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Facile acid catalyzed rearrangement of ethers to diarylmethanes

Veerareddy. Arava*[a], Sreenivasulareddy. Bandatmakuru[a], Sashibhushan. Malreddy[a], Narayanaswamy. Golla[b], Sreenivasulareddy. Thummala[b]

[a] *R&D Centre, Suven Life Sciences Ltd. Plot No.#18, Phase-III, Jeedimetla, Hyderabad, India*
[b] *Department of Chemistry, Sri Krishnadevaraya University, Anantapur, India*

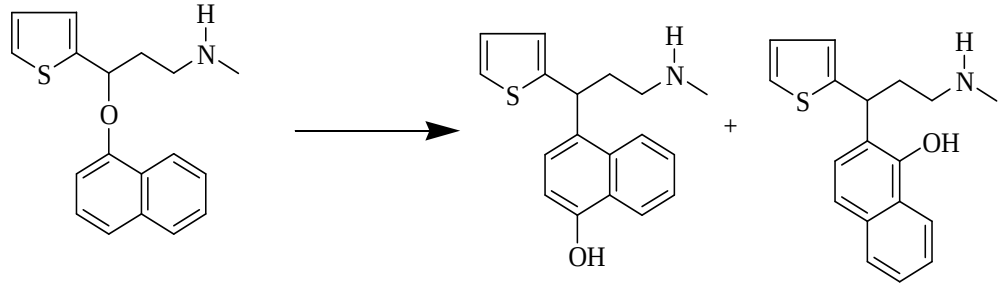
ABSTRACT

The acid catalyzed rearrangement of benzylphenolic ethers to biphenylmethane compounds is described.

Keywords: Ethers, Aluminum chloride, perchloric acid, Rearrangement.

INTRODUCTION

The rearrangement chemistry has a special significance in the art of organic synthesis. During our stability studies (under acidic stress conditions) on drug duloxetine (Scheme.1), we found that the ether linkage of the duloxetine molecule **1** undergoes rearrangement to give phenolic products[1] **2** & **3.** Similar observation was reported by Brenna[2] et al. and they compared this phenomenon as so-called photo claisen reaction. Later few patents[3] were appeared for the preparation of pure duloxetine without impurities **2** & **3**.



1 **2** **3**

Scheme1: Duloxetine and rearrangement products

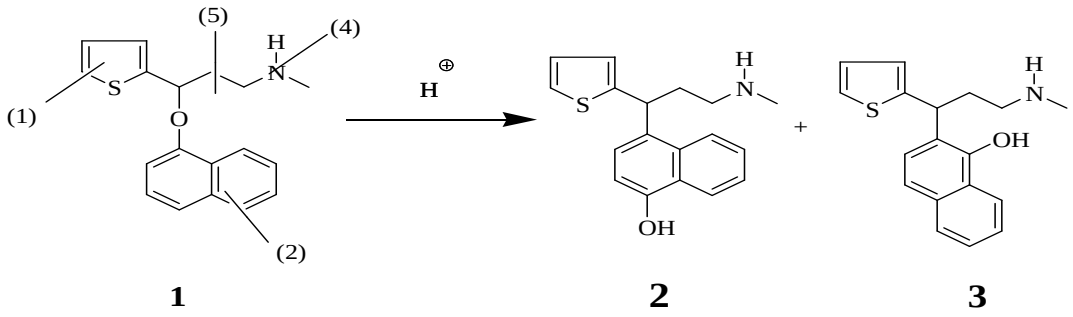
RESULTS AND DISCUSSION

We believed that this is an acid catalysed rearrangement and studied the same with different acid catalysts. The rearrangement is observed in protic acids like HCl, $HClO_4$ (70%) and lewis acids like $AlCl_3$.(Table.1.)

Table.1: Ether rearrangement in different catalytic conditions.

S.No	Ether	Solvent	Acid catalyst	Time/Temp	Yield of 2	Yield of 3
1	1	EtOAc	Con.HCl	1hr/45°C	30%	17%
2	1	DCM	$HClO_4$	1hr/25°C	10%	6%
3	1	DCM	$AlCl_3$	2hr/40°C	45%	15%

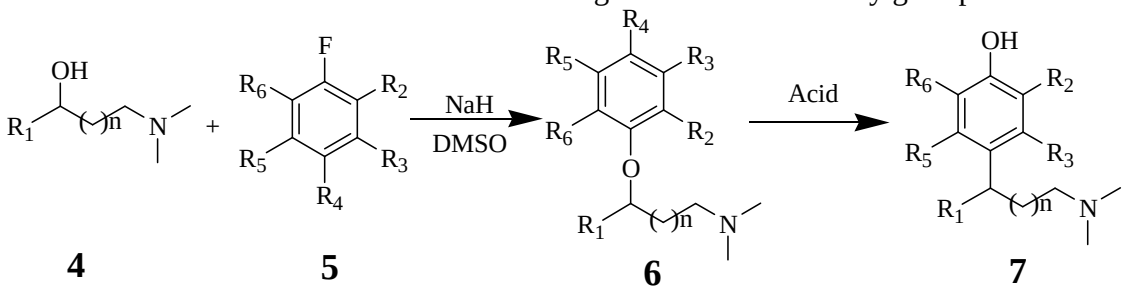
Once the rearrangement is confirmed as an acid catalyzed one, we studied the generality of the rearrangement as follows.



1 **2** **3**

(1) Change thiophene nucleus to Aromatic nucleus (optionally substituted).
(2) Naphthalene ring to Aromatic ring.
(3) Changing both rings to aromatic nucleus(changes 1&2)
(4) –NHMe to different N-substitutions.
(5) Chain length.

The required ethers **6** are prepared from alcohols **4** and fluoro aromatics **5** in presence of NaH/DMSO or KOH/DMSO. Under acidic rearrangement conditions they gave products **7**.

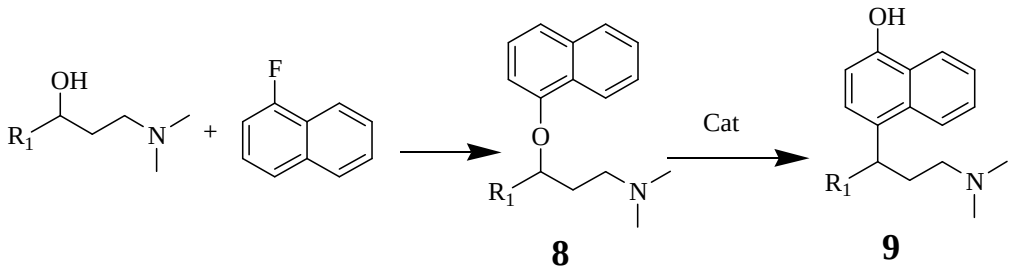


4 **5** **6** **7**

Scheme 2: Preparation of ethers & Acid catalyzed rearrangement.

(1) Change of thiophene ring to aromatic ring.

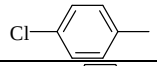
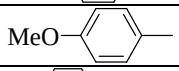
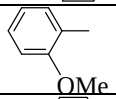
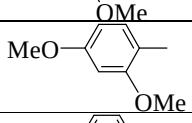
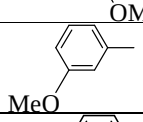
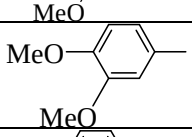
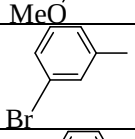
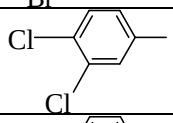
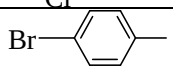
All the ethers prepared (Table-2) are obtained in good yields. The ethers are rearranged into phenols, but mainly 4-OH compounds are characterized.(Table.2)



8 **9**

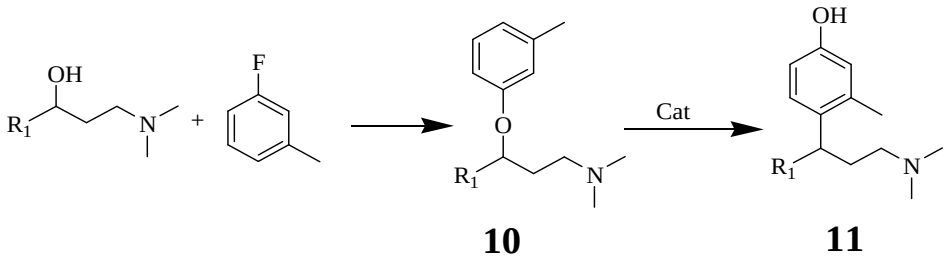
Scheme 3: Preparation of ethers & Acid catalyzed rearrangement.

Table.2: Ethers 8 & Phenol 9 Derivatives

S.NO	R_1	Yield of 8 (%)	Cat	Yield of 9 (%)
1		8.1(73)	$AlCl_3$	9.1(30)
2		8.2(75)	$AlCl_3$	9.2(25)
3		8.3(62)	$AlCl_3$	9.3(50)
4		8.4(90)	$AlCl_3$	9.4(25)
5		8.5(85)	$AlCl_3$	9.5(35)
6		8.6(90)	$AlCl_3$	9.6(20)
7		8.7(60)	$AlCl_3$	9.7(15)
8		8.8(65)	$AlCl_3$	9.8(35)
9		8.9(65)	$AlCl_3$	9.9(30)

(2) **Change of naphthalene ring to benzene ring.**

Ethers are prepared and characterized in good yield. The acid catalyzed rearrangement gave phenols in which 4-OH compound isolated and characterized (Table.3).



10 **11**

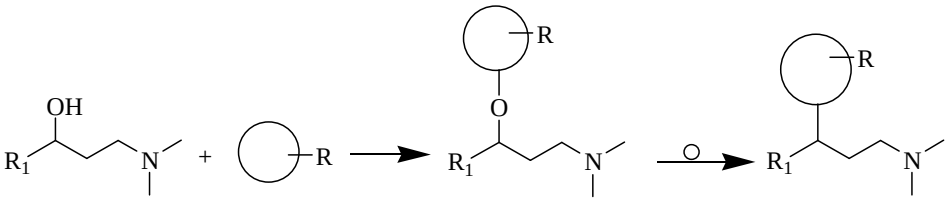
Scheme 4: Preparation of ethers & Acid catalyzed rearrangement

Table.3. Ether(10) & phenol(11) derivatives.

S.NO	R_1	Yield of 10(%)	Cat	Yield of 11 (%)
1		10(73)	$AlCl_3$	11(60)

(3) Change of thiophene and naphthalene rings to aromatic ones.

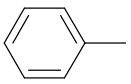
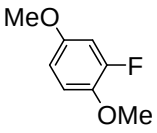
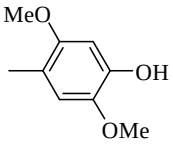
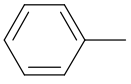
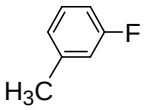
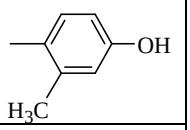
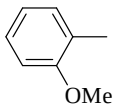
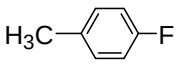
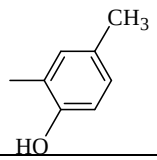
Ethers are prepared and characterized in good yields. The acid catalyzed rearrangement gave phenols in which 4-OH compounds are isolated & characterized (Table.4)

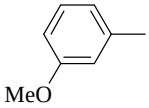
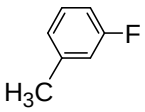
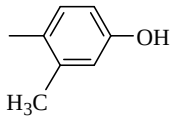
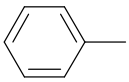
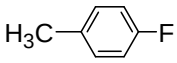
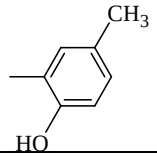


12 **13**

Scheme 5: Preparation of ethers & Acid catalyzed rearrangement

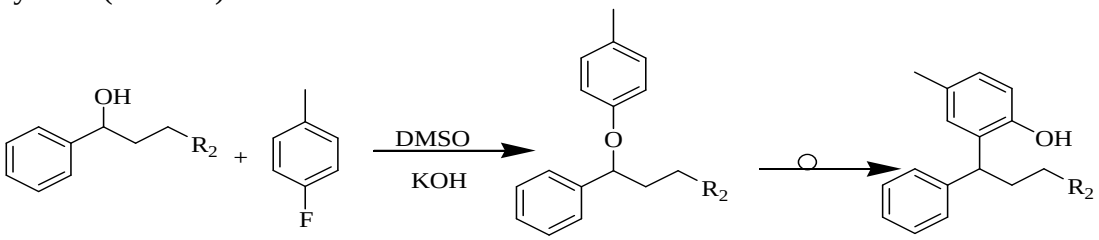
Table.4. Ethers(12) & phenols(13) derivatives

S.NO	R_1		Yield of 12 (%)	Catalyst	Yield of 13 (%)	13 
1			12.1(60)	70%$HClO_4$	13.1(45)	
2			12.2(70)	$AlCl_3$	13.2(60)	
3			12.3(60)	$AlCl_3$	13.3(60)	

4			12.4(60)	$AlCl_3$	13.4(65)	
5			12.5(60)	$AlCl_3$	13.5(60)	

(4) –NHMe to different Aminoderivatives.

