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ULTRASOUND MEDIATED SYNTHESIS, CHARACTERISATION OF 3-(4,5-DIPHENYL-1-((SUBSTITUTED 1-PHENYL-1*H*-1,2,3-TRIAZOL-4-YL)METHYL)-1*H*-IMIDAZOL-2-YL)-1-((SUBSTITUTED1-PHENYL-1*H*-1,2,3-TRIAZOL-4-YL)METHYL)-1*H*-INDOLE AND EVALUATION OF THEIR ANTI MICROBIAL ACTIVITIES

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Abstract:
In an attempt to find potential anti-cancer agents, a series of novel 3-(4,5-diphenyl-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole (**3a-l**) were synthesized in good yields from 3-(4,5-Diphenyl-1-prop-2-ynyl-1H-imidazol-2-yl)-1-prop-2-ynyl-1H-indole with suitable different substituted aromatic azides by click reaction in ultrasound irradiation method and target molecules were characterized by ^{1}H NMR, ^{13}C NMR, IR and mass spectral analysis. These compounds were further evaluated for their antimicrobial activity.

Key words: Ultrasound irradiation, 3-(4,5-diphenyl-1-((substituted 1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole, anti-microbial activity.

Introduction

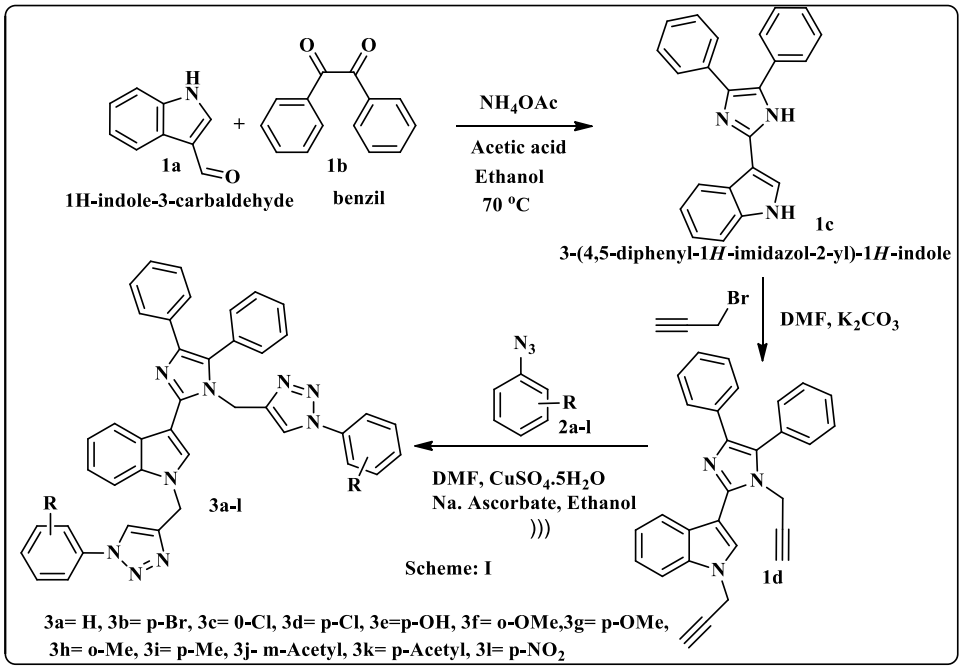
Indole or 1H-benzo[b]pyrrole is a bicyclic heterocycle with fused benzene and pyrrolering.Indole is considered as a biologically privileged scaffold, widely distributed in natural products such as alkaloids, plant, animal and microbial hormones [i-vi].d. It shows broad spectrum of biological activities such as antibacterial, antiviral [vii], antifungal [viii-xii], antioxidant [xiii-xvi], anti-inflammatory [xvii-xxii], anticholinesterase [xxiii, xxiv],antihistamine [xxv], anti-diabetic [xxvi], and anticancer [xxvii-xxxii].

Considering the anti-antimicrobial activity exhibited by both indole derivatives and 1,2,3-Triazole derivatives from literature search, it was hypothesized that fusion of indole and 1,2,3 triazoles could result in molecules having greater anti-microbial activity due to synergistic effect of both indole and 1,2,3 triazoles scaffolds. Hence, a series of novel hybrid derivatives have been synthesized and evaluated for their anti-microbial activity using different Gram +ve, Gram -Ve and different fungi's.

