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The reaction between 4-dimethylaminopyridine (DMAP) and 2-bromoacetophenone(s) readily gives 1-[2-(4-substitutedphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium bromide (**1**-**14**). Action of aqueous NaOH on **1**-**8** generates the corresponding pyridinium ylide (**15**-**22**), which is isolated as a colored stable crystalline solid. Addition of **15**-**22** to dimethylacetylene dicarboxylate (DMAD) gives dimethyl 3-(substitutedbenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**23**-**30**) in 46-62% yield.

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Introduction.

Chemists are attracted continuously by indolizines due to their applications in various fields. In pharmaceutical industries, indolizine derivatives are employed as CNS depressant [1] cardiovascular agents [2] and calcium entry blockers [3]. They are also used in the treatment of angina pectoris [4]. Some of the indolizine derivatives are found to be anti-inflammatory agent [5,6]. Indolizines are also used as spectral sensitizers [7], dyes [8], and intermediates in the synthesis of electron-enriched cycloazines [9]. To continue with these important studies, attempts are made to improve the methods of synthesis [10] as well as synthesis of new indolizines. To the best of our knowledge, indolizines with $–NMe_2$ substituents at 7- position have not so far been reported. Early studies revealed that compounds containing aryl-NMe_2 group would affect the metabolic activation due to the electronic and physicochemical influence exerted by the $–NMe_2$ group [11]. Hence, we made an attempt to construct the indolizine with $–NMe_2$ at the 7-position. Our continuous work on dimethylaminopyridine (DMAP) quaternary salts and the isolation of stable pyridinium ylides [12] helped us to achieve the target indolizines.

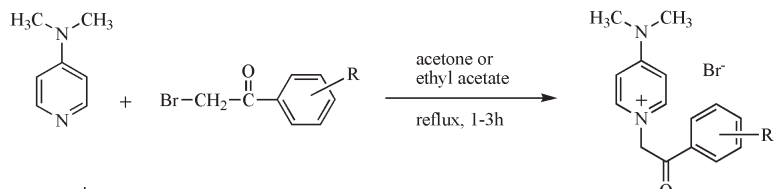
Results and Discussion.

2-Bromoacetophenones have been prepared from their corresponding acetophenones using literature procedures [13]. Suitable conditions have been chosen to give 2-bromoacetophenone(s) selectively. These compounds were purified by repeated recrystalisation and column chromatography.

The reaction between 2-bromoacetophenone(s) and DMAP has been carried out to give 1-[2-(substitutedphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium bromide (**1**-**14**) (Scheme 1). Compound **1** was reported in our previous report [12]. The physical and spectral data of **2**-**14** were collected and are presented in the experimental section. The presence of electron withdrawing group at the 4'-position of 2-bromoacetophenones facilitates the cleavage of the C-Br bond through electronic effects.

Methanolic solutions of **2**-**14** exhibit analogous absorption spectra with two maxima in the range of 281-293 (π-π^*) and 211-218 (n-π^*) nm. The former is characteristic of the 4-dimethylaminopyridinium moiety and the later is due to the carbonyl function. In the IR spectra of compounds **2**-**14**, the carbonyl frequency is affected to some extent by the substituents present in the phenyl ring. Electron withdrawing groups such as Cl, Br and NO_2 increases the carbonyl frequencies (shorter wavelength). On the other hand the electron releasing group CH_3 decreases the wave number. The presence of Cl (**2**), Br (**3**), NO_2 (**9** and **10**) and OH (**11** and **12**) are reflected from their stretching bands.

Scheme 1



	1	2	3	4	5	6	7
R	H	4-Me	4-Cl	4-Br	4-OMe	4-Ph	2-OMe

8	9	10	11	12	13	14
2,4-$(Cl)_2$	4-NO_2	3-NO_2	4-OH	2-OH	4-OCH_2Ph	2-OCH_2Ph

In the ^{1}H NMR spectra of compounds **2-14**, the sharp singlet around at δ 5.89 ppm corresponds to the methylene protons. The chemical shifts of methylene protons are exaggerated by substituents present in the phenyl ring. The 2-H and 6-H protons of the pyridine ring of compounds **2-14** appeared in the down field region around at δ 8.20 as a doublet compared to the 3-H and 5-H protons. This is because of the electron withdrawing effect of the endocyclic nitrogen atom. A broad singlet at δ 8.73 ppm in compound **10** corresponds to the 2-H proton of phenyl ring. This down field shift may be due to the inductive effect of the NO_2 group at C3. The disappearance of signal through a D_2O exchange experiment on **11** and **12** established the presence of OH. However, the down field shift of the OH proton in compound **12** around 1 ppm more than that of the OH proton in **11** may be due to hydrogen bonding between the OH and carbonyl group. The ^{13}C NMR spectra of **2-14** agree with the assigned structures. Mass spectra of these compounds show the molecular ion peak without the bromide counter ion $(M\text{-}Br)^+$.