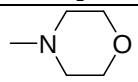
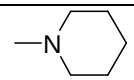
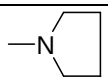
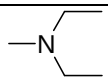
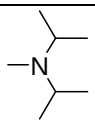
The required amino alcohols are prepared as per De Castro [4] method. The ethers are obtained in good yields and are characterized thoroughly. The ethers on rearrangement gave phenols in good yields. (Table.5.).



14 **15**

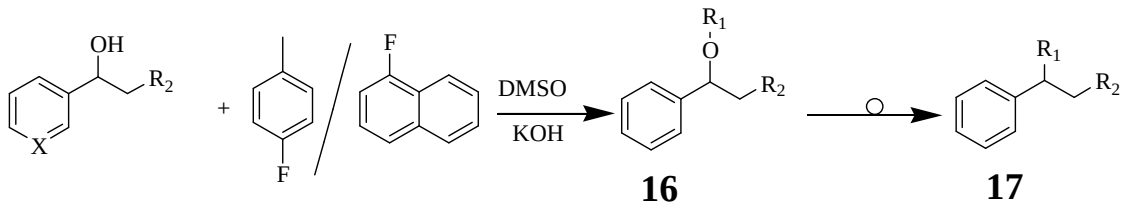
Scheme 6: Preparation of ethers & Acid catalyzed rearrangement.

Table.5. Ethers(14) & phenols(15) derivatives.

S.NO	R_2	Yield of 14 (%)	Catalyst	Yield of 15 (%)
1		14.1(68)	70%$HClO_4$	15.1(60)
2		14.2(66)	70%$HClO_4$	15.2(50)
3		14.3(61)	70%$HClO_4$	153(55)
4		14.4(59)	70%$HClO_4$	15.4(45)
5		14.5(80)	70%$HClO_4$	15.5(60)

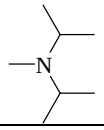
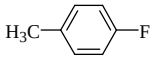
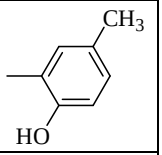
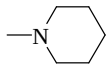
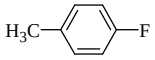
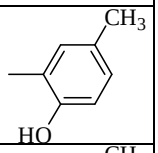
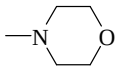
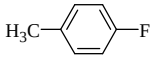
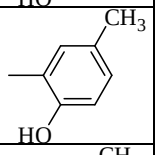
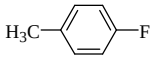
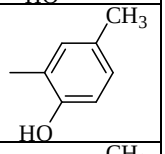
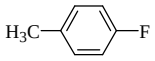
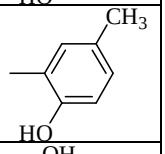
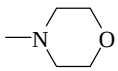
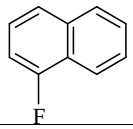
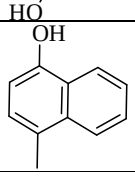
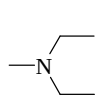
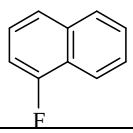
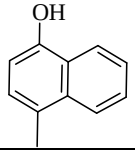
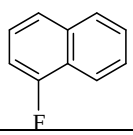
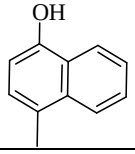
(5) Chain length reduction.

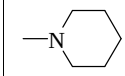
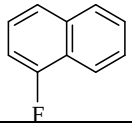
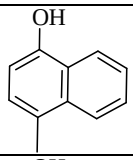
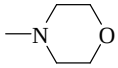
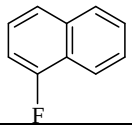
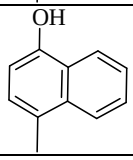
The required amino alcohols are prepared by known methods. The ethers and rearranged phenols are characterized thoroughly by spectral data.



Scheme 7: Preparation of ethers & Acid catalyzed rearrangement

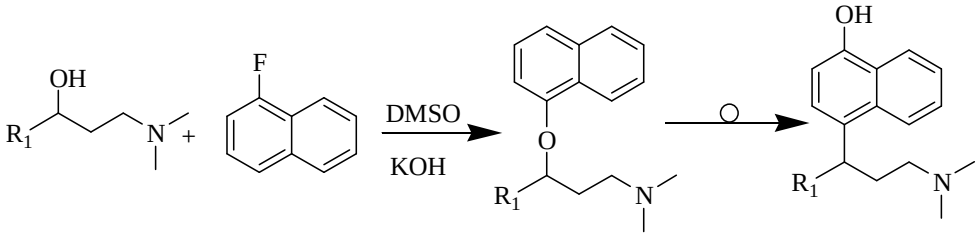
Table.6. Ethers(16) & phenols(17) derivatives.

S.No	X	R_2	R_1	Yield of 16 (%)	Cat	Yield of 17 (%)	R_1
1	$-CH_2-$			16.1(57)	$AlCl_3$	17.1(62.5)	
2	CH_2-			16.2(52)	$AlCl_3$	17.2(61)	
3	$-CH_2-$			16.3(60)	$AlCl_3$	17.3(60)	
4	$-CH_2-$			16.4(54)	$AlCl_3$	17.4(45)	
5	$-CH_2-$			16.5(62)	$AlCl_3$	17.5(63)	
6	$-CH_2-$			16.6(54)	$AlCl_3$	17.6(67)	
7	$-CH_2-$			16.7(54)	$AlCl_3$	17.7(65)	
8	$-CH_2-$			16.8(49)	$AlCl_3$	17.8(50)	

9	-CH_2-			16.9(59)	$AlCl_3$	17.9(63)	
10	-N-			16.10(65)	$AlCl_3$	17.10(10)	

(6) Miscellaneous ethers rearranged to phenols.

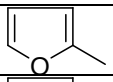
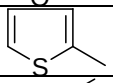
The required amino alcohols are prepared by known methods. The ethers and rearranged phenols are characterized thoroughly by spectral data.



18 **19**

Scheme 8: Preparation of ethers & Acid catalyzed rearrangement

Table.7. Ethers(18) & phenols(19) derivatives

S.NO	R_1	Yield of 18 (%)	Catalyst	Yield of 19 (%)
1		18.1(55)	$AlCl_3$	19.1(50)
2		18.2(60)	$AlCl_3$	19.2(60)
3		18.3(65)	$AlCl_3$	19.3(20)

Using this rearrangement chemistry we have prepared Tolterodine[5] and Isomimosifoliol derivatives[6].

MATERIALS AND METHODS

Most of the reagents used in this work were obtained from commercial suppliers and were of LR/AR grade. Solvents were purified before use by standard procedures. Melting points were determined using open capillary tubes on POLMON melting points apparatus (Model-96) and are uncorrected. The purity of all the compounds were routinely checked by TLC on silica gel-GF 254 (Merck) coated plates. Visualization of TLC plates was done by Iodine or under UV light. Yields have been reported throughout this paper in percent molar based on the immediate precursor of the reaction. IR spectra were recorded using Perkin-Elmer Model – 2000 instrument

(KBr) ^{1}H-NMR & ^{13}C-NMR spectra were recorded on Brucker instrument (Model-AVN 400) operating at 400 MHz for ^{1}H & 100 MHz for ^{13}C using $CDCl_3$ / DMSO-d_6 as solvents and TMS as internal standard (chemical shift in δ, ppm). Mass spectra have been recorded under Chemical Ionization conditions on ESI-MS Mass Spectrometer (Model API-2000LCMS-MS).

Typical procedure for Ethers preparation

Method A:-

To a solution of alcohol (1.0moles) in dimethyl sulfoxide (5 vol), potassium hydroxide (85% assay) (5 moles) was added at 25-30°C and the reaction mass heated to 100-105°C and stirred for 90 minutes. The resulting slurry was allowed to cool to 80-85°C and fluoro compound (1.5 moles) was added over a period of 20 minutes. The reaction mixture was heated to 140-145°C for 4hours and allowed to cool to ~ 70°C then 10 Vol of water and 10 Vol of toluene were added. The reaction mixture was stirred for 20 minutes, and the layers were separated. The aqueous layer was extracted again with toluene (3 x 5 Vol). The combined organic layers were washed with water (3 X 5 Vol) and dried over anhydrous sodium sulphate. The solution was concentrated at 50-60°C to get the product ether.

Method B:-

To a solution of alcohol (1.0moles) in dimethyl sulfoxide (5 Vol), sodium hydride (60%) (1.2 moles) was added at 25-30°C, then fluoro compound (1.5 moles) was added over a period of 20 minutes at 25-30°C. The reaction mixture was heated to 70-80°C for 4hours and allowed to cool to ~ 40°C then 10 Vol of water and 10 Vol of toluene were added. The reaction mixture was stirred for 20 minutes, and the layers were separated. The aqueous layer was extracted again with toluene (3 x 5 Vol). The combined organic layers were washed with water (3 X 5 Vol) and dried over anhydrous sodium sulphate. The solution was concentrated at 50-60°C to get ether compound.

3-(4-chlorophenyl) - N, N - dimethyl - 3- (naphthalen-1-yloxy) propan-1-amine (8.1): Yield 5.8 gm (73%). Yellow liquid. IR (In Neat): 2953, 2818, 1739, 1398, 1265 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.42 (t, 1H, *J*=4.5 Hz), 7.78 (t, 1H, *J*=4.3Hz), 7.52 (t, 2H, J_1=3.7Hz), 7.37 (d, 3H, J_1=8.3Hz), 7.30-7.26 (m, 2H), 7.22 (t, 1H, *J*=7.9Hz), 5.46 (dd, 1H, J_1=4.8, J_2=4.8Hz), 2.53 (t, 2H, *J*=6.6Hz), 2.35-2.30 (m, 1H) 2.26 (s, 6H), 2.09-2.05 (m, 1H)ppm; ^{13}C NMR($CDCl_3$, 100MHz) δ = 153.30, 140.45, 134.59, 133.20, 128.85, 127.61, 127.23, 126.39, 125.96, 125.78, 125.28, 122.04, 120.35, 106.92, 77.54, 55.83, 45.56, 36.98 ppm. ESIMS $[M+H]^+$m/z 340.40 .

[3-(4-methoxy-phenyl)-3-(naphthalene-1-yloxy)-propyl]-dimethyl-amine (8.2):

Yield 6.0 gm (75%). Yellow liquid. IR (In Neat): 2959, 1597, 1398, 425 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.48 (d, 1H, *J*=7.5Hz), 7.81 (t, 1H, *J*=4.3Hz), 7.55-7.51 (m, 2H), 7.39 (d, 3H, *J*=8.6Hz), 7.23 (t, 1H, *J*=7.95Hz), 6.89 (d, 2H, *J*=8.0Hz), 6.71 (d, 1H, *J*=7.6Hz), 5.42 (dd, 1H, J_1=5.00, J_2=5.01Hz), 3.78 (s, 3H), 2.58 (q, 2H), 2.39 (q, 1H), 2.2 (s, 6H), 2.15-2.08 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 159.00, 153.62, 134.61, 133.83, 127.58, 127.04, 126.29, 126.14, 125.91, 125.16, 122.20, 120.04, 114.03, 107.08, 77.99, 56.06, 55.05, 45.57, 37.12ppm. ESIMS $[M+H]^+$m/z 336.5.

