Supplementary Information

Synthesis, spectroscopic characterization, X-ray analysis and theoretical studies on the spectral features (FT-IR, ^{1}H-NMR), chemical reactivity, NBO analyses of 2-(4-fluorophenyl)-2-(4-fluorophenylamino)acetonitrile, and its docking into IDO enzyme

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This paper is dedicated to Professor Brindaban C. Ranu on the occasion of his 67th birthday

Table S1. Selected bond lengths (angstroms), bond angles (degrees) for α-aminonitrile calculated at the B3LYP/6-311++G(d,p) level and compared with experimental data.

Parameter	Calculated	Experimental	Parameter	Calculated	Experimental
C25-C27	1.472	1.540	C27-N28	1.152	1.140
C25-C14	1.535	1.518	C25-N12	1.460	1.451
C21-F24	1.353	1.359	N12-C2	1.405	1.416
C6-F11	1.358	1.363	N28-C27-C25	179.7	177.7
C27-C25-C14	110.0	111.1	N12-C25-C27	108.4	110.9
C7-C6-F11	119.3	119.3	C5-C6-F11	119.0	118.4
C17-C21-F24	118.8	119.0	F24-C21-C18	118.8	118.3

Table S2. Local reactivity descriptors for α-aminonitrile calculated at B3LYP/6-311++G(d,p) level

Atom no.	f_k^+	f_k^-	s_k^+	s_k^-	ω_k^+	ω_k^-
1C	0.4410	-0.2501	0.0900	-0.0510	1.3248	-0.7513
2C	0.2895	0.1089	0.0590	0.0222	0.8697	0.3271
3C	- 0.0603	0.0782	-0.0123	0.0159	- 0.1811	0.2349
5C	0.0518	0.0613	0.0105	0.0125	0.1556	0.1841
6C	-0.0191	-0.0058	-0.0039	-0.0011	- 0.0573	0.0174
7C	-0.2491	0.1895	-0.0508	0.0386	- 0.7483	0.5693
14C	0.3338	-0.0324	0.0681	-0.0066	1.0028	-0.0973
15C	0.4603	0.1425	0.0939	0.0290	1.3828	0.4281
16C	0.7363	0.0003	0.1502	0.00006	2.2119	0.0009
17C	0.0713	-0.0191	0.0145	-0.0039	0.2142	-0.0573
19C	0.0538	0.1402	0.0109	0.0286	0.1616	0.9211
21C	0.0037	0.0324	0.0007	0.0066	0.0111	0.0973
25C	-0.8113	0.1545	-0.1655	0.0315	-2.4373	0.4641
27C	0.4724	0.1230	0.0964	0.0251	1.4191	0.3695

Table S3. Second–order perturbation theory analysis of the Fock matrix in NBO basis for α-aminonitrile. Selected donor (Lewis) and acceptor (non–Lewis) orbitals, percentage electron density over bonded atoms (ED_A, ED_B in %), NBO hybrid orbitals of bonded atoms and stabilization energy of various intramolecular interactions ($E^{(2)}$).