2. Results and discussion:

Chemistry

In **Scheme-I**, the synthesis of 3-(4,5-diphenyl-1-((substituted-phenyl-1H-1,2,3-triazol-4-yl)methyl)-1H-imidazol-2-yl)-1-((substituted-phenyl-1H-1,2,3-triazol-4yl)methyl)-1H-indole **3a-l** was outlined.**Step: 1,**3-(4,5-diphenyl-1H-imidazol-2-yl)-1H-indole (**1c**) was prepared by condensing 1H-indole-3-carbaldehyde (**1a**), benzil (**1b**) and ammonium acetate in presence of ethanol and acetic acid under reflux condition for6 h, in good yield.**Step: 2**, Compound**(1c)** was propargylated with 3-bromoprop-1-yne using K_2CO_3 in DMF solventat 30°C for 15-17 hours, afforded bis-propargylated compound (**1d**). **Final step**, Synthesis of 3-(4,5-diphenyl-1-((substituted-phenyl-1H-1,2,3-triazol-4-yl)methyl)-1H-imidazol-2-yl)-1-((substituted-phenyl-1H-1,2,3-triazol-4yl)methyl)-1H-indole (**3a-l**) were carried out by ultra sound assisted click reaction, in which bis-propargylated compound (**1d**) (0.1 mmol) was reacted with different aryl azides (**2a-l**) (0.2mmol) in presence of $CuSO_4.5H_2O$-sodium ascorbate catalytic systemin DMF solvent under ultra sound irradiation for 15-20minutesafforded final compounds **(3a-l)** in excellent yields 75-85%.



Scheme 1: The synthetic route 3-(4,5-diphenyl-1-((substituted 1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole

2.1. Antibacterial Activity

All the synthesized compounds **3a-l** were assayed for their antibacterial activity in opposition to Gram-positive bacteria *viz Bacillus subtilis*(MTCC 441), *Bacillus sphaericus*(MTCC 11), *Staphylococcus aureus* (MTCC 96), and Gram-negative bacteria *viz. Pseudomonas aeruginosa* (MTCC 741), Klebsiella aerogenes(MTCC 39), Chromobacterium violaceum (MTCC 2656) by disc diffusion method[10], and the data of mean inhibition zone reported in **Table-1.** All assays incorporate the solvent and reference controls. Standard drug used as streptomycin.

The exploration of screening data antibacterial activity discloses that almost all synthesized compounds 3**a-l** are potent and exhibit tolerable to marvelous antibacterial activity. Among them compounds containing **3b**[1-(4-bromophenyl)-1H-1,2,3-triazol-4-yl)], **3d [**(1-(4-chlorophenyl)-1H-1,2,3-triazol-4-yl)], **3j** [(1-(3-acetylphenyl-1,2,3-triazol-4-yl))], **3k** [-((1-(4-acetylphenyl)-1H-1,2,3-triazol-4-yl)] and **3l** [(1-(4-nitrophenyl)-1H-1,2,3-triazol-4-yl)]

moiety exhibit noteworthy antibacterial activity, almost equal/greater than the activity compare to standard drug streptomycin.

2.2. Antifungal Activity

All the synthesized compounds **3a-l** were assayed for their antifungal activity in opposition to Gram-positive bacteria *viz* Candida albicans (ATCC 10231), Aspergillus fumigatus (HIC 6094), Trichophyton rubrum (IFO 9185), and Trichophyton mentagrophytes (IFO 40996) in dimethyl sulfoxide (DMSO) by disc diffusion method. Amphotericin B was used as a standard drug and the data of mean inhibition zone (MZI) reported in **Table-2.**MZI data measured and compared with controls, the MZI values of the compounds screened.

The exploration of screening data antifungal activity discloses that almost all synthesized compounds **3a-l** are potent and exhibit tolerable to marvelous antifungal activity. Among them, compounds containing **3b**[1-(4-bromophenyl)-1H-1,2,3-triazol-4-yl)], **3d [**(1-(4-chlorophenyl)-1H-1,2,3-triazol-4-yl)], **3j** [(1-(3-acetylphenyl-1,2,3-triazol-4-yl))], **3k** [-((1-(4-acetylphenyl)-1H-1,2,3-triazol-4-yl)] and **3l** [(1-(4-nitrophenyl)-1H-1,2,3-triazol-4-yl)] moiety exhibit noteworthy antifungal activity, almost equal/greater than the activity compare to standard drug streptomycin.