[3-(2-Methoxy-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.3):
Yield 4.96 gm (62%). Yellow liquid. IR (in KBr): 3764, 1576, 1460, 1284cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.48 (d, 1H, *J*=7.3Hz), 7.79 (d, 1H, *J*=7.0Hz), 7.52-7.50 (m, 2H), 7.39-7.32 (m, 2H), 7.22 (t, 1H, *J*=6.8Hz), 6.93 (d, 1H, *J*=8.1Hz), 6.58 (d, 1H, *J*=7.6Hz), 5.84 (d, 1H, *J*=3.9Hz), 3.95 (s, 3H), 2.63 (t, 2H, *J*=7.3Hz), 2.28 (s, 6H), 2.24-2.16 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ =155.85, 153.49, 134.47, 129.84, 128.29, 127.46, 126.15, 126.03, 125.97, 125.86, 125.02, 122.11, 120.90, 119.73, 110.12, 106.32, 72.40, 56.39, 55.32, 45.56, 35.41ppm. ESIMS $[M+H]^+$m/z 336.5 .

[3-(2,4-Dimethoxy-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.4):
Yield 6.87 gm (90%). White solid; mp 78.6-80.5°C. IR (in KBr): 2963, 2934, 1925, 1295, 491 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.48 (d, 1H, *J*=7.3Hz), 7.80 (d, 1H, *J*=7.1Hz), 7.51 (br, 2H), 7.35-7.20 (m, 3H), 6.63 (d, 1H, *J*=7.4Hz), 6.51 (s, 1H), 6.39 (d, 1H, *J*=7.7Hz), 5.78 (d, 1H, *J*=4.5Hz), 3.90 (s, 3H), 3.76 (s, 3H), 2.61 (t, 2H, *J*=7.35Hz), 2.28 (s, 6H), 2.23-2.17 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 159.98, 156.90, 153.46, 134.40, 127.37, 126.69, 126.03, 125.93, 125.89, 124.89, 122.23, 122.06, 119.58, 106.29, 104.46, 98.15, 72.20, 56.33, 55.33, 55.17, 45.51, 35.61ppm. ESIMS $[M+H]^+$m/z 366.5.

[3-(3-Methoxy-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.5):
Yield 6.8 gm (85%). White solid; mp 94.2-95.8°C. IR (in KBr): 2791, 1924, 1745, 1262 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.45 (d, 1H, *J*=9.2Hz), 7.77 (s, 1H), 7.52-7.49 (m, 2H), 7.36 (d, 1H, *J*=8.2Hz), 7.26-7.18 (m, 2H), 7.20-7.18 (m, 2H), 7.03 (t, 1H, *J*=7.6Hz), 6.98 (d, 1H, *J*=8.4Hz), 5.43 (dd, 1H, J_1=4.62, J_2=4.60Hz), 3.76 (s, 3H), 2.56 (t, 2H, *J*=7.2Hz), 2.37-2.33 (m,1H), 2.31 (s, 6H), 2.11-2.09 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 159.80, 153.53, 143.65, 134.48, 129.64, 127.46, 126.19, 125.92, 125.80, 125.07, 122.05, 120.02, 118.07, 112.67, 111.42, 106.85, 78.21, 56.01, 55.07, 45.54, 37.08ppm. ESIMS $[M+H]^+$m/z 336.5**.**

[3-(3,4-Dimethoxy-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.6):
Yield 6.87 gm (90%). Yellow liquid. IR (In Neat): 12950, 2054, 1594, 1263, 733 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.44 (d, 1H, *J*=9.3Hz), 7.79 (d, 1H, *J*=9.1Hz), 7.51-7.48 (m, 2H), 7.36 (d, 1H, *J*=8.2Hz), 7.23 (d, 1H, *J*=3.95Hz), 6.97 (d, 2H, *J*=6.5Hz), 6.82 (d, 1H, *J*=8.7Hz), 6.69 (d, 1H, *J*=7.6Hz), 5.40 (dd, 1H, J_1=5.0, J_2=4.9Hz), 3.85 (s, 3H), 3.82 (s, 3H), 2.53-2.50 (m, 2H), 2.36-2.34 (m, 1H), 2.27(s, 6H), 2.09-2.05 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.48, 149.12, 148.33, 134.46, 134.17, 127.48, 126.17, 125.98, 125.78, 125.08, 121.94, 120.08, 118.11, 111.18, 108.82, 107.13, 78.21, 55.71, 55.75, 55.66, 45.09, 40.52, 36.58ppm. ESIMS $[M+H]^+$m/z 366.5.

[3-(3-Bromo-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.7):
Yield 4.4 gm (60%). Yellow liquid. IR (In Neat): 2943, 2767, 1578, 1237, 421cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.42 (t, 1H, *J*=4.6Hz), 7.79 (d, 1H, *J*=2.4Hz), 7.58 (s, 1H), 7.53-7.50 (m, 2H), 7.40-7.35 (m, 3H), 7.23-7.17 (m, 2H), 6.61 (d, 1H, *J*=7.6Hz), 5.43 (dd, 1H, J_1=4.7, J_2=4.7Hz), 2.53 (q, 2H), 2.33-2.30 (m, 1H), 2.28 (s, 6H), 2.10 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.33, 144.47, 134.62, 130.75, 130.34, 128.90, 127.63, 126.32, 125.95, 125.34, 124.42, 122.83, 122.18, 120.46, 106.99, 78.30, 56.03, 42.77, 37.09ppm. ESIMS $[M+H]^+$m/z 384.2.

[3-(3,4-Dichloro-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.8):
Yield 4.9 gm(65%). White solid; mp 105.1-106.8°C. IR (in KBr): 2946, 1909, 1628, 1264, 573 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 8.43 (d, 1H, *J*=8.4Hz), 7.82 (t, 1H, *J*=4.2Hz), 7.55-7.51 (m, 3H), 7.41 (d, 2H, *J*=8.2Hz), 7.29-7.21 (m, 2H), 6.61 (d, 1H, *J*=7.6Hz), 5.46 (dd, 1H, J_1=4.9, J_2=5.0Hz), 2.56-2.50 (m, 2H), 2.36-2.32 (m, 1H), 2.28 (s, 6H), 2.10-2.07 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.00, 142.24, 134.49, 132.74, 131.43, 130.67, 127.78, 127.53, 126.38, 125.73, 125.63, 125.29, 125.11, 121.82, 120.52, 106.72, 77.30, 55.58, 45.41, 36.70ppm. ESIMS $[M+H]^+$m/z 374.4.

[3-(4-Bromo-phenyl)-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (8.9):
Yield 4.8 gm (65%). Yellow liquid. IR (In Neat): 2859, 2498, 1528, 1265, 501cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 8.43 (d, 1H, *J*=7.2Hz), 7.81 (d, 1H, *J*=8.5Hz), 7.53-7.44 (m, 4H), 7.36 (dd, 3H, J_1=8.2, J_2=8.1Hz), 7.22 (t, 1H, *J*=7.9Hz), 6.61 (d, 1H, *J*=7.6Hz), 5.43 (dd, 1H, J_1=4.9, J_2=4.9Hz), 2.54-2.50 (m, 2H), 2.34 (s, 1H), 2.27 (s, 6H), 2.10-2.06 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.24, 140.91, 134.50, 131.71, 127.50, 126.28, 125.86, 125.66, 125.18, 121.93, 121.27, 120.27, 106.83, 77.55, 55.77, 45.49, 36.87ppm. ESIMS $[M+H]^+$m/z 385.4.

Dimethyl-(3-thiophen-2-yl-3-m-tolyloxy-propyl)-amine (10):
Yield 4.6 gm (62%). Brown liquid. IR (In Neat): 3106, 2945, 2815, 2766, 1601, 1584, 1488, 1459, 1256, 1154, 1042, 701 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 7.23 (d, 1H, *J*= 4.95Hz), 7.10 (t, 1H, *J*= 7.81Hz), 7.00 (d, 1H, *J*=3.06 Hz), 6.94 (t, 1H, *J*=2.42Hz), 6.7 (m, 3H), 5.5 (t, 1H, *J*=6.57Hz), 2.43 (t, 2H, *J*=7.03Hz), 2.27 (s, 3H), 2.25 (s, 7H), 2.08-2.03 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.76, 145.55, 130.39, 129.69, 126.38, 124.59, 124.49, 116.14, 74.83, 55.63, 45.47, 36.75, 20.41ppm. ESIMS $[M+H]^+$m/z 276.4.

[3-(2,5-Dimethoxy-phenoxy)-3-phenyl-propyl]-dimethyl-amine (12.1):
Yield 5.2 gm (60%). White solid; mp 128.3-130.6°C. IR (In KBr): 3433, 2946, 1878, 1690, 1509, 1460, 1231, 1162, 762 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 7.39 (d, 2H, *J* = 7.3 Hz), 7.31 (t, 2H, *J* = 7.5 Hz), 7.25 (d, 1H, *J* = 7.2Hz), 6.78 (d, 1H, *J* = 8.7Hz), 6.39-6.32 (m, 2H), 5.24 (dd, 1H, J_1=1.2, J_2=1.8Hz), 3.83 (s ,3H), 3.50 (s, 3H), 2.46 (t, 2H, *J* = 9.1Hz), 2.30-2.26 (m, 1H), 2.23 (s, 6H), 2.03-1.97 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.93, 148.66, 144.32, 141.72, 128.42, 127.47, 126.03, 113.27, 104.26, 104.15, 79.74, 56.93, 55.75, 55.32, 45.39, 36.40ppm. Anal. Calcd for $C_{19}H_{25}NO_3$ (315.40): C, 72.35; H, 7.99; N, 4.44. Found: C, 72.0961; H, 7.8667; N, 4.7088. ESIMS $[M+H]^+$m/z 316.3.

Dimethyl-(3-phenyl-3-m-tolyloxy-propyl)-amine (12.2):
Yield 5.25 gm (70%). Yellow liquid. IR (In Neat): 2950, 1602, 1489, 1261, 1155, 1053, 700 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 7.37-7.31(m, 4H), 7.25 (t, 1H, *J*=3.4Hz), 7.06 (t, 1H, *J*=7.8Hz), 6.72-6.64 (m, 3H), 5.23 (dd, 1H, J_1=4.8, J_2=4.8Hz), 2.45 (t, 2H, *J*=7.2Hz), 2.26 (s, 9H), 2.22 (s, 1H), 2.17-2.15 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 158.24, 145.12, 142.12, 139.16, 128.52, 127.83, 125.88, 121.49, 116.86, 112.62, 78.05, 55.69, 45.45, 45.26, 36.87, 21.45ppm. ESIMS $[M+H]^+$m/z 270.3.

[3-(2-Methoxy-phenyl)-3-p-tolyloxy-propyl]-dimethyl-amine (12.3):
Yield 4.29 gm (60%). Yellow liquid. IR (In Neat): 2945, 1508, 1286, 1236, 755 cm^{-1}.^1H NMR ($CDCl_3$, 400MHz) δ = 7.35-7.21 (m, 2H), 6.97 (d, 2H, *J*=8.2Hz), 6.89 (d, 2H, *J*=7.9Hz), 6.73 (d,

2H, *J*=8.3Hz), 5.5 (br, 1H), 3.89 (s, 3H), 2.49 (d, 2H, *J*= 5.3Hz), 2.49-2.47 (m, 2H), 2.23 (s, 6H), 2.04 (s, 2H), 1.55 (m, 3H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.99, 155.78, 155.06, 129.96, 129.82, 129.65, 129.49, 128.16, 126.29, 120.83, 115.46, 115.26, 110.06, 72.33, 56.07, 55.22, 45.16, 34.67, 20.36ppm. ESIMS $[M+H]^+$m/z 300.3.