Donar(i)			Acceptor (j)			
Orbital / lp (occupancy)	ED_A, % ED_B, %	NBO hybrid orbitals	orbital (occupancy)	ED_A, % ED_B, %	NBO hybrid orbitals	$E^{(2)}$ (kcal/mol)
π (C1 - C2) (1.97211)	49.08 50.92	$0.7005(sp^{1.85})_c$ $0.7136(sp^{1.75})_c$	π* (C3 - C5) (0.34290)	49.36 50.64	$0.7025(sp^{1.00})_c$ $0.7116(sp^{1.00})_c$	18.49
π (C1 - C2) (1.65325)	52.42 47.58	$0.7240(sp^{1.00})_c$ $0.6898(sp^{1.00})_c$	π* (C6 - C7) (0.02630)	50.11 49.89	$0.7079(sp^{1.56})_c$ $-0.7063(sp^{1.91})_c$	21.93
σ(C1 - C7) (1.97084)	49.95 50.05	$0.7068(sp^{1.79})_c$ $0.7074(sp^{1.76})_c$	σ*(C6 - F11) 0.03364	72.94 27.06	$0.8541(sp^{3.57})_c$ $0.5202(sp^{2.28})_c$	4.46
σ(C1 - H10) (1.97667)	61.17 38.83	$0.7821(sp^{2.43})_c$ $0.6231(sp^{0.00})_c$	σ*(C2 - C3) (0.02115)	48.84 51.16	$0.6988(sp^{1.80})_c$ $-0.7153(sp^{1.84})_c$	4.23
σ(C3 - H4) (1.97771)	61.02 38.98	$0.7811(sp^{2.48})_c$ $0.6244(sp^{0.00})_c$	σ*(C1 - C2) (0.39987)	47.58 52.42	$0.6898(sp^{1.00})_c$ $-0.7240(sp^{1.00})_c$	4.51
σ(C3 - C5) (1.97173)	49.87 50.13	$0.7062(sp^{1.77})_c$ $0.7080(sp^{1.75})_c$	σ*(C6 - F11) (0.03364)	72.94 27.06	$0.8541(sp^{3.57})_c$ $-0.5202(sp^{2.28})_c$	4.34
π(C3 - C5) (1.71621)	50.64 49.36	$0.7116(sp^{1.00})_c$ $0.7025(sp^{1.00})_c$	π* (C1 - C2) (0.39987)	47.58 52.42	$0.6898(sp^{1.00})_c$ $-0.7240(sp^{1.00})_c$	19.84
π(C3 - C5) (1.97771)	50.64 49.36	$0.7240(sp^{1.00})_c$ $0.6898(sp^{1.00})_c$	π*(C6 - C7) (0.02630)	50.11 49.89	$0.7079(sp^{1.56})_c$ $-0.7063(s1.91)_c$	19.38
σ(C5 - C6) (1.98007)	50.12 49.88	$0.7080(sp^{1.93})_c$ $0.7063(sp^{1.00})_c$	σ*(C6 - C7) (0.38055)	49.07 50.93	$0.7005(sp^{1.00})_c$ $-0.7136(sp^{1.00})_c$	4.30
σ(C6 - C7) (1.98041)	49.89 50.11	$0.7240(sp^{1.56})_c$ $0.6898(sp^{1.57})_c$	σ*(C5 - C6) (0.02680)	49.88 50.12	$0.7063(sp^{1.93})_c$ $-0.7080(sp^{1.57})_c$	4.29
π(C6 - C7) (1.68473)	50.93 49.07	$0.7136(sp^{1.00})_c$ $0.7005(sp^{1.00})_c$	π* (C1 - C2) (0.39987)	47.58 52.42	$0.6898(sp^{1.00})_c$ $0.7240(sp^{1.00})_c$	17.30
π(C6 - C7) (1.68473)	50.93 49.07	$0.7136(sp^{1.00})_c$ $0.7005(sp^{1.00})_c$	π* (C3 - C5) (0.34290)	49.36 50.64	$0.7025(sp^{1.00})_c$ $-0.7116(sp^{1.00})_c$	20.71
σ(N12 - H13) (1.98185)	70.26 29.74	$0.8382(sp^{3.03})_c$ $0.5454(sp^{0.00})_c$	σ*(C1 - C2) (0.39987)	47.58 52.42	$0.6898(sp^{1.00})_c$ $0.7240(sp^{1.00})_c$	4.08
π(C14 - C16) (1.97425)	50.73 49.27	$0.7123(sp^{1.00})_c$ $0.7019(sp^{1.00})_c$	π*(C15 - C17) (0.01289)	50.14 49.86	$0.7081(sp^{1.83})_c$ $-0.7061(sp^{1.76})_c$	22.33
π(C14 - C16) (1.97320)	50.80 49.20	$0.7127(sp^{1.85})_c$ $0.7014(sp^{1.77})_c$	π*(C19 - C21) (0.2673)	50.03 49.97	$0.7073(sp^{1.94})_c$ $-0.7069(sp^{1.56})_c$	18.92
σ(C14 - C25) (1.96005)	48.32 51.68	$0.6951(sp^{2.35})_c$ $0.7189(sp^{2.39})_c$	σ*(C27 - N28)	57.80 42.20	$0.7240(sp^{1.00})_c$ $0.6898(sp^{1.00})_c$	4.34