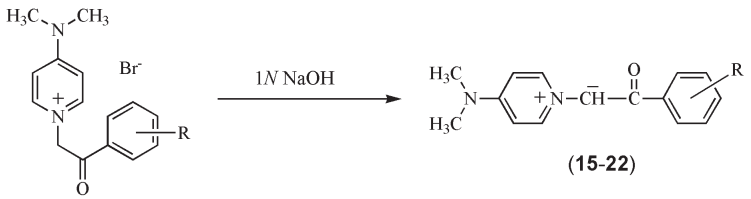
Single crystal X-ray analyses of **3** and **4** as typical examples were solved [14]. Crystal data confirmed the assigned structure as well as the quinoidal character. The pyridinium systems in **2** and **3** have a substantial degree of quinoidal character, since the bond lengths C2—C3 and C5—C6 in **2** and **3** [1.334 (4) Å, 1.339 (5) and 1.339 (5) Å, 1.342 (5) Å] are significantly shorter than those observed for C3—C4 and C4—C5 [1.406 (4) Å, 1.413 (4) and 1.407 (5) Å, 1.412 (5) Å]. The bond lengths C4—N2 in **2** and **3** are the same within experimental error [1.326 (4) Å, 1.327 (4) Å] and lie between the carbon-nitrogen single and double bond distances [1.326 (4) Å, 1.458 (4) in **2** and 1.327 (4) Å, 1.462 (5) in **3**, indicating a significant conjugation.

The pyridinium ylides **16-22** were generated by the action of 1 *N* NaOH on **1-8** (Scheme 2). The physical and spectral (IR and ^{1}H NMR) data were collected and are presented in Table's 1 and 2 respectively. Compound **15** was reported in our previous work [12]. Conjugation of the ylidic carbon with the carbonyl group lowers the ν C=O observed in the ir spectra. The ylidic proton resonance of **16-18** is observed as a singlet in the down field region of δ 6.30-6.33 ppm. The carbonyl group conjugated to the carbanion makes the ylide to be more stable by resonance (Scheme 3). The negative charge on carbon shifts to more electronegative oxygen atom, which is better capable of holding this charge than carbon. This leads to formation of the enolate ylide. Further, the ylide is stabilized by field effect caused by the positive nitrogen adjacent to the negatively charged carbon. The stability of the **15-22** varies from days to hours. Interestingly ylides **15** and **16** are stable for about 10-15 days and **17-20** and **22** are stable for 4-6 hours at 30 °C. Ylide **21** was not stable enough to characterize. All isolated ylides are stable for extended periods of time in a vacuum. The variation in the stability of ylides may be explained in terms of the nature of the substituent on the phenyl ring. Electron withdrawing group at the 4'-position may develop a residual positive charge on the carbonyl carbon, which may disturb the conjugation between the ylidic carbon and the carbonyl carbon.

Dimethyl 3-(substitutedbenzoyl)-7-(dimethylamino)-indolizine-1,2-dicorboxylate (**23-30**) have been prepared by the reaction of **15-22** with dimethyl acetylenedicarboxylate in DMF in the presence of K_2CO_3 in 44-62% (Scheme 4). Attempts were made to improve the yield by conducting the reaction in different bases such as Et_3N, pyridine, NaOH, $NaHCO_3$ however improved yields were not observed. Further, the reaction was also conducted in a mixture of $DMSO/CH_3CN$ and results were less favorable than in DMF. The reaction under this experimental condition did not yield the dihydroindolizine as reported elsewhere [15]. The structures assigned to indolizines **23-30** are supported by their spectral data (IR, ^{1}H and ^{13}C NMR and MS).

In the IR spectra of **23-30**, the CO at C-3 appeared at 1685-1699 cm^{-1}, whereas, the ester CO appeared at 1736-1738 cm^{-1}. The ^{1}H NMR spectra of **23-30** showed a sharp singlet at δ 3.06-3.15 ppm, which confirmed the presence of the $-N(CH_3)_2$ group. The 5-H proton appeared in the down field region at δ 9.33-9.77 ppm as a doublet (br, J~7.9 Hz). This is due to the presence of the adjacent ring nitrogen

Scheme 2



	15	16	17	18	19	20	21	22
R	H	4-Me	4-Cl	4-Br	4-OMe	4-Ph	2-OMe	2,4-$(Cl)_2$

Table 1

Physical and IR (KBr) Data of **15-22**

Compd.	Yield %	mp °C	UV-VIS λ_{max} nm
16	86	137-39	388, 282
17	88	139-40(d)	381, 270
18	83	135-36(d)	448, 286
19	80	158-59(d)	464, 286
20	85	180-81(d)	468, 313, 273
21	-	-	-
22	82	54-55	365, 282

at C2, which resonates at δ 3.70-3.81 ppm. The down field shift of the latter may be due to the electronic influence exerted by CO at C3. In the ^{13}C NMR spectra of **23**-**30**, the carbonyl group appeared at δ 178-185 ppm. The ester carbonyl group attached to the C1 position was observed at δ 163-164 ppm, whereas, the carbonyl group at the C2 position was observed at δ 165-166 ppm. Mass spectra of **23**-**30** showed the molecular ion peak at their exact mass (M^+).

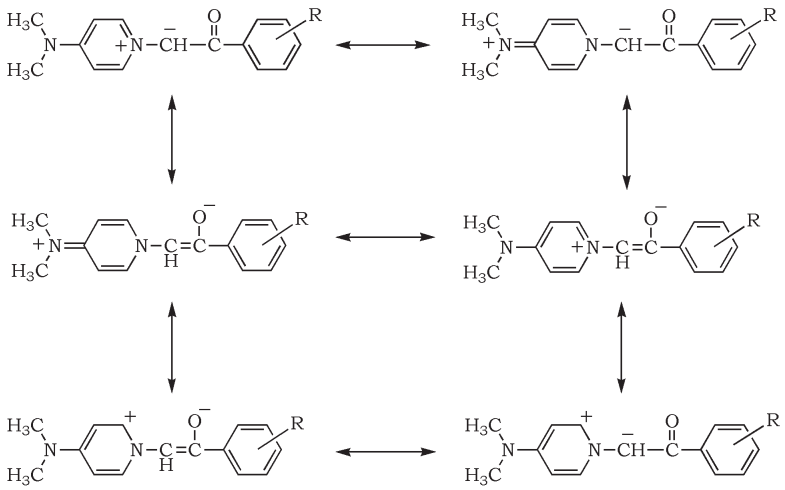
Furthermore, the single crystal and molecular structures of some of the compounds (**23** and **26**) were solved by