[3-(2-Methoxy-phenyl)-3-m-tolyloxy-propyl]-dimethyl-amine (12.4):
Yield 4.29 gm (60%). Yellow liquid. IR (In Neat): 2940, 1601, 1462, 1261, 1240 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.49 (q, 1H), 7.28 (s, 1H), 7.14 (t, 1H, *J*=7.8Hz), 6.98 (dd, 2H, J_1=7.4, J_2=8.2Hz), 6.82 (s, 1H), 6.76-6.73 (m, 2H), 5.74 (t, 1H, *J*=6.1Hz), 3.94 (s, 3H), 2.63-2.52 (m, 2H), 2.33 (s, 9H), 2.16-2.11 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 158.24, 155.78, 139.07, 130.20, 128.90, 128.11, 126.30, 121.18, 120.84, 116.49, 112.12, 110.03, 72.06, 56.21, 55.22, 45.47, 35.24, 21.43, 21.14ppm. ESIMS $[M+H]^+$m/z 30.

Dimethyl-(3-phenyl-3-p-tolyloxy-propyl)-amine (12.5):
Yield 4.5 gm (60%). Yellow liquid. IR (In Neat): 2766, 1614, 1237 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.40-7.32 (m, 4H), 7.28 (t, 1H, *J*=7.0Hz), 7.01 (d, 2H, *J*=8.4Hz), 6.79 (d, 2H, *J*=8.4Hz), 5.21 (dd, 1H, J_1=4.9, J_2=4.9Hz), 2.48 (t, 2H, *J*=7.2Hz), 2.24 (s, 6H), 2.22 (s, 3H), 2.21 (s, 1H), 2.00-1.97 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.17, 142.23, 129.78, 128.57, 127.47, 125.99, 115.88, 78.39, 55.94, 45.50, 36.92, 20.48. ESIMS $[M+H]^+$m/z 270.3.

4-(3-Phenyl-3-p-tolyloxy-propyl)-morpholine (14.1):
Yield 2.0 gm (68%). Yellow liquid. IR (In Neat): 3060, 3029, 2955, 2855, 2810, 1968, 1613, 1509, 1454, 1330, 1234, 1118, 1022, 817,757, 701 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.25-7.37 (m, 5H), 6.98 (d, 2H, *J*=8.3Hz), 6.75 (d, 2H, *J*=8.4Hz), 5.18 (dd, 1H, J_1=4.9, J_2=4.9Hz), 3.73 (t, 4H, *J*=4.5Hz), 2.49-2.54 (m, 2H), 2.46 (br, 4H), 2.23 (s, 3H), 2.01-2.20 (m, 1H), 1.98-1.99 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.05, 142.0, 129.83, 129.72, 128.51, 127.44, 125.92, 115.78, 78.35, 66.89, 55.06, 53.67, 35.66, 20.40ppm. ESIMS $[M+H]^+$m/z 312.40.

1-(3-Phenyl-3-p-tolyloxy-propyl)-piperidine (14.2)
Yield 1.85 gm (66%). Brown liquid. IR (In Neat): 3060, 3062, 3027, 2932, 2852, 2801, 2770, 1612, 1534, 1509, 1467, 1452, 1377, 1351, 1236, 1120, 1014, 816, 761, 700 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.24-7.36 (m, 5H), 6.98 (d, 2H, *J*=8.3Hz), 6.75 (d, 2H, *J*=8.4Hz), 5.15 (dd, 1H, J_1=4.9, J_2=4.8Hz), 2.38-2.45 (m, 6H), 2.23 (s, 3H), 2.06 (m, 2H), 1.58 (br, 4H), 1.45 (br, 2H) ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.14, 142.18, 129.69, 128.46, 127.33, 125.93, 115.79, 78.81, 55.55, 54.56, 36.0, 25.93, 24.43, 20.41, 14.18ppm. ESIMS $[M+H]^+$m/z 310.50.

1-(3-Phenyl-3-p-tolyloxy-propyl)-pyrrolidine (14.3):
Yield 3.5 gm (61%). Brown liquid. IR (In Neat): 3059, 3027, 2953, 2930, 2793, 1721, 1646, 1508, 1453, 1396, 1358, 1235, 1013, 816, 702 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.24-7.36 (m, 5H), 6.97 (d, 2H, *J*=8.3Hz), 6.74 (d, 2H, *J*=8.4Hz), 5.16 (dd, 1H, J_1=4.9, J_2=4.8Hz), 2.64-2.58 (m, 2H), 2.5 (br, 4H), 2.22 (br, 4H), 2.03 (m, 1H), 1.78 (br, 4H) ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.06, 142.09, 129.73, 129.65, 128.44, 127.32, 125.89, 115.76, 78.62, 54.10, 52.66, 37.95, 23.40, 20.37ppm. ESIMS $[M+H]^+$m/z 296.4.

Diethyl-(3-phenyl-3-p-tolyloxy-propyl)-amine (14.4):
Yield 1.7 gm (59%). Yellow liquid. IR(In Neat): 3060, 3027, 2967, 2929, 2871, 2805, 1613, 1508, 1452, 1288, 1237, 1069, 816, 700 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.26-7.38 (m, 5H), 6.97 (d, 2H, *J*=8.3Hz), 6.77 (d, 2H, *J*=8.4Hz), 5.18 (dd, 1H, J_1=4.5, J_2=4.5Hz), 2.64 (t, 2H, *J*=7.2Hz), 2.55 (m, 4H), 2.23 (s, 3H), 2.06 (m, 2H), 1.02 (t, 6H, *J*=7.128Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.10, 142.34, 129.64, 128.43, 127.27, 125.88, 115.71, 78.46, 48.91, 46.90, 36.22, 20.37, 11.77ppm. ESIMS $[M+H]^+$m/z 298.4.

Diisopropyl-(3-phenyl-3-p-tolyloxy-propyl)-amine (14.5):
Yield 12.50 gm (73%). Yellow liquid. IR (In Neat): 3061, 3027, 2964, 2925, 2869, 2812, 2605, 1947, 1870, 1613, 1585, 1509, 1452, 1385, 1360, 1287, 1283, 1202, 1174, 1058, 816, 754, 699cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.34-7.30 (m, 4H), 7.26-7.23 (m ,1H), 6.98 (d, 2H, *J*=8.3 Hz), 6.76 (d, 2H, *J*= 8.4Hz), 5.22 (dd, 1H, J_1=3.7, J_2=3.7Hz), 3.02 (pentet, 2H), 2.65 (t, 2H, *J* = 7.0Hz), 2.23 (s, 3H), 2.07-2.03 (m, 1H), 1.93-1.92 (m, 1H), 1.00 (t, 12H, *J*=6.82Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.17, 142.72, 129.85, 129.61, 129.45, 128.41, 127.31, 127.10, 125.84, 115.61, 77.80, 48.39, 41.34, 40.24, 21.25, 20.38, 20.16ppm. ESIMS $[M+H]^+$m/z 326.40.

Diisopropyl-(2-phenyl-2-p-tolyloxy-ethyl)-amine (16.1):
Yield 4.0 gm (57%). Yelloq liquid. IR (In Neat): 3029, 2963, 2925, 2870, 1613, 1509, 1453, 1381, 1362, 1285, 1238, 1175, 1024 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.40 (d, 2H, *J*=7.2Hz), 7.35 (t, 2H, *J*=7.4Hz), 7.27 (t, 1H, *J*=3.5Hz), 6.98 (d, 2H, *J*=8.3Hz), 6.78 (d, 2H, *J*=8.4Hz), 5.02 (t, 1H, *J*=6.1Hz), 3.04-3.10 (m, 3H), 2.75-2.78 (dd, 1H, J_1=5.6, J_2=5.6Hz), 2.25 (s, 3H), 1.04 (d, 6H, *J*=6.5 Hz), 0.9 (d, 6H, *J*=6.6Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.35, 141.43, 129.58, 129.44, 128.07, 127.16, 126.39, 115.67, 81.42, 53.22, 48.79, 21.26, 20.66, 20.36ppm. ESIMS $[M+H]^+$m/z 312.4.

1-(2-Phenyl-2-p-tolyloxy-ethyl)-piperidine (16.2):
Yield 3.0 gm (52%). Brown liquid. IR (In Neat): 3029, 2933, 2854, 2802, 1613, 1585, 1509, 1452, 1287, 1235, 1175, 1118, 1038, 817, 699 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.39 (d, 2H, *J*=7.8Hz), 7.33 (t, 2H, *J*=7.4Hz), 7.25 (t, 1H, *J*=6.5Hz), 6.99 (d, 2H, *J*=8.1Hz), 6.78 (d, 2H, *J*=7.6Hz), 5.34 (t, 1H, *J*=4.0Hz), 2.98-3.00 (d, 1H, *J*=8.4Hz), 2.63-2.70 (m, 3H), 2.54-2.56 (m, 2H), 2.24 (s, 3H), 1.58-1.63 (br, 4H), 1.45 (br, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.68, 141.18, 129.82, 129.65, 128.44, 127.37, 125.98, 115.85, 78.48, 66.34, 54.69, 26.02, 24.16, 20.37ppm. ESIMS $[M+H]^+$m/z 296.3.

4-(2-Phenyl-2-p-tolyloxy-ethyl)-morpholine (16.3):
Yield 4.2 gm (60%). Yellow liquid. IR (In Neat): 3061, 3029, 2956, 2855, 1613, 1509, 1453, 1357, 1287, 1233, 1117, 1010, 871, 817, 756, 700 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ =7.41 (d, 2H, *J*=3.3Hz), 7.36 (t, 2H, *J*=7.4Hz), 7.29 (d, 1H, *J*=7.1Hz), 6.69 (d, 2H, *J*=8.2Hz), 6.79 (d, 2H, *J*=8.3Hz), 5.3 (dd, 1H, J_1=2.8Hz, J_2=2.8Hz), 3.74 (t, 4H, *J*=4.5Hz), 3.0 (q, 1H), 2.68-2.72 (m, 3H), 2.58-2.62 (m, 2H), 2.25 (s, 3H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.55, 140.66, 130.03, 129.71, 128.51, 127.58, 126.0, 115.81, 78.68, 66.96, 65.81, 53.98, 14.07ppm. ESIMS $[M+H]^+$m/z 298.2.

1-(2-Phenyl-2-p-tolyloxy-ethyl)-pyrrolidine (16.4):
Yield 4.0 gm (54%). Yellow liquid. IR (In Neat): 3061, 3028, 2963, 2929, 2874, 2796, 1613, 1585, 1509, 1452, 1355, 1236, 1175, 1043, 1028, 805, 816, 700 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.43 (d, 2H, *J*=7.2Hz), 7.36 (t, 2H, *J*=7.4Hz), 7.28 (d, 1H, *J*=7.2Hz), 7.01 (d, 2H, *J*=8.3Hz), 6.38 (d, 2H, *J*=8.5Hz), 5.34-5.37 (dd, 1H, J_1=2.8, J_2=2.9Hz), 3.03 (d, 1H, *J*=8.70Hz), 2.88-2.92 (dd, 1H, J_1=3.0Hz, J_2=3.0Hz), 2.67-2.75 (m, 4H), 2.26 (s, 3H), 1.82 (br, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.72, 140.91, 129.80, 129.68, 128.51, 127.56, 126.06, 115.80, 80.02, 63.39, 54.71, 23.47, 20.42ppm. ESIMS $[M+H]^+$m/z 282.20.

