchers are interested in designing novel antioxidants, because of their medicinal properties, used in treating a large number of lifestyle diseases like aging, cardiovascular, diabetic, cancer and a variety of diseases. All the synthesized compounds **6a-o** was evaluated for their antioxidant activity towards DPPH radical. Results of these findings were presented in Table 7 and Fig. 6 and 7. The antioxidant activity was expressed in IC_{50} value. IC_{50} value is the half maximal inhibitory concentration of a substance or drug. The entire synthesized triazolo-quinazolinons **6a-o** exhibit interesting antioxidant activity compared to standard. Among the synthesized compounds **6e** and **6f** was reported with potent antioxidant property compared to that of the standard.

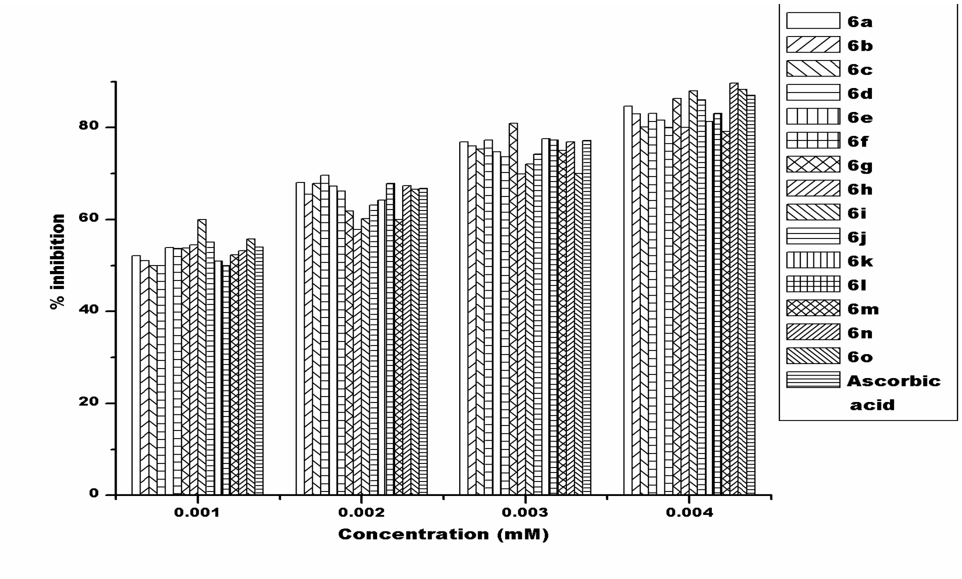


Fig. 6: Radical scavenging activity for compounds **6a-o** (Concentration (0.001 to 0.004 mM) Vs. Percentage of inhibition).

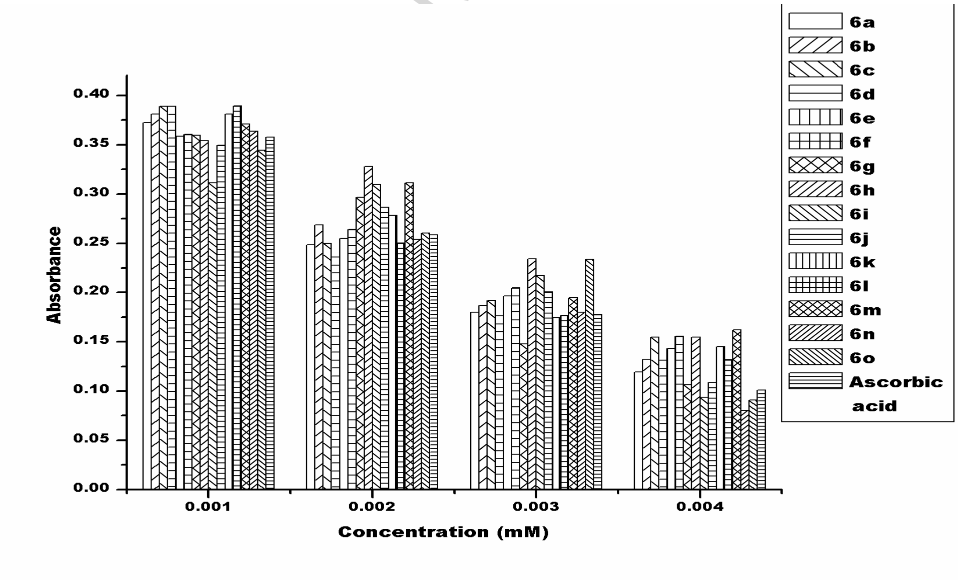


Fig. 7: Radical scavenging activity for compounds **6a-o** (Concentration (0.001 to 0.004 mM) Vs. Absorbance).

Table 7
Antioxidant activity of compounds **6a-o**.