			(0.01115)			
σ(C15 - C17) (1.97118)	49.86 50.14	0.7061$(sp^{1.83})_c$ 0.7081$(sp^{1.76})_c$	σ*(C21 - F24) (0.03348)	72.92 27.08	0.7240$(sp^{1.00})_c$ 0.6898$(sp^{1.00})_c$	4.27
π(C15 - C17) (1.67115)	48.31 51.69	0.6950$(sp^{2.50})_c$ 0.7190$(sp^{0.00})_c$	π*(C14 - C16) (0.35885)	46.77 53.23	0.6839$(sp^{99.99})_c$ -0.7296$(sp^{1.00})_c$	19.29
π(C15 - C17) (1.67115)	48.31 51.69	0.6950$(sp^{1.00})_c$ 0.7190$(sp^{1.00})_c$	π*(C19 - C21) (0.02673)	50.03 49.97	0.7073$(sp^{1.00})_c$ -0.7069$(sp^{1.00})_c$	23.14
σ(C15 - H18) (1.97817)	61.25 38.75	0.7827$(sp^{2.50})_c$ 0.6225$(sp^{0.00})_c$	σ*(C14 - C16) (0.35885)	46.77 53.23	0.7240$(sp^{1.00})_c$ 0.6898$(sp^{1.00})_c$	4.82
σ(C16 - C19) (1.97105)	49.82 50.18	0.7058$(sp^{1.83})_c$ 0.7084$(sp^{1.75})_c$	σ*(C21 - F24) (0.03348)	72.92 27.08	0.7240$(sp^{1.00})_c$ 0.6898$(sp^{1.00})_c$	4.26
σ(C16 - H20) (1.97781)	61.69 38.31	0.7854$(sp^{2.45})_c$ 0.6190$(sp^{0.00})_c$	σ*(C14 - C15) (0.02198)	49.27 50.73	0.7240$(sp^{1.00})_c$ 0.6898$(sp^{1.00})_c$	4.89
σ(C17 - C21) (1.98051)	50.00 50.00	0.7071$(sp^{1.95})_c$ 0.7071$(sp^{1.56})_c$	σ*(C19 - C21) (0.36714)	48.99 51.01	0.6999$(sp^{1.00})_c$ -0.7142$(sp^{1.00})_c$	4.08
σ(C19 - C21) (1.98065)	49.97 50.03	0.7069$(sp^{1.94})_c$ 0.7073$(sp^{1.56})_c$	σ*(C17 - C21) (0.02660)	50.00 50.00	0.7071$(sp^{1.95})_c$ 0.7071$(sp^{1.56})_c$	4.08
π(C19 - C21) (1.65389)	51.01 48.99	0.7142$(sp^{1.94})_c$ 0.6999$(sp^{1.56})_c$	π*(C14 - C16) (0.35385)	46.77 53.23	0.6839$(sp^{99.99})_c$ -0.7296$(sp^{1.00})_c$	21.19
π(C19 - C21) (1.65389)	51.01 48.99	0.7142$(sp^{1.94})_c$ 0.6999$(sp^{1.56})_c$	π*(C15 - C17) (0.33037)	51.69 48.31	0.7240$(sp^{1.00})_c$ 0.6898$(sp^{1.00})_c$	18.81
σ(C25 - H26) (1.95462)	62.86 37.14	0.7928$(sp^{3.45})_c$ 0.6094$(sp^{0.00})_c$	σ*(C27 - N28) (0.01115)	57.80 42.20	0.7603$(sp^{1.11})_c$ -0.6496$(sp^{1.10})_c$	5.20
σ(C27 - N28) (1.95575)	42.20 57.80	0.6496$(sp^{1.11})_c$ 0.7603$(sp^{1.10})_c$	σ*(C25 - C27) (0.03140)	49.40 50.60	0.7029$(sp^{3.09})_c$ -0.7113$(sp^{0.89})_c$	4.95
LP(N28)			σ*(C25 - C27) (0.03140)	49.40 50.60	0.7029$(sp^{3.09})_c$ -0.7113$(sp^{0.89})_c$	4.07
LP(F11)			σ*(C5 - C 6) (0.38055)	49.88 50.12	0.7063$(sp^{1.93})_c$ -0.7080$(sp^{1.57})_c$	5.84
LP(F11)			σ*(C6 - C 7) (0.02630)	49.07 50.93	0.7029$(sp^{3.09})_c$ -0.7113$(sp^{0.89})_c$	5.79
LP(F11)			π* (C6 - C 7) (0.38055)	50.11 49.89	0.7005$(sp^{1.00})_c$ -0.7136$(sp^{1.00})_c$	16.46
LP(N12)			π* (C1 - C 2) (0.02351)	50.92 49.08	0.7136$(sp^{3.09})_c$ -0.7005$(sp^{0.89})_c$	28.27
LP(N12)			σ*(C14 -	49.27	0.7019$(sp^{1.85})_c$	4.46