Diethyl-(2-phenyl-2-p-tolyloxy-ethyl)-amine (16.5):
Yield 4.5 gm (62%). Yellow liquid. IR (In Neat): 3029, 2968, 2927, 2806, 1613, 1509, 1453, 1237, 1044, 816, 699 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.42 (d, 2H, *J*=7.2Hz), 7.36 (t, 2H, *J*=7.4Hz), 7.28 (t, 1H, *J*=6.9Hz), 7.0 (d, 2H, *J*=8.3Hz), 6.8 (d, 2H, *J*=8.4Hz), 5.28 (dd, 1H, J_1=3.6, J_2=3.6Hz), 3.1 (q, 1H), 2.8 (dd, 1H, J_1=3.6Hz, J_2=3.6Hz), 2.72 (q, 4H), 2.27 (s, 3H), 1.1 (t, 3H, *J*=7.1Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 155.87, 141.22, 129.64, 128.41, 127.36, 126.06, 115.72, 79.20, 60.18, 47.78, 29.68, 20.39, 12.09ppm. ESIMS $[M+H]^+$m/z 284.30.

4-[2-(Naphthalen-1-yloxy)-2-phenyl-ethyl]-morpholine (16.6):
Yield 2.6 gm (54%). Yellow liquid. IR (In Neat): 3057, 3013, 2964, 2958, 2859, 2402, 1579, 1596, 1494, 1454, 1397, 1354, 1266, 1237, 1216, 1097, 756 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.49 (d, 1H, *J*=7.5Hz), 7.81 (d, 1H, *J*=1.6Hz), 7.55 (t, 2H, *J*=7.5Hz), 7.46 (d, 2H, *J*=7.2Hz), 7.23-7.40 (m, 5H), 6.67 (d, 1H, *J*=7.6Hz), 5.6 (m, 1H), 3.72 (t, 4H, *J*=4.6Hz), 3.18 (d, 1H, *J*=8.1Hz), 2.90 (d, 1H, *J*=2.9Hz), 2.77-2.78 (m, 2H), 2.64-2.68 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.08, 140.39, 134.52, 128.64, 127.76, 127.54, 126.32, 126.01, 125.87, 125.77, 125.25, 122.11, 120.33, 107.15, 79.08, 67.07, 66.07, 54.14ppm. ESIMS $[M+H]^+$m/z 334.3.

Diethyl-[2-(naphthalen-1-yloxy)-2-phenyl-ethyl]-amine (16.7):
Yield 4.5 gm (54%). Yellow liquid. IR (In Neat): 3056, 2968, 2931, 2807, 1629, 1595, 1579, 1462, 1451, 1399, 1265, 1237, 1097, 1068, 789, 770, 698 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.53 (d, 1H, *J*=7.7Hz), 7.82 (d, 1H, *J*=1.5Hz), 7.24-7.58 (m, 9H), 6.70 (d, 1H, *J*=7.6Hz), 5.56 (d, 1H, *J*=4.5Hz), 3.33 (d, 1H, *J*=7.9Hz), 2.99 (dd, 1H, J_1=3.3, J_2=3.3Hz), 2.8 (q, 4H), 1.16 (t, 6H, *J*=5.7Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.3, 140.74, 134.5, 128.50, 127.51, 127.46, 126.17, 126.02, 125.88, 125.76, 125.04, 122.19, 120.01, 106.88, 79.18, 60.23, 47.76, 47.95, 12.27ppm. ESIMS $[M+H]^+$m/z 320.7.

1-[2-(Naphthalen-1-yloxy)-2-phenyl-ethyl]-pyrrolidine (16.8):
Yield 4.1 gm (49%). Brown liquid. IR (In Neat): 3046, 2978, 2951, 2827, 1639, 1545, 1529, 1472, 1452, 1379, 1261, 1232, 1091, 1058, 780, 771, 697 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.51 (d, 1H, *J*=7.4Hz), 7.79 (s, 1H), 7.53-7.52 (m, 2H), 7.46 (d, 2H, *J*=7.2Hz), 7.37-7.21 (m, 5H), 6.67 (d, 1H, *J*=7.6Hz), 5.63 (t, 1H, *J*=5.5Hz), 3.13 (d, 2H, J=5.5Hz), 2.80-2.73 (m, 4H), 1.80-1.77 (m, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.08, 140.50, 134.46, 128.54, 127.64, 127.43, 126.15, 125.96, 125.85, 125.78, 125.04, 122.18, 120.00, 106.83, 80.24, 63.38, 54.98, 23.51ppm. ESIMS $[M+H]^+$m/z 318.3.

1-[2-(Naphthalen-1-yloxy)-2-phenyl-ethyl]-piperidine (16.9):
Yield 4.8 gm (59%). Yellow liquid. IR (In Neat): 3054, 3033, 2933, 2852, 2800, 1595, 1578, 1462, 1452, 1399, 1349, 1265, 1237, 1097, 1022, 789, 770, 699 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.49 (d, 1H, *J*=8.8Hz), 7.79 (s, 1H), 7.21-7.53 (m, 9H), 6.65 (d, 1H, *J*=7.6Hz), 5.60 (d, 1H, *J*=5.4Hz,), 3.17 (q, 1H), 2.87 (dd, 1H, J_1=3.8, J_2=5.6Hz), 2.71 (m, 2H), 2.62 (m, 2H), 1.55-1.60 (m, 4H), 1.42 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.21, 140.90, 134.51, 128.55, 128.29, 127.53, 127.46, 126.23, 126.10, 125.84, 125.13, 122.29, 120.12, 107.14, 78.85, 66.61, 54.87, 26.18, 24.13ppm. ESIMS $[M+H]^+$m/z 332.20.

4-[2-(Naphthalen-1-yloxy)-2-pyridin-3-yl-ethyl]-morpholine (16.10):
Yield 3.0 gm (65%). White solid; mp 92.3-94.6°C. IR (In KBr) 3053, 3030, 2965, 2945, 2916, 2904, 2821, 2808, 1594, 1573, 1397, 1097, 798 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.74 (d, 1H, *J*=1.8Hz), 8.54-8.52 (m, 2H), 7.79-7.73 (m, 2H), 7.54-7.51 (m, 2H), 7.39 (d, 1H, *J*=8.2Hz), 7.23-7.21 (m, 2H), 6.63 (d, 1H, *J*=7.6Hz), 5.55 (m, 1H), 3.68 (t, 4H, *J*=4.6Hz), 3.16-3.14 (m, 1H), 2.87 (q, 1H), 2.73-2.71 (m, 2H), 2.63-2.59 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 152.61, 149.23, 148.03, 135.85, 134.52, 133.49, 127.54, 126.43, 125.85, 125.54, 125.39, 123.50, 121.83, 120.81, 107.02, 76.69, 66.65, 65.32, 54.13ppm. ESIMS $[M+H]^+$m/z 335.3.

[3-Furan-2-yl-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (18.1):
Yield 4.8 gm (55%). Brown liquid. IR (In Neat): 2942, 2767, 1832, 1264, 790cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.35 (t, 1H, *J*=3.0Hz), 7.08 (t, 1H, *J*=3.0Hz), 7.51 (q, 2H), 7.45-7.43 (m, 2H), 7.36 (d, 1H, *J*=7.8Hz), 6.96 (d, 1H, *J*=7.5Hz), 6.34-6.32 (m, 2H), 5.56 (t, 1H, *J*=7.0Hz), 2.54-2.51(m, 2H), 2.49-2.44 (m, 1H), 2.33-2.30 (m, 1H), 2.30 (s, 6H), ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.63, 142.03, 134.51, 127.40, 126.22, 126.14, 125.70, 125.13, 122.09, 120.63, 110.18, 107.59, 107.13, 72.25, 55.54, 45.42, 32.83ppm. ESIMS $[M+H]^+$m/z 296.4.

Dimethyl-[3-(naphthalen-1-yloxy)-3-thiophen-2-yl-propyl]-amine (18.2):
Yield 2.0 gm (58%). Yellow liquid. IR (In Neat): 3042, 3029, 2972, 2941, 2902, 2831, 2816, 1543, 1243, 702 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.39 (t, 1H, *J*=4.00Hz), 7.79 (s, 1H), 7.52-7.49 (m, 2H), 7.42 (d, 1H, *J*=8.0Hz), 7.30 (d, 1H, *J*=8.0Hz), 7.28 (d, 1H, *J*=4.0Hz), 7.09 (d, 1H, *J*=3.1Hz), 6.95 (d, 1H, *J*=4.7Hz), 6.90 (d, 1H, *J*= 7.6Hz), 5.79 (t, 1H, *J*=6.0Hz), 2.52 (t, 2H, *J*= 6.0Hz), 2.48-2.44 (m, 1H), 2.27 (s, 6H), 2.25-2.20 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.39, 145.25, 134.49, 127.38, 126.44, 126.20, 126.07, 125.67, 125.11, 124.60, 124.53, 122.11, 120.45, 106.94, 74.59, 55.70, 45.55, 37.01ppm. ESIMS $[M+H]^+$m/z 312.4.

[3-Cyclopropyl-3-(naphthalen-1-yloxy)-propyl]-dimethyl-amine (18.3):
Yield 6.1 gm (65%). Yellow liquid. IR (In Neat): 2950, 1572, 1265, 482 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.35 (t, 1H, *J*=4.4Hz), 7.81 (t, 1H, *J*=4.3Hz), 7.50 (m, 2H), 7.43 (m, 2H), 6.92 (d,1H, *J*=7.4Hz), 4.19 (d, 1H, *J*=5.9Hz), 2.54 (m, 2H), 2.24 (s, 6H), 2.06 (m, 2H), 1.29 (m, 2H), 0.56 (m, 2H), 0.44 (m, 1H), 0.42 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) = δ 154.57, 134.70, 127.43, 126.60, 126.19, 125.87, 124.97, 122.35, 120.11, 107.27, 79.86, 55.78, 45.47, 45.33, 33.16, 15.42, 2.96, 2.21ppm. ESIMS $[M+H]^+$m/z 270.40.

Typical procedure for Phenols preparation.

Method A:-

To a solution of ether compound (1.0 mole) in dichloromethane (10 Vol) aluminum chloride (1.2 mole) was added at 20-25°C. The reaction mixture was stirred for 1 hour at 20-25°C. (Reaction was monitored by TLC). At the end of this period, the reaction mass was poured into ice water (10 Vol) and basified (pH 9-10) with aqueous ammonium hydroxide solution and again stirred for 30 minutes. The layers were separated and the aqueous layer was extracted with dichloromethane (2 X 10 Vol). The combined organic layers was washed with water (2 X 10 Vol) and dried over anhydrous sodium sulphate. The solution was concentrated at 30-35°C to get phenol compound. This was purified by column chromatography to yield the pure phenol**.**

Method B:-

To a solution of Ether (1.0 mole) in dichloromethane (10 Vol) perchloric acid (1.2 mole) was added at 20-25°C. The reaction mixture was stirred for 1 hour at 20-25°C. (Reaction was monitored by TLC). At the end of this period, the reaction mass was poured into ice water (10 Vol) and basified (pH 9-10) with aqueous ammonium hydroxide solution and again stirred for 30 minutes. The layers were separated and the aqueous layer was extracted with dichloromethane (2 X 10 Vol). The combined organic layers was washed with water (2 X 10 Vol) and dried over anhydrous sodium sulphate. The solution was concentrated at 30-35°C to get phenol compound. This was purified by column chromatography to yield the pure phenol**.**

Method C:-

To a solution of Ether (1.0 mole) in ethyl acetate (10 Vol) Con. HCl (1.2 mole) was added at 20-25°C. The reaction mixture was stirred for 1 hour at 40°C. (Reaction was monitored by TLC). At the end of this period, the reaction mass was poured into ice water (10 Vol) and basified (pH 9-10) with aqueous ammonium hydroxide solution and again stirred for 30 minutes. The layers were separated and the aqueous layer was extracted with ethylacetate (2 X 10 Vol). The combined organic layers was washed with water (2 X 10 Vol) and dried over anhydrous sodium sulphate. The solution was concentrated at 30-35°C to get phenol compound. This was purified by column chromatography to yield the pure phenol**.**

4-(1-(4-chlorophenyl)-3-(dimethylamino)propyl)naphthalen-1-ol (9.1):

Yield 300 mg (30%). White solid; mp 129.5-130.6°C. IR (in KBr): 3433, 3050, 2862, 2827, 1491 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 12.40 (s, 1H), 8.44 (d, 1H, *J*=8.1Hz), 7.72 (d, 1H, *J*=7.8Hz), 7.51-7.43 (m, 2H), 7.31-7.22 (m, 5H), 6.78 (d, 1H, *J*=8.5Hz), 4.71 (t, 1H, *J*=7.5Hz), 2.48-2.42 (m, 2H), 2.39 (s, 6H), 2.26 (d, 1H, *J*=8.8Hz), 2.09 (t, 1H, *J*=11.32Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 151.66, 143.14, 133.29, 131.87, 129.63, 128.28, 127.12, 126.50, 126.21, 125.66, 124.81, 123.23, 123.04, 119.51, 55.03, 44.05, 37.73, 30.97. ESIMS $[M+H]^+$m/z 340.1.