Entry	Compound code	% inhibition at different concentrations (mM)				IC_{50}
		0.001	0.002	0.003	0.004	
1	**6a**	52.11	68.09	76.89	84.67	0.6417
2	**6b**	51.00	65.45	75.99	82.99	0.7718
3	**6c**	49.99	67.89	75.33	80.12	0.7904
4	**6d**	49.98	69.65	77.34	83.12	0.7895
5	**6e**	53.67	66.19	73.69	80.00	0.4314
6	**6f**	53.88	67.26	74.77	81.59	0.4235
7	**6g**	53.77	61.89	80.98	86.32	0.8042
8	**6h**	54.47	57.87	69.89	80.09	0.8194
9	**6i**	60.00	60.02	72.11	87.99	0.6622
10	**6j**	55.11	63.15	74.23	86.00	0.6217
11	**6k**	50.99	64.24	77.56	81.34	0.8083
12	**6l**	49.95	67.85	77.30	83.07	0.8121
13	**6m**	52.33	60.01	74.99	79.19	0.8395
14	**6n**	53.25	67.35	76.89	89.67	0.6748
15	**6o**	55.76	66.54	69.99	88.34	0.6490
16	**Ascorbic acid**	54.00	66.76	77.18	87.00	0.5667

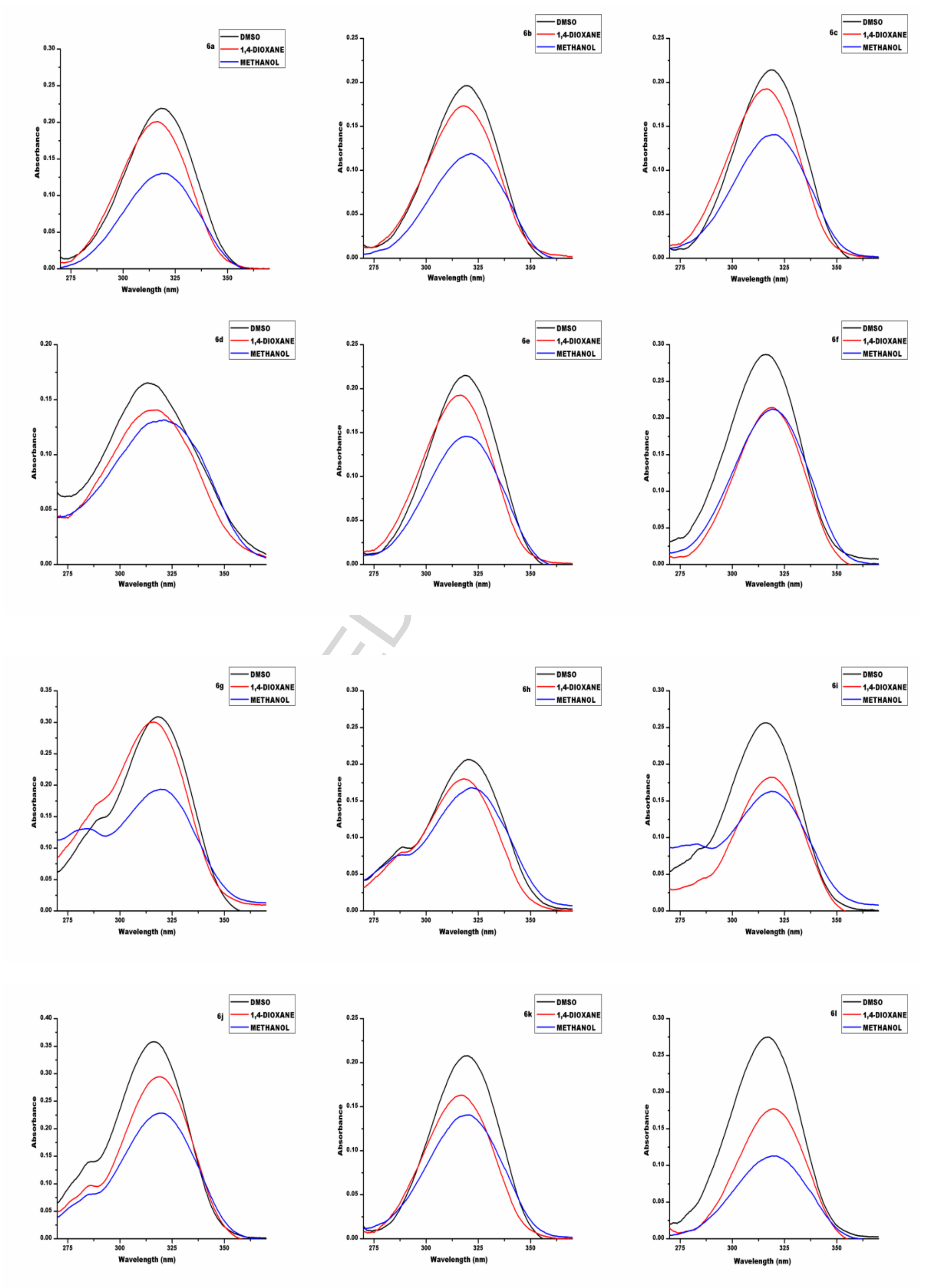
3.4. Effect of solvents on absorption spectra

The absorption spectra of the synthesized compounds **6a-o** were measured in 1,4-dioxane, methanol and dimethyl sulfoxide. The measured absorption maxima (λ_{max}) values were summarized in Table 8 and Fig. 8. Among the three solvents, the highest absorption maxima were observed in DMSO a polar aprotic solvent. The λ_{max} was induced by π-π* transition caused due to the delocalization of electrons in the phenyl group. The substituents on the phenyl ring does not show any influence on the λ_{max}.