Table.1: Antibacterial Activity of Compounds 5a-l

Compound	**Mean zone inhibition (MZI)[a] in 100 *µ*g/mL**					
	B. subtilis	***B. sphaericus***	***S. aureus***	***P. aeruginosa***	***K. aerogenes***	***C. violaceum***
3a	19	16	17	20	25	23
3**b**	**29**	**26**	**25**	**21**	**25**	**23**
3c	12	14	13	16	17	16
3**d**	**32**	**29**	**32**	**23**	**29**	**26**
3e	21	22	20	18	13	14
3f	20	10	11	14	16	17
3g	18	20	16	16	20	21
3 h	16	22	21	20	23	18
3i	19	20	23	20	26	23
3**j**	**32**	**26**	**27**	**20**	**28**	**23**
3**k**	**33**	**26**	**28**	**22**	**26**	**22**
3**l**	**30**	**26**	**28**	**20**	**26**	**23**
Streptomycin	**31**	**27**	**26**	**19**	**27**	**24**

[a]Values are mean (n = 3).

Table 2. Antifungal Activity of Compounds 6.3a-l

Compound	**Mean zone inhibition (MZI)[a] in 100 *µ*g/mL**			
	C. albicans	***A. fumigatus***	***T. rubrum***	***T. mentagropytes***
3a	16	15	14	18
3**b**	**28**	**24**	**15**	**28**
3c	21	18	20	18
3**d**	**28**	**26**	**26**	**26**
3e	21	22	22	24
3f	16	15	16	12
3g	18	18	18	20

3h	21	20	22	23
3i	20	19	10	25
3**j**	**28**	**24**	**23**	**25**
3**k**	**28**	**24**	**23**	**26**
3**l**	**30**	**26**	**25**	**26**
Amphotericin B	29	25	24	27

[a]Values are mean (n = 3).

3. Conclusions

A new sequence of 3-(4,5-diphenyl-1-((substituted 1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole(**3a-l**)has been synthesized and appraise for their antimicrobial activity against Gram-Positive, Gram-negative bacteria and fungi. Most of the compounds exhibit a average degree of antimicrobial activity. Among them, compounds consists **3b**[(1-(4-bromophenyl)-1H-1,2,3-triazol-4-yl)], **3d [**(1-(4-chlorophenyl)-1H-1,2,3-triazol-4-yl)], **3j** [(1-(3-acetylphenyl-1,2,3-triazol-4-yl))], **3k** [(1-(4-acetylphenyl)-1H-1,2,3-triazol-4-yl)] and **3l** [(1-(4-nitrophenyl)-1H-1,2,3-triazol-4-yl)] moiety showed average or more activity against standard drug streptomycin, Amphotericin respectively and emerged as potential molecules for further evaluation.

4. Experimental:

4.1. Synthesis of 3-(4,5-diphenyl-1H-imidazol-2-yl)-1H-indole (1c)

This process involved condensing of 1H-indole-3-carbaldehyde (1a), benzil (1b), and ammonium acetate in presence of ethanol and acetic acid at 70°C. The reaction proceeded for 6h, leading to the formation of the desired 3-(4,5-diphenyl-1H-imidazol-2-yl)-1H-indole (1c). Yield: 71%

4.2. Synthesis of 3-(4,5-diphenyl-1-(prop-2-ynyl)-1H-imidazol-2-yl)-1-(prop-2-ynyl)-1H-indole (1d)

To the stirred solution of 3-(4,5-diphenyl-1H-imidazol-2-yl)-1H-indole (1c) (10 mmol) in DMF was added 3-bromoprop-1-yne (12 mmol), K_2CO_3 (25 mmol) at 30°C for 15-17 hours. After confirming completion by TLC, the reaction was quenched with water, extracted with ethyl acetate, dried, and concentrated. The product 1d was purified via column chromatography (25% ethyl acetate in hexane), yielding 68%.