			C25) (0.02198)	50.73	$-0.7123(sp^{1.77})_c$	
LP(N12)			σ*(C25 - H26) (0.03416)	37.14 62.86	$0.6094(sp^{3.45})_c$ $-0.7928(sp^{0.00})_c$	5.76
LP(F24)			σ*(C17 - C21) (0.02660)	50.00 50.00	$0.7071(sp^{1.95})_c$ $-0.7071(sp^{1.56})_c$	5.90
LP(F24)			σ*(C19 - C21) (0.2673)	50.03 49.97	$0.7073(sp^{1.94})_c$ $-0.7069(sp^{1.56})_c$	5.89
LP(F24)			π*(C19 - C21) (0.36714)	48.99 51.01	$0.6999(sp^{1.00})_c$ $-0.7142(sp^{1.00})_c$	17.71
LP(N28)			σ*(C25 - C27) (0.03140)	49.40 50.60	$0.7029(sp^{3.09})_c$ $-0.7113(sp^{0.89})_c$	10.49

Scanned ^{1}H-NMR and ^{13}C-NMR spectra of 2-(4-fluorophenyl)-2-(4-fluorophenylamino)acetonitrile (1):

Yield 0.220 gm (90%); white solid; m.p. 116-118 ^{0}C; R_f 0.434 (PE:EtOAc 90:10), $[\alpha]_D^{30} = \pm 0^o$; FT-IR ν_{max} (KBr): 3331, 3063, 2924, 2236, 1605, 1505, 1418, 1233, 1105, 1018, 937, 833, 723, 671, 519, 453 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.57 (dd, *J* = 8.5, 5 Hz, 2H, Ar–*H*), 7.14 (t, *J* = 8.5 Hz, 2H, Ar–*H*), 6.97 (t, *J* = 8.5 Hz, 2H, Ar–*H*), 6.73-6.71 (m, 2H, Ar–*H*), 5.34 (d, *J* = 9 Hz, 1H, *CH*(CN)-NH-), 3.97 (d, *J* = 8.5 Hz, 1H, CH(CN)-N*H*-). ^{13}C NMR: (125 MHz, $CDCl_3$): 164.27, 162.29, 158.45, 156.55, 140.76, 140.74, 129.64, 129.62, 129.21, 129.14, 118.01, 116.49, 116.31, 116.30, 116.12, 115.91, 115.85, 50.39; *Anal. Calcd*. for $C_{14}H_{10}F_2N_2$: C, 68.85, H, 4.13, N, 11.47; TOF-MS: cald. for $C_{14}H_{10}F_2N_2Na$ at *m/z* 267.0710 $[M + Na]^+$; found at *m/z* 267.0706 $[M + Na]^+$.