Table 8

λ_{max} Values of compounds **6a-o** in various solvents.

Compound	λ_{max} values with different polarity of solvents		
	DMSO	1,4-DIOXANE	METHANOL
6a	318	315	319
6b	319	317	321
6c	318	316	319
6d	313	315	321
6e	318	316	319
6f	317	318	320
6g	318	315	320
6h	320	318	322
6i	316	318	319
6j	316	318	320
6k	319	316	320
6l	316	319	320
6m	317	320	321
6n	316	318	320
6o	317	319	321


6a
6b
6c
6d
6e
6f
6g
6h
6i
6j
6k
6l
DMSO
1,4-DIOXANE
METHANOL
Absorbance
Wavelength (nm)
275
300
325
350
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40

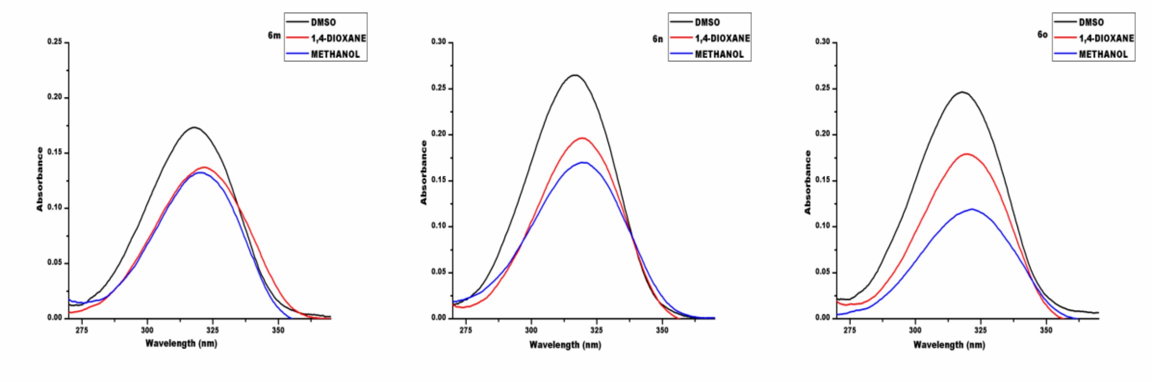


Fig. 8: Absorption spectra of compounds **6a-o** in 1,4-dioxane, methanol and DMSO.

4. Conclusion

We have reported an easy, high yielding, and convenient method for the synthesis of compounds **6a-o** by treating the compounds **4a-o** with benzyl chloride **5** using K_2CO_3 as a base in the presence of DMF under microwave irradiation with short reaction time and high yields. The compounds **4a-o** and **6a-o** were analyzed and confirmed by melting point, NMR and HRMS. Absorption maxima for all the compounds **6a-o** were measured, the highest absorption maxima were observed in dimethyl sulfoxide. The compounds **6a-o** were evaluated for the antioxidant activity and the compounds **6e** and **6f** were found to be most potent antioxidants compared to Ascorbic acid.

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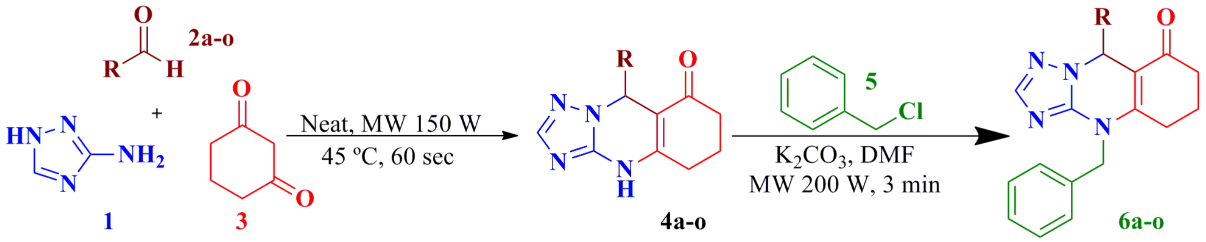
Graphical abstract



R = Ph, 4-NO_2Ph, 3-NO_2Ph, 2-NO_2Ph, 4-$CH(CH_3)_2$, 4-Me, 3,4-di-OMe, 2,4-di-OMe, 4-OMe, 3-OMe, 4-Br, 3-Br, 2-Br, 4-Cl, 2-Cl.

Highlights

1. Non-conventional approach has been adopted in our report.
2. Microwave assisted triazolo-quinazolinone synthesis has been investigated.
3. Synthesized compounds characterized by NMR and Mass spectral data.
4. Antioxidant activity of triazolo-quinazolinone was screened.
5. Solvatochromism study of triazolo-quinazolinone was done.