4.3. General procedure for the preparation of 3-(4,5-diphenyl-1-((substituted 1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole(3a-l)

bis-propargylated compound **(1d)** (0.1 mmol) was reacted with different aryl azides**(2a-l)** (0.2mmol) using Click chemistryin $CuSO_4.5H_2O$ with sodium ascorbate and DMF under ultrasound irradiationfor 15-20 minutes. The progress of the reaction was monitored by TLC .Upon completion the contents of the flask poured into a 100 ml beaker containing crushed ice. Solids at the bottom were filtered through a Buchner funnel and dried in vacuum at reduced pressure to yield crude compounds which were purified by column chromatography using hexane/ ethyl acetate (1:3 v/v) to afford 3-(4,5-diphenyl-1-((substituted 1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((substituted1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole**(3a-l)**gave excellent yields 75-85%.

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Conflict of interest:

Authors declare no conflict of interest

Spectral data:

3-(4,5-diphenyl-1-((1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((1-phenyl-1H-1,2,3-triazol-4-yl)methyl)-1*H*-indole(3a)

Yield 85%, mp: 187-189^{o}C; Rf = 0.40 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.49 (s, 2H), 7.78 (d, J = 7.57 Hz, 2H), 7.76 (d, J = 7.57 Hz, 2H), 7.72 (d, J = 7.90 Hz, 1H), 7.64 (d, J = 7.85 Hz, 2H), 7.58 (s, 1H), 7.50 (dd, J = 7.90, 6.99 Hz, 1H), 7.44 (d, J = 7.85 Hz, 1H), 7.43 (dd, J = 7.85, 7.45 Hz, 2H), 7.41 (dd, J = 7.57, 7.20 Hz, 2H), 7.41 (dd, J = 7.85, 7.45 Hz, 2H), 7.41 (t, J = 7.45 Hz, 2H), 7.37 (t, J = 7.20 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H), 7.35 (dd, J = 7.57, 7.20 Hz, 2H), 7.33 (t, J = 7.45 Hz, 1H), 7.20 (dd, J = 7.85, 6.99 Hz, 1H), 5.38 (s, 2H), 5.33 (s, 2H).^{13}C NMR (125 MHz, DMSO-*d6*) δ 150.1, 144.2, 143.9, 143.3, 139.6, 137.4, 135.7, 133.2, 130.1, 129.8, 129.4, 128.6, 128.5, 128.0, 127.9, 127.8, 127.6, 125.0, 124.8, 124.4, 124.3, 123.0, 122.7, 120.7, 112.8, 110.1, 50.1, 50.0.

1-((1-(4-bromophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(4-bromophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3b)

Yield 80%, mp: 191-193^{o}C; Rf = 0.40 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.49 (s, 1H), 8.48 (s, 1H), 7.96 (d, J = 8.30, 9.30 Hz, 2H), 7.81 (d, J = 8.30, 9.30 Hz, 2H) 7.72 (d, J = 7.90 Hz, 1H), 7.64 (d, J = 7.85 Hz, 2H), 7.58 (s, 1H), 7.56 (d, J = 8.30, 9.30 Hz, 2H), 7.53 (d, J = 8.30, 9.30 Hz, 2H), 7.45 (dd, J = 7.85, 7.45 Hz, 2H), 7.44 (t, J = 7.45 Hz, 1H), 7.42 (dd, J = 7.90, 6.99 Hz, 1H), 7.40 (d, J = 7.85 Hz, 1H), 7.39 (t, J = 7.85 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H) 7.33 (t, J = 7.45 Hz, 1H), 7.16 (dd, J = 7.85 6.99 Hz, 1H), 5.32 (s, 2H), 5.30 (s, 2H).^{13}C NMR (125 MHz, DMSO-d_6) δ 145.21, 12.13, 140.14, 139.72, 135.77, 133.68, 132.14, 130.27, 128.73, 128.37, 127.83, 127.67, 127.30, 127.04, 125.07, 124.33, 124.06, 122.03, 121.02, 120.12, 119.54, 118.95, 118.82, 110.41, 109.41, 40.13, 38.12.