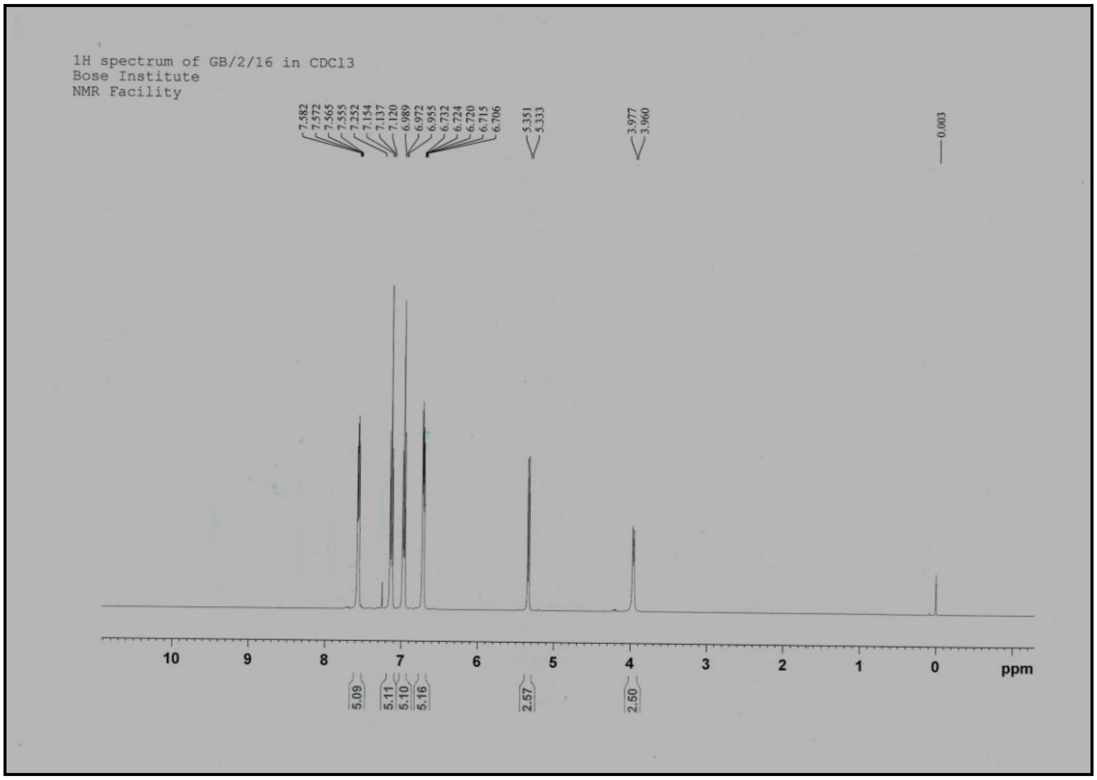

Figure S1. [1]H-NMR spectrum of α-aminonitrile **1**

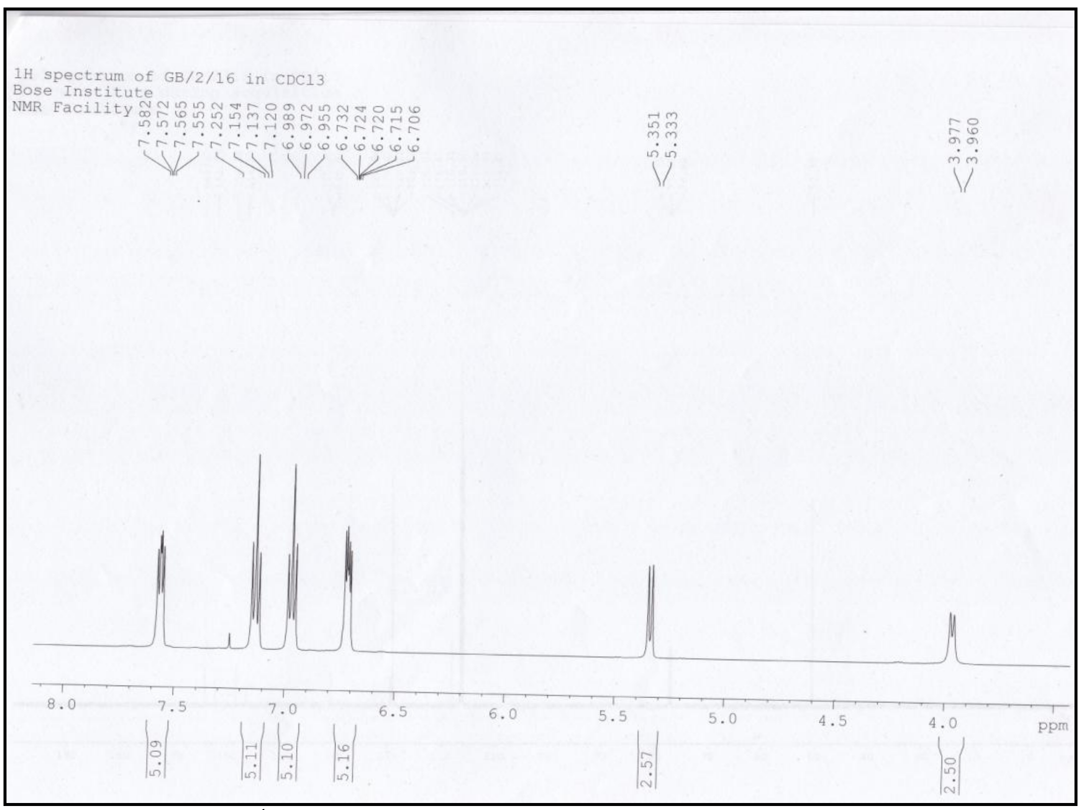