4-(3-(dimethylamino)-1-(4-methoxyphenyl)propyl)naphthalen-1-ol (9.2):

Yield 250 mg (25%). White solid; mp 146.3-146.9°C. IR (in KBr): 3442, 3042, 2943, 2500, 1583, 944 cm^{-1}. ^1HNMR ($CDCl_3$, 400MHz) δ = 12.05 (s, 1H), 8.42 (d, 1H, *J*=8.1Hz), 7.70 (d, 1H, *J*=7.6Hz), 7.47-7.42 (m, 2H), 7.26-7.20 (m, 3H), 6.88-6.81 (m, 3H), 4.70 (t, 1H, *J*=7.5Hz), 3.80 (s, 3H), 2.49-2.43 (m, 2H), 2.40 (s, 6H), 2.26-2.24 (m, 1H), 2.11 (t, 1H, *J*=3.4Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 157.87, 151.51, 136.78, 133.22, 129.21, 127.13, 126.53, 125.48,

124.67, 124.09, 123.05, 119.34, 113.57, 55.18, 44.05, 37.45, 31.34ppm. ESIMS $[M+H]^+$m/z 336.5.

4-(3-(dimethylamino)-1-(2-methoxyphenyl)propyl)naphthalen-1-ol (9.3):
Yield 500 mg (50%). White solid; mp 143.3-143.8°C. IR (in KBr): 3428, 3050, 2951, 1735, 474 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 12.00 (s, 1H), 8.44 (d, 1H, *J*=8.1Hz), 7.69 (d, 1H, *J*=7.8Hz), 7.56 (d, 1H, *J*=7.3Hz), 7.41 (m, 2H), 7.26 (d, 1H, *J*=3.9Hz), 7.18 (d, 1H, *J*=8.5Hz), 7.06 (s, 1H), 6.90 (d, 1H, *J*=8.5Hz), 6.88 (d, 1H, *J*=8.0Hz), 4.95 (t, 1H, *J*=6.5Hz), 3.54 (s, 3H), 2.46-2.41 (m, 2H), 2.23 (s, 6H), 2.23-2.14 (m 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 127.36, 127.10, 127.00, 125.69, 125.12, 124.29, 123.09, 120.00, 118.76, 111.23, 55.61, 55.11, 44.13, 32.07, 31.42ppm. ESIMS $[M+H]^+$m/z 336.5.

4-(3-(dimethylamino)-1-(2,4-dimethoxyphenyl)propyl)naphthalen-1-ol (9.4):
Yield 250 mg (25%). White solid; mp 129.4-131.8°C. IR (in KBr): 3411, 2950, 1734, 1503, 765 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 9.98 (s, 1H), 8.12 (d, 1H, *J*=7.7Hz), 7.94 (d, 1H, *J*=8.1Hz), 7.41-7.31 (m, 3H), 6.87 (t, 2H, *J*=6.4Hz), 6.54 (s, 1H), 6.36 (d, 1H, *J*=7.5Hz), 4.95 (t, 1H, *J*=6.7Hz), 3.83 (s, 3H), 3.67 (s, 3H), 2.49-2.42 (m, 2H), 2.32 (s, 6H), 2.15-2.13 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 159.01, 157.30, 152.03, 132.91, 130.37, 128.57, 126.35, 125.72, 125.34, 124.64, 124.38, 123.61, 122.82, 107.73, 105.27, 98.67, 57.27, 56.04, 55.38, 44.34, 34.62, 32.20, 21.49ppm. ESIMS $[M+H]^+$m/z 366.5.

4-(3-(dimethylamino)-1-(3-methoxyphenyl)propyl)naphthalen-1-ol (9.5):
Yield 350 mg (350%). White solid; mp 143.3-1449°C. IR (in KBr): 3058, 2998, 2830, 1598, 1039, 462 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 12.0 (s, 1H), 8.45 (d, 1H, *J*=8.1Hz), 7.72 (d, 1H, *J*=7.8Hz), 7.49-7.44 (m, 2H), 7.26 (q, 2H), 6.96 (d, 1H, *J*=7.6Hz), 6.89 (d, 2H, *J*=8.6Hz), 6.81 (d, 1H, *J*=8.1Hz), 4.74 (dd, 1H, J_1=1.86, J_2=3.08Hz), 3.78 (s, 3H), 2.50-2.46 (m, 2H), 2.36 (s, 6H), 2.27 (m, 1H), 2.12 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 159.51, 151.52, 146.27, 133.28, 129.08, 127.11, 126.50, 126.40, 125.50, 124.67, 123.65, 123.03, 120.75, 119.43, 114.33, 111.40, 55.12, 44.07, 38.33, 31.00ppm. ESIMS $[M+H]^+$m/z 336.5.

4-(3-(dimethylamino)-1-(3,4-dimethoxyphenyl)propyl)naphthalen-1-ol (9.6):
Yield 200 mg (20%). White solid; mp 131.8 -133.6°C. IR (in KBr): 3411, 3052, 2489, 1514, 1447, 1271, 946 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 12.03 (s, 1H), 8.42 (d, 1H, *J*=8.0Hz), 7.71 (d, 1H, *J*=8.0Hz), 7.47-7.40 (m, 2H), 7.23 (d, 1H, *J*=8.5Hz), 6.96 (d, 1H, *J*=1.3Hz), 6.87-6.83 (m, 2H), 6.72 (s, 1H), 4.67 (d, 1H, *J*=12.6Hz), 3.88 (s, 3H), 3.76 (s, 3H), 2.45-2.41 (m, 2H), 2.35 (s, 6H), 2.25(m, 1H), 2.08 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 151.53, 148.89, 147.54, 137.43, 133.37, 127.20, 126.62, 126.49, 125.54, 124.74, 124.03, 123.10, 119.48, 119.33, 112.63, 110.76, 55.90, 55.26, 44.16, 42.68, 37.94, 31.50ppm. ESIMS $[M+H]^+$m/z 366.5.

4-(1-(3-bromophenyl)-3-(dimethylamino)propyl)naphthalen-1-ol (9.7):
Yield 150 mg (15%). Brown solid; mp 186.5 – 187.8°C. IR (in KBr): 3208, 2964, 2474, 1573, 1076, 674 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 10.79 (br, 1H), 9.95 (br, 1H), 8.24 (d, 1H, *J*=8.0Hz), 7.78 (s, 1H), 7.57 (s, 1H), 7.40 (m, 6H), 7.27 (t, 1H, *J*=6.0Hz), 4.76 (d, 1H, *J*=8.0Hz), 2.98-2.96 (m, 2H), 2.70 (s, 6H), 2.55-2.49 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 149.74, 147.39, 133.53, 131.06, 129.58, 128.85, 127.97, 127.19, 126.25, 125.92, 125.70, 125.53, 124.39, 122.75, 122.21, 120.59, 55.90, 42.37, 28.54ppm. ESIMS $[M+H]^+$m/z 386.4.

4-(1-(3,4-dichlorophenyl)-3-(dimethylamino)propyl)naphthalen-1-ol (9.8):
Yield 350 mg (35%). White solid; mp 148.2-149.6°C. IR (in KBr): 3455, 29425, 1625, 785 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 12.40 (br, 1H), 8.41(d, 1H, *J*=8.0Hz), 7.72 (d, 1H, *J*=7.6Hz), 7.50-7.43 (m, 3H), 7.35 (d, 1H, *J*=8.3Hz), 7.24 (d, 1H, *J*=8.5Hz), 7.12 (d, 1H, *J*=8.2Hz), 6.74 (d, 1H, *J*=8.5Hz), 4.69 (d, 1H, *J*=12.17Hz), 2.47-2.42 (m,2H), 2.35 (s, 6H), 2.30-2.25 (m, 1H), 2.09-2.04 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 151.67, 144.93, 133.38, 132.20, 130.04, 129.92, 128.02, 127.11, 126.51, 125.88, 125.78, 124.90, 123.02, 122.50, 119.73, 54.95, 44.01, 37.70, 30.83ppm. ESIMS $[M+H]^+$m/z 376.4.

4-(1-(4-bromophenyl)-3-(dimethylamino)propyl)naphthalen-1-ol (9.9):
Yield 300 mg (30%). White solid; mp 134.4-136.7 °C. IR (in KBr): 3428, 3050, 1893, 1597, 946 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 12.0 (s, 1H), 8.43 (d, 1H, *J*=8.0Hz), 7.72 (d, 1H, *J*=7.7Hz), 7.50-7.43 (m, 4H), 7.24-7.19 (m, 3H), 6.77 (d, 1H, *J*=8.5Hz), 4.71 (d, 1H, *J*=12.0Hz), 2.48-2.40 (m, 2H), 2.36 (s, 6H), 2.31-2.27 (m, 1H), 2.13-2.07 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 151.60, 143.60, 133.31, 130.02, 127.12, 126.49, 126.15, 125.67, 124.82, 123.11, 123.09, 119.99, 119.55, 55.04, 44.00, 37.88, 30.86ppm. ESIMS $[M+H]^+$m/z 386.2.

4-(3-Dimethylamino-1-thiophen-2-yl-propyl)-3-methyl-phenol (11):
Yield 6.0 gm (60%). White solid; mp 226.6-229.8°C. IR (In KBr): 3420, 2935, 2665, 1643, 1464, 968, 708 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 10.81 (s, 1H), 9.25 (s, 1H), 7.21 (d, 1H, *J*=4.7Hz), 7.0 (d, 1H, *J*=8.3 Hz), 6.86-6.82 (m, 2H), 6.54-6.49 (m, 2H), 4.27 (t, 1H, *J*=7.5Hz), 2.87 (br, 1H), 2.78 (br, 1H), 2.60 (s, 6H), 2.32 (br, 2H), 2.11 (s, 3H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ= 156.18, 148.65, 137.02, 131.73, 127.48, 127.06, 124.54, 124.43, 117.53, 113.61, 55.64, 42.33, 38.65, 30.96, 19.73pp. ESIMS $[M+H]^+$m/z 276.40.

4-(3-(dimethylamino)-1-phenylpropyl)-2,5-dimethoxyphenol (13.1):
Yield 450 mg (45%). White solid; mp 138.3-139.5^{0}C. IR (In KBr): 2830, 2477, 1587, 1466, 1197, 1041, 787 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ =7.26 (d, 4H, *J*=4.0Hz), 7.17 (q, 1H), 6.72 (s, 1H), 6.50 (s, 1H), 4.35 (t, 1H, *J* = 7.3 Hz), 3.77 (s, 3H), 3.69 (s, 3H), 2.27-2.22 (m, 7H), 2.19 (s, 3H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 151.43, 144.98, 144.75, 140.67, 128.09, 127.77, 125.70, 123.67, 111.03, 99.94, 58.15, 56.45, 56.01, 45.31, 40.90, 32.69ppm. Anal. Calcd for $C_{19}H_{25}NO_3$ (315.40): C, 72.35; H, 7.99; N, 4.44. Found: C, 71.9882; H, 8.2287; N, 4.9499. ESIMS $[M+H]^+$m/z 316.3.