Table 2

IR and ^1H NMR Spectral Data of **16-22**

Compd	IR (KBr), cm^{-1}	^1H NMR ($CDCl_3$), δ ppm		
		Ylidic H	Aliphatic H	Aromatic H
16	3429,2920, 1654, 1515, 1433 and 734.	6.30 (s, 1H),	3.14 (s, 6H),	9.15 (d, J=7.4, 2H), 7.74 (d, J=8.3, 2H), 7.27 (d, J=8.3, 2H), 6.60 (d, J=7.4, 2H).
17	3437, 3072, 1657,1545 and 572.	6.29 (s, 1H),	3.12 (s, 6H),	9.11 (d, J=7.1, 2H), 7.66 (d, J=8.1, 2H), 7.41 (d, J=8.1, 2H), 6.60 (d, J=7.1, 2H).
18	3434, 2917, 1654, 1573 and 820.	6.33 (s, 1H),	3.11 (s, 6H), 2.35 (s, 3H)	9.17 (d, J=7.1, 2H), 7.67 (d, J=7.8, 2H), 7.13 (d, J=7.8, 2H), 6.57 (d, J=7.1, 2H).
19	3445, 3065, 1652, 1571 and 1174.	-	-	-
20	3435, 3057, 2920,1651, and 1544.	-	-	-
22	3417, 2992, 1651, 1582 and 576.	-	-	-

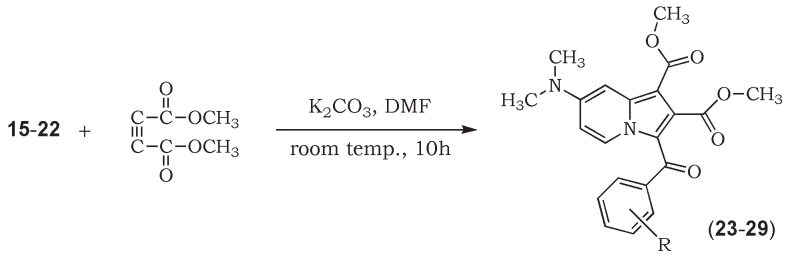
Scheme 3



atom, which may deshield the 5-H proton. The 6-H proton appeared as a doublet of doublet at δ 6.67-6.57 (J~7.9 and 2.8 Hz). This is because of the coupling of 5-H and 8-H protons. A sharp doublet was observed for 8-H proton at δ 7.26-7.35 ppm with coupling constant ~2.8 Hz. From the coupling constant, it is inferred that the 8-H proton coupled with 6-H. The methyl protons of the ester attached to C1 appeared in the slightly up field region at δ 3.35-3.20 ppm compared with that of the methyl protons of the ester

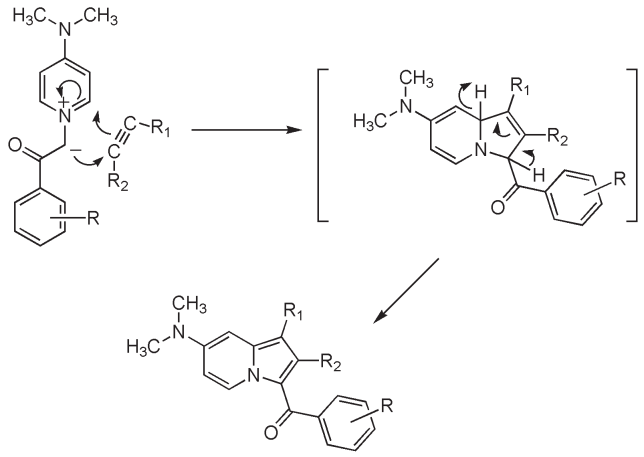
X-ray studies [16,17]. The dihedral angle between the planes of the indolizine ring and the benzoyl ring is 58.13 (5)°. The planes of the 1- and 2-carboxylate groups are oriented at angles of 5.97 (9) and 72.05 (7)°, respectively, with respect to the plane of the indolizine moiety. The carboxylate groups are approximately perpendicular to each other. In addition, the phenyl ring (Cg1) and the six-membered ring of the indolizine moiety are involved in weak intermolecular C–H…π interactions. The mecha-

Scheme 4



	23	24	25	26	27	28	29	30
R	H	4-Me	4-Cl	4-Br	4-OMe	4-Ph	2-OMe	2,4-(Cl)$_2$

Scheme 5



nism for formation of the indolizine derivatives is readily explained by 1,3-dipolar cycloaddition reactions between pyridinium ylides **15**-**22** and dimethyl acetylenedicarboxylate (Scheme 5).

Conclusion.

Stable 4-dimethylaminopyridinium ylides are generated by the action of aqueous NaOH on the salts obtained from the reaction between DMAP and 2-bromoacetophenones. Dipolar cycloaddition of 4-dimethylaminopyridinium ylides with DMAD readily gives indolizines in 44-62% yield. Attempts were made to improve the yield but improved yields were not achieved. Dihydroindolizines are not found under the present experimental conditions.