1-((1-(2-chlorophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(2-chlorophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3c)

Yield 78%, mp: 195-197^{o}C; Rf = 0.38 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.47 (s, 1H), 8.45 (s, 1H), 8.21(s, 1H), 7.96 (dd, J = 7.51, 2.03 Hz,1H), 7.47-7.36 (m, J = 7.80, 7.49, 2.02 Hz, 14H), 7.30 (m, 7.50, 2.0 Hz, 2H), 7.21 (t, J = 7.85, 6.99 Hz, 1H), 5.23 (s, 2H), 4.97 (s, 2H).^{13}C NMR (125 MHz, DMSO-d_6) δ 145.43, 141.87, 140.26, 139.94, 125.84, 133.96, 133.84, 132.02, 131.96, 130.27, 128.76, 128.52, 128.30, 127.98, 127.83, 127.60, 127.51, 127.49, 127.03, 125.09, 124.38, 124.17, 122.05, 121.37, 120.50, 119.38, 118.94, 110.42, 109.36, 40.36, 38.52.

1-((1-(4-chlorophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(4-chlorophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3d)

Yield 80%, mp: 193-195^{o}C; Rf = 0.38 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.49 (s, 1H), 8.48 (s, 1H), 7.92 (d, J = 8.43 Hz, 2H), 7.82 (d, J = 8.43 Hz, 2H), 7.72 (d, J = 7.90 Hz, 1H), 7.64 (d, J = 7.85 Hz, 2H), 7.58 (s, 1H), 7.44 (t, J = 7.45 Hz, 1H), 7.42 (dd, J = 7.90, 6.99 Hz, 1H), 7.41 (dd, J = 7.85 7.45 Hz, 2H), 7.40 (d, J = 7.85 Hz, 1H), 7.39 (dd, J = 7.85, 7.45 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H), 7.33 (t, J = 7.45 Hz, 1H), 7.23 (d, J = 8.43 Hz, 2H), 7.22 (d, J = 8.43 Hz, 2H), 7.16 (dd, J = 7.85, 6.99 Hz, 1H), 5.32 (s, 2H), 5.30 (s, 2H).^{13}C NMR (125 MHz, DMSO-d_6) δ 145.48, 142.13, 140.26, 139.75, 135.82, 133.82, 132.97, 132.53, 132.08, 130.34, 130.26, 128.74, 158.35, 127.86, 127.64, 127.06, 125.07, 124.39, 124.18, 122.07, 121.47, 119.56, 118.94, 110.42, 109.32, 40.12, 38.17.

4-(4-((2-(1-((1-(4-hydroxyphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indol-3-yl)-4,5-diphenyl-1*H*-imidazol-1-yl)methyl)-1*H*-1,2,3-triazol-1-yl)phenol(3e)

Yield 75%, mp: 189-191^{o}C; Rf = 0.30 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 9.41 (s, 1H), 8.60 (s, 1H), 8.49 (s, 1H), 7.72 (d, J = 7.90 Hz, 1H), 7.64 (d, J = 7.85 Hz,

2H), 7.58 (s, 1H), 7.57 (d, J = 8.43 Hz, 4H), 7.47 (dd, J = 7.90, 6.99 Hz, 1H), 7.44 (d, J = 7.85 Hz, 1H), 7.41 (dd, J = 7.85, 7.45 Hz, 2H), 7.41 (t, J = 7.45 Hz, 1H), 7.39 (dd, J = 7.85, 7.45 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H), 7.33 (t, J = 7.45 Hz, 1H), 7.20 (dd, J = 7.85, 6.99 Hz, 1H), 6.84 (d, J = 8.43 Hz, 2H), 6.83 (d, J = 8.43 Hz, 2H), 5.33 (s, 2H), 5.32 (s, 2H).^{13}C NMR (125 MHz, DMSO-*d6*) δ 157.6, 150.1, 144.2, 143.9, 139.7, 139.6, 137.4, 136.0, 134.1, 130.9, 129.8, 128.6, 128.3, 128.1, 128.0, 127.8, 126.1, 125.0, 124.1, 123.2, 122.9, 120.7, 115.3, 112.8, 110.1, 50.3, 50.1.

1-((1-(2-methoxyphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(2-methoxyphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3f)

Yield 77%, mp: 187-189^{o}C; Rf = 0.36 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*) δ8.44 (s, 1H), 8.41 (s, 1H), 8.19 (s, 1H), 7.86 (d, J = 7.90 Hz, 1H), 7.37 - 7.35 (m,4H), 7.21 - 7.19 (m, 5H), 7.01 (m, 2H), 5.18 (s, 2H), 5.03 (s, 2H), 3.82 (s, 6H).^{13}C NMR (125 MHz, DMSO-d_6) δ 154.6, 145.42, 141.53, 140.39, 139.68, 125.82, 133.85, 132.06, 130.27, 128.74, 128.46, 128.37, 127.85, 127.02, 125.06, 124.37, 124.23, 123.09, 122.04, 120.84, 118.95, 118.32, 114.72, 110.48, 109.36, 55.67, 40.32, 38.52.

