[4+2]-Cycloaddition of 1,1,3,3-tetramethylguanidine and *o*-quinone methides: synthesis of arene-fused 2-dimethylamino-4*H*-1,3-oxazines*

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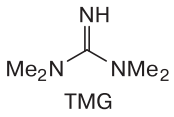
A method for producing substituted 4*H*-1,3-benzoxazines and their fused derivatives bearing *N*,*N*-dimethylamino moiety in the position 2 of 4*H*-1,3-oxazine ring from phenolic and naphtholic Mannich bases, their iodomethylates or salicylic alcohols, and 1,1,3,3-tetramethylguanidine has been developed. This reaction is supposed to proceed *via* the generation of *o*-quinone methides followed by [4+2]-cycloaddition and elimination of dimethylamine.

Key words: [4+2]-cycloaddition, 1,1,3,3-tetramethylguanidine, *o*-quinone methides, arene-fused 2-dimethylamino-4*H*-1,3-oxazines.

Potent inhibitors of phosphoinositide 3-kinase and DNA-dependent protein kinase have been found among 2-amino-substituted 1,3-benzoxazines.[1,2] A number of their derivatives show antiplatelet, antiatherosclerotic,[3—5] anticancer,[6] and antituberculotic[7] activities, and are also chemosensitizers.[8] Among 3-amino-1*H*-naphthoxazines, compounds with antibacterial and antiviral activities (H_5N_1) were identified.[9] Certain 2-amino-1,3-benzoxazines display herbicidal,[10] insecticidal,[11] and fungicidal[12] properties, while substituted 4*H*-1,3-oxazines[13] and related 1,4-dihydro-3,1-benzoxazines[14] are commonly used in fine organic synthesis.

A little number of methods for obtaining 2-amino-substituted 1,3-benzoxazines are known, namely, nucleophilic substitution of methylsulfanyl moiety in 2-methylthio-substituted naphtho[2,1-*e*][1,3]oxazines,[2,3,8] cyclization of *o*-cyanatobenzamides or starting from *o*-cyanatobenzoic acid esters and amides,[15] palladium-catalyzed aerobic oxidative coupling of *o*-(aminomethyl)-phenol or *o*-hydroxybenzoic acid (thio)amide and isonitriles,[16] cyclization of 1-[(2-hydroxy-1-naphthyl)-methyl]ureas.[8] 2-Amino-4*H*-1,3-oxazines were prepared *via* three-component condensation of alkynes, urea, and aldehydes.[17] Note that a number of the above-mentioned methods are not of general scope, and the synthesis of starting compounds sometimes is a separate synthetic task. An acetic acid-catalyzed three-component condensation of 2-naphthol, aromatic aldehydes, and 1,1,3,3-tetramethylguanidine (TMG) has also been developed.[18] However, the need to use microwave irradiation and chromatographical purification of the product reduces the value of this procedure, especially when obtaining multigram amounts of *N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amines. Moreover, this method provides solely 1-aryl-substituted derivatives. Therefore, the practical importance of 2-amino-substituted arene-fused 1,3-oxazines prompts the need to develop novel approaches to their preparation based on readily available starting compounds.



TMG

According to the retrosynthetic analysis of 2-dialkylamino-4*H*-1,3-benzoxazines, the most logical way to construct these heterocyclic system *via* cycloaddition is the reaction between *o*-quinone methides **A** and *N*,*N*-dialkylcyanamides. However, many hours of refluxing 2-dimethylaminomethyl-4,5-dimethylphenol and *N*,*N*-diethylcyanamide in DMF resulted only in the recovery of the starting compounds (Scheme 1).

Using in this reaction stable precursors to *o*-quinone methides — phenolic (naphtholic) Mannich bases — and TMG as a synthetic equivalent of *N*,*N*-dimethylcyanamide allows avoiding these obstacles.

1,1,3,3-Tetramethylguanidine is commonly used in organic synthesis as a strong (pK_α 13.6) non-nucleophilic base.[19] However, virtually nothing is known about the use of TMG as an iminodienophile. At the same time, *o*-quinone methides are widely used as hetero-