EXPERIMENTAL.

All melting points were measured on a Boetius micro hot-stage apparatus and are uncorrected. The infrared spectra of solids (Potassium bromide) were recorded on a Perkin-Elmer FT-IR paragon 1000 spectrometer. The ^{1}H and ^{13}C NMR spectra were recorded on a Bruker, AMX 400 MHz and DRX 500 MHz instrument in DMSO-d_6 or $CDCl_3$ using TMS as internal reference. Chemical shifts (δ) are expressed in ppm and coupling constants are expressed in Hz. Mass spectral measurements were recorded on ESI-MS (Electrospray Ionization Mass Spectroscopy) in acetonitrile and Double Focusing Mass Spectrometer VG 70-250S (VG Analytical Ltd., Manchester, UK).

General Procedure for Preparation of 1-[2-(4-Substitutedphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromides **2-14**.

To a solution of substituted phenacyl bromide(s) (4 mmoles) and DMAP (4.1 mmoles) in dry acetone or ethyl acetate was stirred or refluxed for 30 min. After cooling to room temperature the solid that separated was collected by filtration and washed with dry acetone to give stable crude salt(s) **2-14**, which were dried in vacuum and recrystallised from ethanol.

1-[2-(4-Methylphenyl)-2-oxoethyl]-4-(dimethylamino)-pyridinium Bromide (**2**).

This compound was obtained as colorless crystalline solid (ethanol), yield 90%, mp 185-188 °C; uv λ_{max} (ε): 289 (20783), 263 (10765); ir: 3038, 2917, 1690, 1215 and 1572 cm^{-1}; ^{1}H nmr: δ 8.22 (d, 2H, J=7.3 Hz), 7.94 (d, 2H, J=7.9 Hz), 7.45 (d, 2H, J=7.9 Hz), 7.13 (d, 2H, J=7.3 Hz), 5.9 (s, 2H), 3.24 (s, 6H), 2.4 (s, 3H); ^{13}C nmr: δ 191.80, 156.08, 145.04, 143.31, 131.44, 129.55, 128.18, 107.37, 62.25, 39.85 and 21.29 ppm; ms: m/z= 255 [M-Br]$^+$.

Anal. Calcd. for $C_{16}H_{20}N_2OBr$: C, 57.15%; H, 6.00%; N, 8.33%. Found: C, 57.12%; H, 6.02%; N, 8.31%.

1-[2-(4-Chlorophenyl)-2-oxoethyl]-4-(dimethylamino)-pyridinium Bromide (**3**).

This compound was obtained as a colorless crystalline solid (ethanol), yield 95%, mp 198-201 °C; uv λ_{max} (ε): 288 (58238) and 217 (16926) nm; ir: 3079, 2927, 1697, 1580, 1212 and 824 cm^{-1}; ^{1}H nmr: δ 8.20 (d, 2H, J=7.5 Hz), 8.06 (d, 2H, J=8.5 Hz), 7.74 (d, 2H J=8.5 Hz), 7.14 (d, 2H, J=7.5 Hz), 5.99 (s, 2H), 3.24 (s, 6H); ^{13}C nmr: δ 191.56, 156.06, 143.24, 139.23, 132.65, 130.01, 129.20, 107.41, 62.35 and 39.79 ppm; ms: m/z= 275 [M-Br]$^+$.

Anal. Calcd. for $C_{15}H_{17}N_2OCl$: C, 50.51%; H, 4.80%; N, 7.85%. Found: C, 50.47%; H, 4.82%; N, 7.83%.

1-[2-(4-Bromophenyl)-2-oxoethyl]-4-(dimethylamino)-pyridinium Bromide (**4**).

This compound was obtained as colorless crystalline solid (ethanol), yield 94%, mp 228-31 °C; uv λ_{max} (ε): 289 (30016), 267 (18293) nm; ir: 3072, 2727, 1695, 1581, 1212 and 565 cm^{-1}; ^1H nmr: δ 8.19 (d, 2H, J=7.3 Hz), 7.79 (d, 2H, J=8.4 Hz), 7.88 (d, 2H, J=8.4 Hz), 7.23 (d, 2H, J= 7.3 Hz), 5.97 (s, 2H), 3.24 (s, 6H); ^{13}C nmr: δ 191.74, 156.06, 143.23, 132.95, 132.17, 130.03, 128.50, 107.41, 62.30 and 39.78 ppm; ms: m/z= 320 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{17}N_2OBr_2$: C, 44.92%; H, 4.27%; N, 6.98%. Found: C, 44.89%; H, 4.28%; N, 6.97%.

1-[2-(4-Methoxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**5**).

This compound was obtained as colorless crystalline solid (ethanol), yield 91%, mp 117-119 °C; uv λ_{max} (ε): 293 (43995), 218 (15091); ir: 3072, 2833, 1689, 1574, 1213 and 1110 cm^{-1}; ^1H nmr: δ 8.22 (d, 2H, J=7.3 Hz), 7.94 (d, 2H, J=7.9 Hz), 7.45 (d, 2H, J=7.9 Hz), 7.13 (d, 2H, J=7.3 Hz), 5.96 (s, 2H), 3.23 (s, 6H), 3.36 (s, 3H); ^{13}C nmr: δ 190.60, 164.05, 156.01, 143.31, 130.52, 126.71, 114.31, 107.34, 62.03, 55.77 and 39.98 ppm; ms: m/z= 271 $[M-Br]^+$.