1-((1-(4-methoxyphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(4-methoxyphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3g)

Yield 79%, mp: 184-186^{o}C; Rf = 0.36 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*)δ8.52 (s, 1H), 8.49 (s, 1H), 8.21 (s, 1H), 7.86 (d, J = 7.90 Hz, 1H), 7.65 (m, 2H), 7.55 – 7.54 (m, 4H), 7.48 – 7.42 (m, 6H), 7.37 – 7.35 (m, 4H), 7.19 (dd, J = 7.85, 6.98 Hz, 1H), 7.08 – 7.07 (m, 4H), 5.23 (s, 2H), 5.23 (s, 2H), 3.80 (s, 2H).^{13}C NMR (125 MHz, DMSO-d_6) δ 158.82, 145.42, 142.13, 140.36, 139.72, 135.34, 133.87, 132.06, 130.28, 128.75, 128.36, 128.29, 127.84, 127.53, 127.03, 125.03, 124.35, 124.29, 122.07, 120.98, 119.53, 118.97, 118.72, 116.23, 110.42, 109.38, 55.87, 40.17, 38.12.

3-(4,5-diphenyl-1-((1-(o-tolyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((1-(o-tolyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole(3h)

Yield 76%, mp: 183-185^{o}C; Rf = 0.42 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*)δ8.43 (s, 1H), 8.42 (s, 1H), 8.21 (s, 1H), 7.86 (d, J = 7.91 Hz, 1H), 7.65 (m, J = 7.49, 2.01 Hz, 2H), 7.53 – 7.21(m, 19H), 5.24 (s, 2H), 5.10 (s, 2H), 2.28 (s, 3H), 2.26 (s, 3H).^{13}C NMR (125 MHz, DMSO-d_6) δ 145.47, 141.56, 140.13, 139.05, 135.82, 135.34, 133.85, 132.06, 130.95, 130.24, 129.26, 128.74, 128.36, 127.98, 127.63, 127.54, 127.25, 127.09, 125.08, 124.35, 124.26, 122.05, 120.37, 119.63, 118.95, 118.54, 110.47, 109.38, 40.32, 38.53, 17.39.

3-(4,5-diphenyl-1-((1-(p-tolyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-imidazol-2-yl)-1-((1-(p-tolyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indole(3i)

Yield 77%, mp: 181-183^{o}C; Rf = 0.42 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*)δ8.53 (s, 1H), 8.50 (s, 1H), 8.21 (s, 1H), 7.86 (d, J = 7.92 Hz, 1H), 7.65 (m, 2H), 7.49 – 7.33 (m, 18H), 7.21 (t, J = 7.85, 6.97 Hz, 1H), 5.25 (s, 2H), 5.10 (s, 2H), 2.36 (s, 6H).^{13}C NMR (125 MHz, DMSO-d_6) δ 145.47, 14213, 140.18, 139.67, 137.85, 135.89, 133.84, 132.09, 131.95, 130.82, 145.25, 128.74, 128.39, 127.76, 127.63, 127.59, 127.28, 125.06, 124.36, 124.28, 122.04, 119.68, 119.35, 119.08, 118.94, 110.47, 109.38, 40.18, 38.17, 21.14.

1-(3-(4-((2-(1-((1-(3-acetylphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indol-3-yl)-4,5-diphenyl-1*H*-imidazol-1-yl)methyl)-1*H*-1,2,3-triazol-1-yl)phenyl)ethan-1-one(3j)