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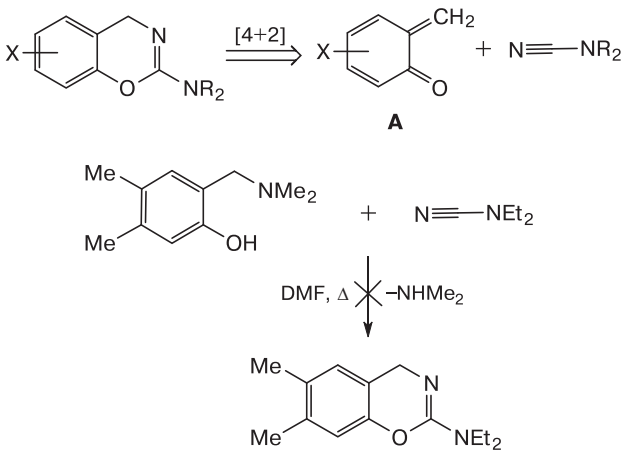
Scheme 1



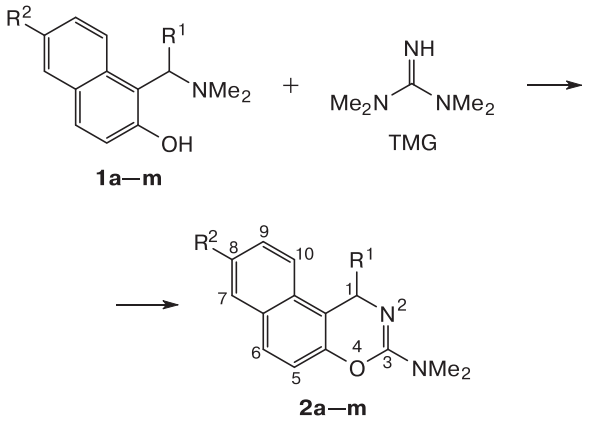
dienes in the design of chromanes,[20,21] and also in the synthesis and functionalization of various nitrogen-containing heterocycles.[22,23] *o*-Quinone methides, electron-deficient dienes, react readily with electron-rich dienophiles under inverse electron demand Diels—Alder conditions. Cycloaddition involving olefins bearing weak electron-donating (alkyl) or electron-withdrawing substituents, with few exceptions, does not occur. While *o*-quinone methides were reacted with various carbodienophiles (vinyl and thiovinyl ethers, furans, ketene acetals, allyl silanes, succinimides, methyl methacrylate, oxazoles, fullerene, arynes, and some others[24]) to give chromanes, the number of examples of [4+2]-cycloadditions between generated *in situ* *o*-quinone methides and imino compounds is limited.[25—29]

First of all, we studied the reaction between 2-naphtholic Mannich bases **1a—m** with TMG (Scheme 2). The reaction was carried out in boiling DMF in the presence of two equivalents of TMG. As a result, a number of *N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]-oxazine-3-amines **2a—m** were obtained, both unsubstituted at the position 1 (R^1 = H) and bearing an aryl substituent, in yields up to 92%. In the last case, the reaction time was generally longer and was 7—10 h. The lowest yields were observed when the aryl substituent had a halogen atom in the *ortho*-position (products **2h**,**i**), which could likely be attributed to steric reasons.

To prepare 2-dimethylamino-4*H*-1,3-benzoxazines, salicylic alcohols **3a—c**, phenolic Mannich bases **3g**,**h**,**i**, and quaternary salts **3d—f**,**j** derived therefrom were used as precursors to benzene *o*-quinone methides (Scheme 3).

Using salicylic alcohols and Mannich bases, the process was also carried out in boiling DMF (method *a*), however, the reaction with quaternary salts **3d—f**,**j** proceeded under milder conditions, namely, in boiling

Scheme 2



Compound	R^1	R^2	Yield (%)
2a	H	H	80
2b	H	Br	73
2c	H	Bu^t	90
2d	H	1-Ad	61
2e	Ph	H	87
2f	4-MeC_6H_4	H	71
2g	4-ClC_6H_4	H	92
2h	2-ClC_6H_4	H	37
2i	2-BrC_6H_4	H	49
2j	4-$MeOC_6H_4$	H	85
2k	2-$MeOC_6H_4$	H	70
2l	3,4,5-$(MeO)_3C_6H_2$	H	72
2m	1-Benzyl-1*H*-imidazol-5-yl	H	62

Reagents and conditions: DMF, reflux for 4—10 h.