Anal. Calcd. for $C_{16}H_{20}N_2O_2Br$: C, 54.56%; H, 5.72%; N, 7.95%. Found: C, 54.53%; H, 5.73%; N, 7.93%.

1-[2-(Biphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**6**).

This compound was obtained as colorless crystalline solid (ethanol), yield 89%, mp 246-48 °C; uv λ_{max}: 295 (57312) and 215 (18336) nm; ir: 3057, 2923, 1686, 1570 and 1201 cm^{-1}; ^1H nmr: δ 8.24 (d, 2H, J=7.6 Hz), 8.13 (d, 2H, J=8.4 Hz), 7.97 (d, 2H, J=8.4 Hz), 7.82 (d, 2H, J=7.3 Hz), 7.55 (t, 2H, J=7.3 Hz), 7.48 (t, 1H, J=7.3 Hz), 7.15 (d, 2H, J=7.6 Hz), 6.05 (s, 2H), 3.25 (s, 6H); ^{13}C nmr: δ 191.98, 156.06, 145.57, 143.31, 138.56, 132.73, 129.17, 128.89, 128.68, 127.07, 107.41, 62.40 and 39.85 ppm; ms: m/z= 317 $[M-Br]^+$.

Anal. Calcd. for $C_{21}H_{22}N_2OBr$: C, 63.32%; H, 5.57%; N, 7.03%. Found: C, 63.29%; H, 5.60%; N, 7.0%.

1-[2-(2-Methoxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**7**).

This compound was obtained as colorless crystalline solid (ethanol), yield 86%, mp 220-222 °C; uv λ_{max} (ε): 290 (29259), 219 (14377) nm; ir: 3017, 2898, 1673, 1571, 1207 and 1110 cm^{-1}; ^1H nmr: δ 8.00 (d, 2H, J=8.9 Hz), 7.61 (dd, 1H, J=7.8 and 1.7 Hz), 7.46 (td, 1H, J=7.0 and 1.7 Hz), 7.08 (d, 1H, J=8.4 Hz), 6.89 (t, 1H, J=7.9 Hz), 6.86 (d, 2H, J=7.7 Hz), 5.54 (s, 2H), 3.78 (s, 3H), 2.98 (s, 6H); ^{13}C nmr: δ 192.09, 159.90, 156.04, 143.38, 135.94, 130.30, 123.45, 120.85, 113.08, 107.20, 66.12, 56.28, 39.83 ppm; ms: m/z= 271 $[M-Br]^+$.

Anal. Calcd. for $C_{16}H_{20}N_2O_2Br$: C, 54.56%; H, 5.72%; N, 7.95%. Found: C, 54.54%; H, 5.74%; N, 7.94%.

1-[2-(2,4-Dichlorophenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**8**).

This compound was obtained as colorless crystalline solid (ethanol), Yield 88%, mp 260-62 °C; uv λ_{max} (ε): 290 (77334) and 222 (28693) nm; ir: 3072, 2996, 1709, 1569, 1214, 780 cm^{-1}; ^1H nmr: δ 8.26 (d, 2H, J=7.7 Hz), 8.13 (d, 1H, J=8.4 Hz), 7.86 (d, 1H, J=1.9 Hz), 7.72 (dd, 1H, J=8.4 and 1.9 Hz), 7.16 (d, 2H, J=7.7 Hz), 5.98 (s, 2H), 3.25 (s, 6H); ^{13}C nmr: δ 192.13, 155.97, 143.01, 137.85, 132.85, 132.53, 132.29, 130.64, 127.62, 107.32, 63.91 and 39.20 ppm. ms: m/z= 309 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{16}N_2OCl_2Br$: C, 46.06%; H, 4.12%; N, 7.16%. Found: C, 46.02%; H, 4.15%; N, 7.14%. 130.80, 127.78, 107.47, 64.06 and 39.88 ppm. ms: m/z= 309 $[M-Br]^+$.

1-[2-(4-Nitrophenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**9**).

This compound was obtained as yellow crystalline solid (ethanol), yield 90%, mp 184-87 °C; uv λ_{max} (ε): 290 (2161), 217 (865) nm; ir: 3046, 2898, 1704, 1572, 1531, 1216 cm^{-1}; ^1H nmr: δ 8.46 (d, 2H, J=8.8 Hz), 8.27 (d, 2H, J=8.8 Hz), 8.22 (d, 2H, J=7.6 Hz), 7.16 (d, 2H, J= 7.6 Hz), 6.07 (s, 2H), 3.25 (s, 6H); ^{13}C nmr: δ 191.84, 156.10, 150.49, 143.19, 139.09, 138.62, 129.62, 124.07, 107.46, 62.71 and 39.87 ppm; ms: m/z= 286 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{17}N_3O_3Br$: C, 49.06%; H, 4.67%; N, 11.44%. Found: C, 49.05%; H, 4.68%; N, 11.43%.

1-[2-(3-Nitrophenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**10**).