Yield 78%, mp: 189-191^{o}C; Rf = 0.38 (EtOAc:n-Hexane 2:3);^{1}H NMR (500 MHz, *DMSO-d6*)δ8.55 (s, 1H), 8.54 (s, 1H), 8.25 (d, J = 2.01 Hz, 1H), 8.23 (d, J = 2.02 Hz, 1H), 8.21 (d, J = 2.00 Hz, 1H), 7.86 (m, 3H), 7.76 – 7.73 (m, 2H), 7.65 – 7.62 (m, 4H), 7.48 – 7.35 (m, 10H), 7.19 (dd, J = 7.85, 6.97 Hz, 1H), 5.23 (s, 2H), 4.92 (s, 2H), 2.55 (s, 6H).^{13}C NMR (125 MHz, DMSO-d_6) δ 197.26, 145.42, 142.23, 139.96, 139.74, 136.85, 136.32, 135.84, 133.86, 131.96, 130.17, 129.34, 128.74, 128.36, 127.85, 127.65, 127.35, 127.14, 124.02, 124.37, 123.98, 122.05, 121.45, 120.49, 119.63, 118.94, 118.02, 110.42, 109.63, 43.41, 39.38, 26.75.

1-(4-(4-((2-(1-((1-(4-acetylphenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-1*H*-indol-3-yl)-4,5-diphenyl-1*H*-imidazol-1-yl)methyl)-1*H*-1,2,3-triazol-1-yl)phenyl)ethan-1-one(3k)

Yield 82%, mp: 192-194^{o}C; Rf = 0.38 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.49 (s, 1H), 8.48 (s, 1H), 7.76 (d, J = 8.43 Hz, 4H), 7.74 (d, J = 8.43 Hz, 2H), 7.72 (d, J = 7.90 Hz, 1H), 7.71 (d, J = 8.43 Hz, 2H), 7.64 (d, J = 7.85 Hz, 2H), 7.58 (s, 1H), 7.42 (t, J = 7.45 Hz, 1H), 7.41 (dd, J = 7.90, 6.99 Hz, 1H), 7.40 (d, J = 7.85 Hz, 1H), 7.39 (dd, J = 7.85, 745 Hz, 2H), 7.38 (dd, J = 7.85, 7.45 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H), 7.32 (t, J = 7.45 Hz, 1H), 7.12 (dd, J = 7.85, 6.99 Hz, 1H), 5.31 (s, 2H), 5.30 (s, 2H), 2.56 (s, 6H).^{13}C NMR (125 MHz, DMSO-d_6) δ 196.84, 145.47, 142.16, 139.98, 139.74, 137.85, 136.22, 135.84, 133.84, 131.96, 130.32, 130.17, 128.74, 128.36, 127.85, 127.63, 127.12, 127.03, 125.02, 124.39, 123.95, 122.07, 119.53, 118.97, 118.85, 110.47, 109.47, 43.42, 39.3, 26.4.

1-((1-(4-nitrophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-3-(1-((1-(4-nitrophenyl)-1*H*-1,2,3-triazol-4-yl)methyl)-4,5-diphenyl-1*H*-imidazol-2-yl)-1*H*-indole(3l)

Yield 80%, mp: 193-195^{o}C; Rf = 0.36 (EtOAc:n-Hexane 2:3); ^{1}H NMR (500 MHz, *DMSO-d6*) δ 8.49 (s, 1H), 8.41 (s, 1H), 8.36 (d, J = 9.20 Hz, 2H), 8.29 (d, J = 9.20, 10.00 Hz, 2H), 7.79 (d, J = 9.20, 10.00 Hz, 2H), 7.73 (d, J = 9.20, 10.00 Hz, 2H), 7.72 (d, J =7.90 Hz, 1H), 7.64 (d, J = 7.85 Hz, 2H), 7.58 (s, 1H), 7.42 (t, J = 7.45 Hz, 1H), 7.41 (dd, J = 7.90, 6.99 Hz, 1H), 7.40 (d, J = 7.85 Hz, 1H), 7.39 (dd, J = 7.85, 7.45 Hz, 2H), 7.38 (dd, J = 7.85, 7.45 Hz, 2H), 7.36 (d, J = 7.85 Hz, 2H), 7.32 (t, J = 7.45 Hz, 1H), 7.12 (dd, J = 7.85 6.99 Hz, 1H), 5.31 (s, 2H), 5.24 (s, 2H).^{13}C NMR (125 MHz, DMSO-d_6) δ 146.05, 145.47, 142.17, 139.98, 139.75, 135.82, 131.97, 130.17, 128.76, 128.36, 127.84, 127.66, 127.13, 127.04, 126.17, 125.03, 124.38, 123.98, 121.95, 120.14, 119.53, 118.92, 118.87, 110.42, 109.63, 43.48, 39.31.

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