Figure S2. [1]H-NMR spectrum (extended scale) of α-aminonitrile **1**

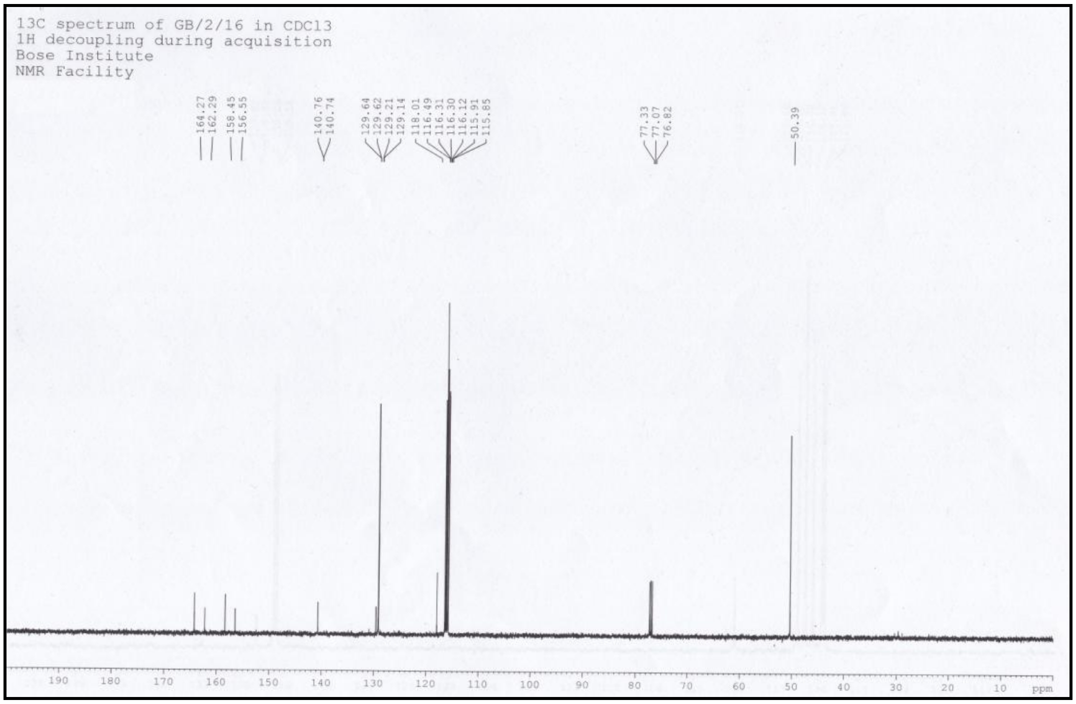

Figure S3. ^{13}C-NMR spectrum of α-aminonitrile **1**