This compound was obtained as yellow crystalline solid (ethanol), yield 90%, mp 241-243 °C; uv λ_{max} (ε): 291 (4998), 280 (3704) nm; ir: 3050, 1650, 1573, 1220, 836 cm^{-1}; ^1H nmr: δ 8.73 (s, 1H), 8.58-8.61 (dd, 1H, J= 7.9 and 1.7 Hz), 8.46 (d, 1H, J=7.7 Hz), 8.22 (d, 2H, J=7.5 Hz), 7.96 (t, 1H, J=7.7 Hz), 7.16 (d, 2H, J=7.5 Hz), 6.11 (s, 2H), 3.25 (s, 6H); ^{13}C nmr: δ 191.33, 156.05, 148.02, 143.135, 135.142, 130.96, 128.333, 122.40, 107.376, 62.51and 39.83 ppm; ms: m/z= 286 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{17}N_3O_3Br$: C, 49.06%; H, 4.67%; N, 11.44%. Found: C, 49.01%; H, 4.69%; N, 11.41%.

1-[2-(4-Hydroxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**11**).

This compound was obtained as colorless crystalline solid (ethanol), yield 85%, mp 221-24°C; uv λ_{max} (ε): 295 (38063), 218 (12839) nm; ir: 3459, 3082, 1657, 1577 and 1215 cm^{-1}; ^1H nmr: δ 10.69 (br s, 1H), 8.19 (d, 2H, J=6.8 Hz), 7.92 (d, 2H, J=8.5 Hz), 7.11 (d, 2H, J=6.8 Hz), 6.96 (d, 2H, J= 8.5 Hz), 5.89 (s, 2H), 3.23 (s, 3H); ^{13}C nmr: δ 190.34, 162.90, 155.93, 143.05, 130.84, 125.21, 115.61, 107.11 and 39.65. ms: m/z= 257 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{18}N_2O_2Br$: C, 53.27%; H, 5.36%; N, 8.28%. Found: C, 53.24%; H, 5.37%; N, 8.25%.

1-[2-(2-Hydroxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**12**).

This compound was obtained as colorless crystalline solid (ethanol), yield 84%, mp 157-60 °C; uv λ_{max} (ε): 290 (25977), 211 (26092) nm; ir: 3449, 2997, 1664, 1574 and 1221 cm^{-1}; ^1H nmr: δ 11.25 (br s, 1H), 8.24 (d, 2H, J=7.5 Hz), 7.84 (br d, 1H, J=7.1 Hz), 7.56 (t, 1H, J= 8.2 Hz), 7.14 (d, 1H, J=8.2 Hz), 7.10 (d, 2H, J=7.6 Hz), 6.99 (t, 1H, J= 7.1 Hz), 5.83 (s, 2H), 3.23 (s, 6H); ^{13}C nmr: δ 193.20, 159.58, 156.05, 143.43, 136.04, 130.0, 120.61, 119.43, 117.68, 107.19, 65.30 and 39.84. ms: m/z= 257 $[M-Br]^+$.

Anal. Calcd. for $C_{15}H_{18}N_2O_2Br$: C, 53.27%; H, 5.36%; N, 8.28%. Found: C, 53.24%; H, 5.37%; N, 8.26%.

1-[2-(4-Benzyloxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**13**).

This compound was obtained as colorless crystalline solid (ethanol), yield 89%, mp 236-39 °C; uv λ_{max} (ε): 293 (84680) and 221 (31427) nm; ir: 3040, 1674, 1572, 2911, 1212 and 1113

cm^{-1}; ^1H nmr: δ 8.21 (d, 2H, J=7.2 Hz), 7.89 (d, 1H, J=6.4 Hz), 7.69-7.62 (m, 3H), 7.45-7.35 (m, 4H), 7.15 (d, 2H, J=7.5 Hz), 7.10 (d, 2H, J=7.3 Hz), 5.7 (s, 2H), 5.4 (s, 2H), 3.23 (s, 6H). ^{13}C nmr: δ 190.59, 163.10, 156.06, 143.34, 136.34, 130.50, 128.04, 127.75, 126.93, 115.17, 107.34, 69.69, 62.03 and 39.85 ppm; ms: m/z= 347 $[M-Br]^+$.

Anal. Calcd. for $C_{22}H_{24}N_2O_2Br$: C, 61.69%; H, 5.65%; N, 6.54%. Found: C, 61.66%; H, 5.66%; N, 6.53%.

1-[2-(2-Benzyloxyphenyl)-2-oxoethyl]-4-(dimethylamino)pyridinium Bromide (**14**).

This compound was obtained as colorless crystalline solid (ethanol), yield 85%, mp 203-206 °C; uv λ_{max} (ε): 290 (32382) and 213 (20391) nm; ir: 3036, 2920, 1665, 1569, and 1225 cm^{-1}; ^1H nmr: δ 8.21 (d, 2H, J=7.2 Hz), 7.90-7.85 (m, 1H), 7.69-7.62 (m, 3H), 7.44 (t, 2H), 7.377 (m, 2H), 7.14 (t, 2H, J=7.5 Hz), 7.10 (d, 2H, J=7.3 Hz), 5.77 (s, 2H), 5.43 (s, 2H), 3.23 (s, 6H). ^{13}C nmr: δ 191.87, 158.81, 156.06, 143.29, 135.78, 130.50, 128.59, 128.23, 128.13, 127.87, 123.75, 121.05, 114.23, 107.24, 70.43, 65.79 and 39.85 ppm; ms: m/z= 347 $[M-Br]^+$.

Anal. Calcd. for $C_{22}H_{24}N_2O_2Br$: C, 61.69%; H, 5.65%; N, 6.54%. Found: C, 61.67%; H, 5.67%; N, 6.52%.

General Procedure for the Preparation of 2-(4-Substitutedphenyl)-1-[4-(dimethylamino)pyridinium-1-yl]-2-oxoethanides **15-22**.