4-(3-(dimethylamino)-1-phenylpropyl)-3-methylphenol (13.2):
Yield 600 mg (60%). White solid; mp 113.2-115.5 °C. IR (in KBr): 3430, 2957, 1450, 1223, 805 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 11.25 (s, 1H), 7.38-7.326 (m, 5H), 6.87 (s, 1H), 6.69-6.63 (m, 2H), 4.53 (m, 1H), 2.53-2.48 (m, 2H), 2.36 (s, 6H), 2.32 (s, 3H), 2.29-2.25 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 156.05, 145.17, 136.96, 128.73, 128.55, 128.02, 127.38, 126.11, 121.10, 118.45, 116.30, 55.32, 44.18, 38.28, 31.89, 21.06ppm. ESIMS $[M+H]^+$m/z 270.3.

2-(3-(dimethylamino)-1-(2-methoxyphenyl)propyl)-4-methylphenol (13.3):
Yield 600 mg (60%). White solid; mp 106.1-109.6°C. IR (in KBr): 3026, 2836, 1025, 748 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.49 (d, 1H, *J*=7.4Hz), 7.26 (t, 1H, *J*=8.5Hz), 7.05 (t, 1H, *J*=7.4Hz), 6.83 (t, 3H, *J*=3.3Hz), 6.53 (s, 1H), 4.71 (t, 1H, J_1=7.63Hz), 3.63 (s, 3H), 2.26 (s, 6H), 2.24-2.19 (m, 3H), 2.17-2.09 (m, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 157.03, 153.90,

133.23, 130.28, 128.61, 128.00, 127.50, 127.24, 127.12, 120.15, 117.11, 110.98, 55.65, 55.35, 44.10, 31.79, 31.75, 20.64ppm. ESIMS $[M+H]^+$m/z 300.3.

4-(3-(dimethylamino)-1-(2-methoxyphenyl)propyl)-3-methylphenol (13.4):
Yield 650 mg (65%). White solid; mp 129.1-130.2°C. IR (in KBr): 3422, 2949, 1492, 1027, 448 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 11.0 (s, 1H), 7.48 (t, 1H, *J*=3.7Hz), 7.24 (d, 1H, *J*=1.5Hz), 7.03 (d, 1H, *J*=1.0Hz), 6.84 (dd, 1H, J_1=0.9, J_2=0.9Hz), 6.75 (d, 1H, *J*=1.2Hz), 6.67 (d, 1H, *J*=7.7Hz), 6.52 (d, 1H, *J*=1.2Hz), 4.70 (dd, 1H, J_1=3.3Hz, J_2=3.2Hz), 3.65 (s, 3H), 2.53-2.50 (m, 1H), 2.33 (s, 6H), 2.25 (m, 4H), 2.23-2.22 (m, 1H), 2.10-2.09 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 157.05, 156.28, 136.57, 133.57, 127.45, 127.20, 127.06, 120.49, 120.00, 117.97, 111.03, 55.67, 55.25, 44.22, 31.96, 31.44, 20.96ppm. ESIMS $[M+H]^+$m/z 300.3.

2-(3-(dimethylamino)-1-phenylpropyl)-4-methylphenol (13.5):
Yield 600 gm (60%). White solid; mp 134.6-138.9°C. IR (in KBr): 3430, 2957, 1450, 1039 cm^{-1}.^1H NMR ($CDCl_3$, 400MHz) δ = 11.0 (s, 1H), 7.36-7.22 (m, 5H), 6.86 (s, 2H), 6.50 (s, 1H), 4.51(dd, 1H, J_1=3.0, J_2=2.1Hz), 2.45-2.40 (m, 2H), 2.31 (s, 6H), 2.28-2.23 (m, 1H), 2.11 (s, 3H), 2.05-2.04 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.83, 144.75, 130.99, 129.09, 128.28, 128.16, 127.80, 126.04, 117.67, 55.23, 44.11, 37.97, 31.80, 20.59ppm. ESIMS $[M+H]^+$m/z 270.4.

4-methyl-2-(3-morpholino-1-phenylpropyl)phenol (15.1):
Yield 3.0 gm (60%). White solid; mp 105-109°C. IR (In KBr): 3420, 2966, 2917, 2857, 1602, 1488, 1452, 1265, 1118, 868, 831, 790, 705 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 10.4 (br, 1H), 7.23-7.34 (m, 5H), 6.86-6.82 (m, 2H), 6.49 (s, 1H), 4.44 (t, 1H, *J*=7.7Hz), 3.86-3.82 (m, 4H), 2.66 (br, 2H), 2.37-2.46 (m, 4H), 2.10 (s, 3H), 2.01-1.98 (m, 1H), 1.55 (br, 3H)ppm.^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.41, 144.42, 130.65, 129.48, 129.12, 128.19, 127.94, 126.13, 117.35, 66.25, 54.46, 38.02, 30.38, 20.54. ESIMS $[M+H]^+$m/z 312.3.

4-methyl-2-(1-phenyl-3-(piperidin-1-yl) propyl) phenol (15.2):
Yield 1.0 gm (50%). White solid; mp 129.1-130.5 °C. IR (In KBr): 3420, 2999, 2929, 2835, 2815, 2767, 2606, 1601, 1495, 1469, 1455, 1271, 1252, 1119, 816, 756, 704 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 11.32 (br, 1H), 7.22-7.31 (m, 5H), 6.84 (s, 2H), 6.47 (s, 1H), 4.46 (d, 1H, *J*=12.7Hz), 2.3-2.6 (m, 6H), 2.14 (s, 3H), 2.05 (br, 2H), 1.75 (br, 4H), 1.5 (br, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.96, 144.9, 131.08, 129.11, 129.0, 128.28, 128.11, 127.76, 125.9, 117.59, 54.39, 38.05, 30.9, 25.08, 24.10, 20.56ppm. ESIMS $[M+H]^+$m/z 310.2.

4-methyl-2-(1-phenyl-3-(pyrrolidin-1-yl) propyl) phenol (15.3):
Yield 1.1gm (55%). Brown liquid. IR (In Neat): 3430, 3017, 2971, 2882, 2862, 2401, 1632, 1493, 1448, 1243, 1216, 1047, 765, 703, 667 cm^{-1}. ^1H NMR ($CDCl_3$, 400MHz) δ = 7.17-7.32 (m, 5H), 6.85 (s, 2H), 6.48 (s, 1H), 4.51-4.56 (dd, 1H, J_1=3.5, J_2=3.3Hz), 2.99 (br, 3H), 2.68 (br, 2H), 2.3-2.54 (m, 3H), 2.1 (s, 3H), 1.93-1.88 (m, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 154.02, 144.84, 131.06, 131.72, 129.16, 128.72, 128.50, 128.30, 128.13, 127.78, 125.99, 117.56, 52.97, 52.05, 38.47, 32.92, 23.12, 20.57. ESIMS $[M+H]^+$m/z 296.3.

2-(3-(diethyl amino)-1-phenylpropyl)-4-methylphenol (15.4):
Yield 450 mg (45%). Yellow liquid. IR (In Neat): 3430, 3025, 2972, 2937, 2605, 1947, 1631, 1492, 1452, 1379, 1265, 1248, 1147, 817, 786, 703 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 11.3 (br, 1H), 7.21-7.33-7.21 (m, 5H), 6.84 (s, 2H), 6.49 (s, 1H), 4.45-4.49 (t, 1H, *J*=7.5Hz), 2.77-2.82 (m, 2H), 2.42-2.53 (m, 5H), 2.1 (s, 3H), 2.0 (m, 1H), 1.08 (t, 6H, *J*=7.19Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.77, 144.88, 131.52, 129.27, 129.08, 128.96, 128.52, 128.32, 128.17, 127.78, 126.02, 117.94, 48.90, 44.56, 38.50, 31.60, 20.96, 20.63, 9.31ppm. ESIMS $[M+H]^+$m/z 298.2.

2-(3-(diisopropyl amino)-1-phenylpropyl)-4-methylphenol (15.5):
Yield 3.0 gm (60%). White solid; mp 72.3-73.5°C. IR (In KBr): 3422, 3058, 3023, 2974, 2936, 2831, 1699, 1607, 1509, 1491, 1365, 1263, 1223, 1163, 1136, 810, 740, 698 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 10.1 (br, 1H), 7.33 (d, 4H, *J*=4.30Hz), 7.24-7.21 (m,1H), 6.86-6.79 (m, 2H), 6.56 (s, 1H), 4.49 (dd, 1H, J_1=10.9, J_2=3.9Hz), 3.25 (t, 2H, *J*=6.3Hz), 2.76-2.73 (m, 1H), 2.33-2.41 (m, 2H), 2.12 (m, 4H), 1.15 (d, 6H, *J*=6.5Hz), 1.10 (d, 6H, *J*=6.3Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.12, 144.69, 132.3, 129.25, 128.56, 128.43, 128.19, 127.65, 126.04, 118.05, 47.87, 42.04, 39.27, 33.21, 20.69, 19.88, 19.46ppm. ESIMS $[M+H]^+$m/z 326.40.

2-(2-Diisopropylamino-1-phenyl-ethyl)-4-methyl-phenol (17.1):
Yield 2.5 gm (62.5%). Yellow liquid. IR (In Neat): 3424, 3025, 2936, 2859, 2818, 1602, 1487, 1265, 1110, 1039, 820, 780, 704 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 12.75 (br, 1H), 7.25-7.41 (m, 5H), 6.84 (d, 1H, *J*=7.7 Hz), 6.78 (d, 1H, *J*=7.9Hz), 6.27 (s, 1H), 4.56 (d, 1H, *J*=10.9Hz), 3.16-3.24 (m, 3H), 3.04 (d, 1H, *J*=12.2Hz), 2.06 s, 3H), 1.06-1.11 (q, 12H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 154.50, 142.19, 131.83, 128.82, 128.45, 127.94, 126.57, 117.57, 53.39, 49.46, 45.74, 22.59, 20.69, 18.59ppm. ESIMS $[M+H]^+$m/z 312.4.

4-Methyl-2-(1-phenyl-2-piperidin-1-yl-ethyl)-phenol (17.2):
Yield 2.45 gm (61%). White solid; mp 141.1-144.7 °C. IR (In KBr): 3421, 3028, 2931, 2856, 2810, 1761, 1485, 1462, 1254, 1118, 1031, 825, 701 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 13.5 (br, 1H), 7.24-7.39 (m, 3H), 7.2 (d, 2H, *J*=7.1Hz), 6.87 (q, 2H), 6.26 (s, 1H), 4.45 (d, 1H, *J*=9.9Hz), 3.11-3.16 (m, 1H), 2.94-2.97 (m, 1H), 2.81(br, 1H), 2.42 (br, 2H), 2.07 (s, 3H), 1.49-1.72 (m, 4H), 1.26 (br, 2H)ppm. ^{13}C NMR ($CDCl_3$, 400MHz) δ = 154.68, 142.26, 131.10, 129.36, 128.72, 128.55, 128.23, 127.67, 126.60, 117.82, 66.04, 54.97, 44.96, 25.36, 23.57, 20.56ppm. ESIMS $[M+H]^+$m/z 296.4.

4-Methyl-2-(2-morpholin-4-yl-1-phenyl-ethyl)-phenol (17.3):
Yield 2.6 gm (60%). White solid; mp 137.4-138°C. IR (In KBr):3423, 2962, 2937, 2854, 1605, 1481, 1453, 1262, 1116cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 12.3 (br, 1H), 7.20-7.39 (m, 5H), 6.89 (d, 1H, *J*=8.0Hz), 6.84 (d, 1H, *J*=8.0Hz), 6.33 (s, 1H), 4.4 (d, 1H, *J*=9.3Hz), 3.78-3.80 (m, 4H), 3.16-3.19 (m, 1H), 3.02-3.06 (m, 1H), 2.84 (br, 2H), 2.47-2.50 (m, 2H), 2.47 (s, 3H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 154.0, 141.82, 130.55, 129.65, 128.63, 128.47, 128.25, 126.7, 117.8, 66.38, 65.83, 53.97, 45.09, 20.52ppm. ESIMS $[M+H]^+$m/z 298.2.