Pyridinium salt (**1-8**) (4 mmoles) was added to a solution of 1 *N* NaOH. The reaction mixture was just placed on a water-bath for 10 min to produce the yellow crystalline solid, which was collected by filtration, washed with a minimum amount of water and dried in vacuum to give **15-22**.

General Procedure for the Preparation of Dimethyl 3-(Substitutedbenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate 23-30.

To the dark yellow solution of 2-(4-substitutedphenyl)-1-[4-(dimethylamino)pyridinium-1-yl]-2-oxoethanides (4 mmoles) (**15-22**) and potassium carbonate in DMF (6 mmoles, 40 mL) were added drop wise dimethyl acetylenedicarboxylate (4.5 mmoles). The medium soon turned black and the mixture was stirred at room temperature for 1 h. After completion of the reaction (TLC), the medium was extracted with the binary system aqueous hydrogen chloride/ethyl acetate. The organic phase was separated and dried over Na_2SO_4. After removal of solvent in vacuum, the residue was separated by column (silica gel) with benzene-ethyl acetate (9:1v/v) as eluent to give indolizines **23-30**.

Dimethyl 3-Benzoyl-7-(dimethylamino)indolizine-1,2-dicarboxylate (**23**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 43%, mp 285-287 °C; uv λ_{max}: 298, 343, 323 and 253 nm; ir: 3094, 2949, 1738, 1688, 1589, 1232 and 1203 cm^{-1}; ^1H nmr: 9.49 (d, 1H, J=7.9 Hz), 7.55 (d, 2H, J=7.18 Hz), 7.42 (d, 2H, J=7.3 Hz), 7.34 (t, 2H, J=7.3 Hz), 7.28 (d, 1H, J=2.6 Hz), 6.61-6.58 (dd, 1H, J=7.9 and 2.8 Hz), 3.73 (s, 3H), 3.20 (s, 3H), 3.07 (s, 6H): ^{13}C nmr: δ 185.43, 165.78, 163.97, 149.68, 141.97, 140.37, 130.95, 129.89, 128.46, 127.89, 118.81, 105.25, 95.55, 52.01, 51.23 and 39.89 ppm; ms: m/z= 380 $[M]^+$.

Anal. Calcd. for $C_{21}H_{20}N_2O_5$: C, 66.31%; H, 5.30%; N, 7.36%. Found: C, 66.29%; H, 5.29%; N, 7.34%.

Dimethyl 3-(4-methylbenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**24**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 49%, mp 170-172 °C; uv λ_{max}: 419, 325 and 265 nm; ir: 3097, 2942, 1736, 1691, 1589, 1231 and 1200 cm^{-1}; ^1H nmr: 9.42 (d, 1H, J=7.9 Hz), 7.47 (d, 2H, J=8.0 Hz), 7.27 (d, 1H, J=2.7 Hz), 7.14 (d, 2H, J=9.8 Hz), 6.59-6.57 (dd, 1H, J= 7.9 and 2.8 Hz), 3.74 (s, 3H), 3.23 (s, 3H), 3.07 (s, 6H), 2.33 (s, 3H); ^{13}C nmr: δ 184.40, 165.76, 163.09, 149.40, 141.76, 133.02, 132.33, 130.14, 129.47, 113.83, 105.26, 95.55, 52.88, 51.26, 39.90 and 21.07 ppm; ms: m/z= 394 $[M]^+$.

Anal. Calcd. for $C_{22}H_{19}N_2O_5$: C, 66.99%; H, 5.62%; N, 7.10%. Found: C, 66.96%; H, 5.64%; N, 7.08%.

Dimethyl 3-(4-Chlorobenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**25**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 41%, mp 110-112 °C; uv λ_{max}: 419, 325 and 265 nm; ir: 3090, 2942, 1736, 16851599, 1231, 1200 and 824 cm^{-1}; ^1H nmr: 9.53 (d, 1H, J=7.9 Hz), 7.56 (d, 2H, J=8.4 Hz), 7.38 (d, 2H, J=8.4 Hz), 7.35 (d, 1H, J=2.8 Hz), 6.68-6.66 (dd, 1H, J= 7.9 and 2.8 Hz), 3.81 (s, 3H), 3.35 (s, 3H), 3.15 (s, 6H); ^{13}C nmr: δ 183.86, 165.74, 163.83, 149.81, 142.05, 138.73, 137.14, 129.91, 128.12, 118.50, 105.32, 95.63, 52.13, 51.27 and 39.88 ppm; ms: m/z= 414 $[M]^+$.

Anal. Calcd. for $C_{21}H_{19}N_2O_5Cl$: C, 60.80%; H, 4.62%; N, 6.75%. Found: C, 60.79%; H, 4.64%; N, 6.74%.

Dimethyl 3-(4-Bromobenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**26**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 39%, mp 120-122 °C; uv λ_{max}: 423, 315 and 266 nm; ir: 3094, 2949, 1737, 1685, 1599, 1225, 1205 and 540 cm^{-1}; ^1H nmr: 9.53 (d, 1H, J=7.9 Hz), 7.5-7.56 (m, 2H), 7.47-7.5 (m, 2H), 7.35 (d, 1H, J=2.7, Hz), 6.68-6.65 (dd, 1H, J= 7.8 and 2.9 Hz), 3.81 (s, 3H), 3.35 (s, 3H), 3.15 (s, 6H); ^{13}C nmr: δ 178.65, 160.43, 158.56, 144.56, 136.78, 133.91, 128.65, 125.82, 124.79, 124.65, 120.24, 113.18, 100.06, 90.38, 46.87, 46.0 and 34.61 ppm; ms: m/z= 459 $[M]^+$.

Anal. Calcd. for $C_{21}H_{19}N_2O_5Br$: C, 54.92%; H, 4.17%; N, 6.10%. Found: C, 54.93%; H, 4.18%; N, 6.08%.

Dimethyl 3-(4-Methoxybenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**27**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 66%, mp 135-37 °C; uv λ_{max}: 419, 322 and 273 nm; ir: 3099, 2942, 1736, 1699, 1590, 1230, 1199 and 1143 cm^{-1}; ^1H nmr: 9.33 (d, 1H, J=7.9 Hz), 7.58 (d, 2H, J=8.6 Hz), 7.26 (d, 1H, J=2.5 Hz), 6.84 (d, 2H, J=8.6 Hz), 6.55-6.58 (dd, 1H, J=7.9 and 2.7 Hz), 3.79 (s, 3H), 3.74 (s, 3H), 3.30 (s, 3H), 3.06 (s, 6H); ^{13}C nmr: δ 184.68, 165.97, 162.29, 149.45, 141.83, 132.99, 132.46, 130.73, 129.59, 113.27, 105.16, 95.45, 55.45, 52.12, 51.19 and 39.89 ppm; ms: m/z= 410 $[M]^+$.

Anal. Calcd. for $C_{22}H_{19}N_2O_6$: C, 64.38%; H, 5.40%; N, 6.83%. Found: C, 64.40%; H, 5.42%; N, 6.82%.

Dimethyl 3-(4-Phenylbenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**28**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 51%, mp 159-61 °C; uv λ_{max}: 402, 343, 310 and 261 nm; ir: 3092, 2934, 1737, 1697, 1584, 1221 and 1205 cm^{-1}; ^1H nmr: 9.49 (d, 1H, J=7.9 Hz), 7.64 (d, 2H, J=8.1 Hz), 7.58-7.56 (m, 4H),

7.40 (t, 2H, J=7.3 Hz), 7.29 (t, 1H, J=7.3 Hz), 6.62-6.59 (dd, 1H, J=2.7 Hz), 3.74 (s, 3H), 3.23 (s, 3H), 3.08 (s, 6H); ^{13}C nmr: δ 185.02, 165.86, 163.99, 149.68, 143.78, 141.97, 140.34, 139.17, 133.32, 129.87, 129.09, 128.96, 127.95, 127.23, 126.56, 118.94, 105.26, 95.55, 52.08, 51.26, and 39.90 ppm; ms: m/z= m/z= 456 $[M]^+$.

Anal. Calcd. for $C_{27}H_{24}N_2O_5$: C, 71.04%; H, 5.30%; N, 6.14%. Found: C, 71.01%; H, 5.31%; N, 6.12%.

Dimethyl 3-(2-Methoxybenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**29**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 48%, mp 145-146 °C; uv λ_{max}: 390, 341, 305 and 215 nm; ir: 3094, 2949, 1737, 1685, 1599, 1225, 1205 and 540 cm^{-1}; ^{1}H nmr: 9.77 (d, 1H, J=7.9 Hz), 7.33-7.27 (m, 2H), 7.21 (d, 1H, J=1.5 Hz), 6.89 (t, 1H, J=7.5 Hz), 6.85 (d, 1H, J=8.3 Hz), 6.61-6.58 (dd, 1H, J= 7.9 and 2.8 Hz), 3.72 (s, 3H), 3.70 (s, 3H), 3.20 (s, 3H), 3.07 (s, 6H); ^{13}C nmr: δ 183.55, 165.77, 163.86, 157.31, 149.88, 141.91, 134.11, 130.98, 130.44, 129.41, 129.22, 119.77, 110.97, 105.12, 95.62, 55.69, 52.11, 51.19 and 39.86 ppm; ms: m/z= 410 $[M]^+$.

Anal. Calcd. for $C_{22}H_{19}N_2O_6$: C, 64.38%; H, 5.40%; N, 6.83%. Found: C, 64.42%; H, 5.42%; N, 6.81%.

Dimethyl 3-(2,4-Dichlorobenzoyl)-7-(dimethylamino)indolizine-1,2-dicarboxylate (**30**).

This compound was obtained as yellow crystalline solid (ethyl acetate), yield 52%, mp 174-75 °C; uv λ_{max}: 390, 341, 305 and 215 nm; ir: 3086, 2949, 1735, 1689, 1596, 1220, 1208 and 826 cm^{-1}; ^{1}H nmr: 9.85 (d, 1H, J= 7.9 Hz), 7.45 (d, 1H, J= 1.6 Hz), 7.36 (d, 1H, J= 2.7 Hz), 7.31-7.28 (m, 3H), 6.69 (dd, 1H, J= 7.9 and 2.8 Hz), 3.79 (s, 3H), 3.36 (s, 3H), 3.16 (s, 6H); ^{13}C nmr: δ 196.29, 166.92, 163.55, 150.30, 146.82, 142.32, 135.90, 133.48, 130.49, 129.35, 126.31, 117.81, 105.41, 95.90, 55.69, 52.28, 51.33 and 39.90 ppm; ms: m/z= 449 $[M]^+$.

Anal. Calcd. for $C_{21}H_{18}N_2O_5Cl_2$: C, 56.14%; H, 4.04%; N, 6.23%. Found: C, 56.11%; H, 4.03%; N, 6.21%.

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