4-Methyl-2-(1-phenyl-2-pyrrolidin-1-yl-ethyl)-phenol (17.4):
Yield 2.45 gm (45%). Yellow liquid. IR (In Neat): 3436, 3004, 2968, 2879, 2836, 2571, 1601, 1489, 1452, 1262, 1217, 1121, 1020, 819, 757, 702 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 7.36

(t, 2H, *J*=7.3 Hz), 7.28 (t, 1H, *J*=6.3Hz), 7.23 (d, 2H, *J*=7.3Hz), 6.91 (d, 1H, *J*=1.1 Hz), 6.86 (d, 1H, *J*=8.0Hz), 6.40 (s, 1H), 4.39 (d, 1H, *J*=8.4Hz), 3.42 (q, 1H), 3.18 (dd, 1H, J_1=1.3, J_2=1.3Hz), 2.80 (d, 2H, *J*=5.9Hz), 2.54 (t, 2H, *J*=4.6 Hz), 2.11 (s, 3H), 1.83 (4H, br)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ 154.97, 142.14, 130.32, 129.91, 129.83, 128.95, 128.59, 128.52, 127.55, 126.53, 117.98, 115.1, 62.80, 54.28, 47.88, 23.41, 20.45ppm. ESIMS $[M+H]^+$m/z 282.20.

2-(2-Diethylamino-1-phenyl-ethyl)-4-methyl-phenol (17.5):
Yield 2.55 gm (63%). Yellow liquid. IR (In Neat): 3314, 2956, 2925, 2855, 2596, 1742, 1491, 1465, 1454, 1378, 1261, 757, 702 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 13.2 (br, 1H), 7.22-7.38 (m, 5H), 6.86-6.81 (m, 2H), 6.27 (s, 1H), 4.49 (m, 1H), 3.23 (q, 1H), 3.02 (q, 1H), 2.82-2.79 (m, 2H), 2.57-2.51 (m, 2H), 2.07 (s, 3H), 1.09 (t, 6H, *J*=7.1Hz)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 154.55, 142.18, 131.32, 129.15, 128.73, 128.52, 128.16, 127.74, 126.6, 117.72, 61.63, 47.43, 45.49, 20.60, 10.76ppm. ESIMS $[M+H]^+$m/z 284.20.

4-(2-Morpholin-4-yl-1-phenyl-ethyl)-naphthalen-1-ol (17.6):
Yield 670 mg (67%). White solid; mp 172.8-174.9 °C. IR (In KBr): 3421, 3043, 2954, 2863, 2374, 1624, 1552, 1465, 1452, 1361, 1344, 1321, 1121, 1036, 862, 826, 804, 763, 741, 700 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ 13.23 (br, 1H), 8.43 (d, 1H, *J*=8.0Hz), 7.69 (t, 1H, *J*=3.6Hz), 7.24-7.47 (m, 7H), 7.15 (d, 1H, *J*=8.1Hz), 6.70 (d, 1H, *J*=8.1Hz), 4.65 (t, 1H, *J*=4.2Hz), 3.85 (t, 4H, *J*=4.2Hz), 3.29-3.26 (m, 1H), 3.15 (t, 1H, *J*=6.3Hz), 2.7 (br, 2H), 2.5 (t, 2H, *J*=5.6Hz), ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 152.30, 142.10, 133.51, 128.70, 127.40, 126.98, 126.79, 126.46, 125.86, 124.73, 123.05, 122.98, 118.35, 66.44, 65.70, 53.97, 45.56ppm. ESIMS $[M+H]^+$m/z 334.30.

4-(2-Diethylamino-1-phenyl-ethyl)-naphthalen-1-ol (17.7):
Yield 6.5 gm (65%). White solid; mp 83.2-87.8°C. IR (In KBr): 3426, 3053, 2934, 2853, 1572, 1495, 1451, 1329, 1039, 801, 773, 703 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ 14.3 (br, 1H), 8.39 (d, 1H, *J*=7.7Hz), 7.68 (t, 1H, *J*=4.Hz), 7.27-7.44 (m, 7H), 7.11 (d, 1H, *J*=8.5Hz), 6.65 (d, 1H, *J*=8.5Hz), 4.72 (d, 1H, *J*=10.5Hz), 3.34 (s, 1H), 3.11 (d, 1H, *J*=12.7Hz), 2.86 (q, 2H), 2.61 (q, 2H), 1.12 (br, 6H,)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ 152.96, 142.42, 133.46, 128.79, 128.61, 126.90, 126.67, 125.60, 124.43, 123.84, 123.08, 117.81, 61.41, 47.88, 47.55, 45.84, 10.72ppm. Mass (m/z): 320.40 (M^++H).ESIMS $[M+H]^+$m/z 282.20.

4-(1-Phenyl-2-pyrrolidin-1-yl-ethyl)-naphthalen-1-ol (17.8):
Yield 1.0 gm (50%). White solid; mp 122.2-124.5°C. IR (In KBr): 3431, 3023, 2944, 2873, 2324, 1654, 1532, 1425, 1453, 1321, 1314, 1171, 1026, 860, 802, 731, 700 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 14.7 (br, 1H), 8.43 (d, 1H, *J*=7.5Hz), 7.7 (d, 1H, *J*=1.6Hz), 7.47-7.44 (m, 2H), 7.36-7.34 (m, 2H), 7.28-2.25 (m, 3H), 7.15 (d, 1H, *J*=8.5Hz), 6.78 (d, 1H, *J*=8.5Hz), 4.60 (t, 1H, *J*=4.3Hz), 3.48 (t, 1H, *J*=6.2Hz), 3.28 (t, 1H, *J*=6.2Hz), 2.85 (br, 2H), 2.63 (br, 2H), 1.89 (br, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ = 153.44, 142.43, 133.66, 128.68, 128.57, 128.47, 126.92, 126.80, 126.55, 125.71, 124.46, 123.19, 122.07, 117.57, 62.80, 54.26, 48.54, 23.52ppm. ESIMS $[M+H]^+$m/z 318.40.

4-(1-Phenyl-2-piperidin-1-yl-ethyl)-naphthalen-1-ol (17.9):
Yield 630 mg (63%). White solid; mp 167.2-168.8 °C. IR (In KBr): 3421, 3058, 2931, 2856, 2393, 1607, 1578, 1492, 1453, 1327, 863, 854, 811, 778, 741, 699 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ 14.23 (br, 1H), 8.43 (d, 1H, *J*=7.9Hz), 7.67 (t, 1H, *J*=4.2Hz), 7.24-7.43 (m, 7H), 7.10 (d, 1H, *J*=8.5Hz), 6.65 (d, 1H, *J*=8.5Hz), 4.70 (d, 1H, *J*=9.2 Hz), 3.23 (t, 1H, *J*=6.2Hz), 3.06 (dd, 1H, J_1=1.8, J_2=3.45Hz), 2.45 (br, 2H), 1.76 (br, 4H), 1.54 (br, 4H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ= 153.03, 142.56, 133.43, 128.77, 128.60, 127.18, 126.89, 126.62, 125.62, 124.43, 123.60, 123.14, 117.69, 65.97, 55.40, 45.40, 25.40, 23.60ppm. ESIMS $[M+H]^+$m/z 332.30.

4-(2-Morpholin-4-yl-1-pyridin-3-yl-ethyl)-naphthalen-1-ol (17.10):
Yield 100 mg (10%). Brown liquid. IR (In Neat): 3421, 3160, 2942, 2832, 1648, 1532, 1361, 1240, 772, 703 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.57 (s, 1H), 8.41 (d, 1H, *J*= 7.9Hz), 7.71 (d, 1H, *J*= 7.2Hz), 7.58 (d, 1H, *J*=7.7Hz), 7.47 (t, 2H, *J*= 7.2Hz), 7.34 (t, 1H, *J*=6.0Hz), 7.18 (d, 1H, *J*=8.5Hz), 6.64 (d, 1H, *J*=8.5Hz), 4.70 (d, 1H, *J*=9.5Hz), 3.84 (s, 4H), 3.32 (t, 1H, *J*= 11.2 Hz), 3.12 (d, 1H, *J*=12.7Hz), 2.88 (br, 2H), 2.25 (br, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ= 152.39, 149.59, 148.02, 137.75, 136.52, 133.63, 127.01, 126.91, 126.52, 126.14, 124.97, 123.70, 122.97, 121.61, 118.74, 66.35, 65.20, 54.00, 43.54ppm. ESIMS $[M+H]^+$m/z 335.4.

4-(3-Dimethylamino-1-furan-2-yl-propyl)-naphthalen-1-ol (19.1):
Yield 2.5 gm (50%). White solid; mp 131.2-135.6°C. IR (in KBr): 3428, 3113, 2939, 1594, 1460, 463 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) δ = 8.40 (d, 1H, *J*=7.2Hz), 7.73 (d, 1H, *J*=6.8Hz), 7.52-7.26 (m, 5H), 6.97 (d, 1H, *J*=8.3Hz), 6.36-6.26 (m, 2H), 4.79 (d, 1H, *J*=11.3Hz), 2.62 (br, 2H), 2.35 (s, 6H), 2.22-2.19 (m, 1H), 2.05-1.99 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) = δ 157.89, 151.68, 141.50, 133.72, 127.18, 126.78, 125.68, 125.53, 124.76, 123.13, 121.03, 119.57, 109.91, 105.83, 54.72, 44.13, 37.45, 30.67ppm. ESIMS $[M+H]^+$m/z 296.4.

4-(3-Dimethylamino-1-thiophen-2-yl-propyl)-naphthalen-1-ol (19.2):
Yield 3.0 gm (60%). Brown liquid. IR (In Neat): 3381, 3161, 2956, 2659, 1625, 1584, 1469, 1381, 1278, 765, 701 cm $^{-1}$. ^{1}H NMR ($CDCl_3$, 400MHz) δ = 8.23 (d, 1H, *J*= 8.8Hz), 7.72 (t, 1H, J=4.3Hz), 7.43-7.40 (m, 2H), 7.35 (d, 1H, *J*=4.8Hz), 7.28 (d, 1H, *J*= 8.5Hz), 7.05 (t, 2H, *J*= 4.0Hz), 6.98 (t, 1H, *J*= 4.2Hz), 4.78 (dd, 1H, J_1=4.5, J_2=4.2Hz), 2.94 (d, 1H, *J*=4.7Hz), 2.49-2.43 (m, 1H), 2.21 (s, 6H), 2.19-2.09 (m, 2H)ppm. ^{13}C NMR ($CDCl_3$, 100MHz) δ= 150.89, 149.15, 133.44, 127.58, 127.00, 126.30, 126.22, 126.01, 125.16, 124.55, 124.48, 124.08, 122.95, 119.41, 55.70, 44.39, 35.34, 33.31ppm. ESIMS $[M+H]^+$m/z 312.20.

4-(1-Cyclopropyl-3-dimethylamino-propyl)-naphthalen-1-ol (19.3):
Yield 200 mg (20%). White solid; mp 79.8-84.8°C. IR (in KBr): 3149, 3073, 2680, 2482, 808 cm^{-1}. ^{1}HNMR ($CDCl_3$, 400MHz) = δ 12.0 (s, 1H), 8.34 (d, 1H, *J*=8.7Hz), 7.76 (t, 1H, *J*=4.3Hz), 7.47-7.39 (m, 4H), 2.36-2.27 (m, 9H), 2.06 (d, 1H, *J*=7.0Hz), 1.6 (m, 2H), 1.28 (t, 1H, *J*=4.2Hz), 0.69 (m, 1H), 0.43 (m, 1H), 0.28 (t, 1H, *J*=4.56Hz), 0.07 (m, 1H)ppm. ^{13}C NMR ($CDCl_3$, 400MHz) δ = 151.39, 133.21, 127.03, 126.35, 125.20, 125.14, 124.47, 123.99, 122.93, 119.11, 55.10, 43.92, 39.83, 33.82, 16.55, 5.95, 4.22ppm. ESIMS $[M+H]^+$m/z 270.0.

CONCLUSION

In conclusion we have demonstrated the rearrangement of ethers in presence of acid catalyst into phenols.

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