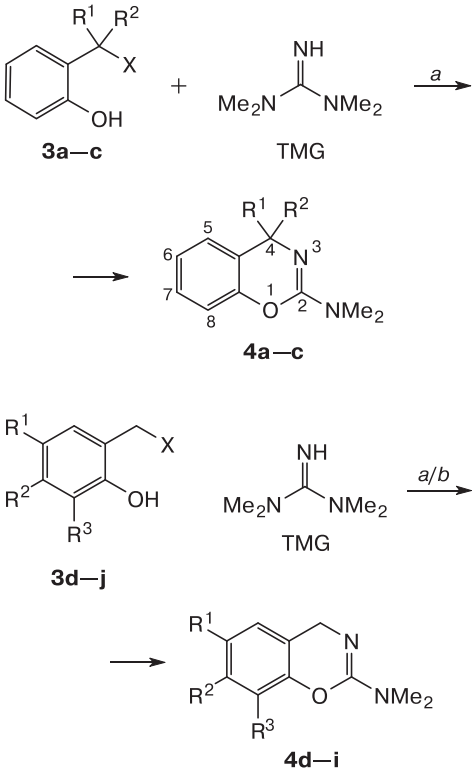
MeCN (method *b*). In this case, product **4i** was prepared in comparable yields both from the phenolic Mannich base **3i** and the quaternary salt **3j** derived therefrom. The reaction of salicylic alcohols with TMG affords the corresponding phenolic Mannich base as a by-product resulting from the addition of the eliminated dimethylamine to *o*-quinone methide. This fact confirms that salicylic alcohols are more effective precursors to *o*-quinone methides than Mannich bases. The reaction also occurs in good yields using sterically loaded precursors to *o*-quinone methides **3b**,**f**,**g**,**h**.

The use of Mannich bases of pyridine (**5**), indole (**7**), and carboline (**9**) series provided the synthesis of novel fused 1,3-oxazines **6**, **8**, **10** (Scheme 4).

Sequential generation of *o*-quinone methides from bis(Mannich bases) **11**, **12** furnishes 1,3-benzoxazines **13** and **14** (Scheme 5).

In the IR spectra of benzoxazines, the most intense absorption band generally corresponds to the C=N vibrations (1657—1682 cm^{-1}). In the ^1H NMR spectra, the protons for dimethylamino moiety appear as singlets in the 2.93—3.04 ppm region. The signals of the 4-positioned methylene group of the oxazine ring are observed at 4.43—4.93 ppm. In the ^{13}C NMR spectra, the carbon

Scheme 3



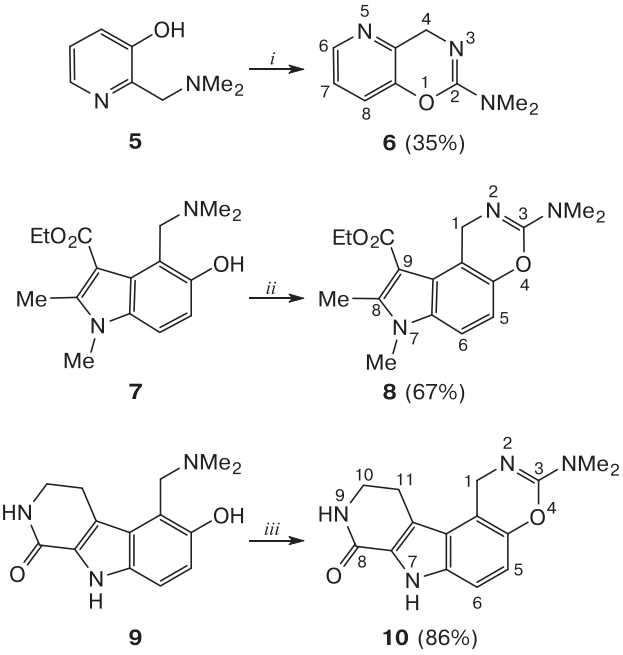
Compound	X	R^1	R^2	R^3	Method	Product	Yield (%)
3a	OH	H	Ph	—	*a*	**4a**	81
3b	OH	Ph	Ph	—	*a*	**4b**	79
3c	OH	H	Pr^i	—	*a*	**4c**	71
3d	$N^+Me_3I^-$	Ph	H	H	*b*	**4d**	43
3e	$N^+Me_3I^-$	1-Ad	H	H	*b*	**4e**	59
3f	$N^+Me_3I^-$	Me	H	1-Ad	*b*	**4f**	84
3g	NMe_2	Bu^t	H	1-Ad	*a*	**4g**	88
3h	NMe_2	Bu^t	H	Bu^t	*a*	**4h**	85
3i	NMe_2	Me	Me	H	*a*	**4i**	69
3j	$N^+Me_3I^-$	Me	Me	H	*b*	**4i**	62

Conditions: *a*. TMG (2 equiv.), DMF; *b*. TMG (2 equiv.), MeCN, reflux.

atoms of dimethylamino and methylene moieties are found at 37.0—38.1 and 42.6—47.2 ppm, respectively. In the case of 4-substituted fused 4*H*-1,3-oxazines, the carbon atom in this position appears at 53.3—65.1 ppm in the ^{13}C NMR spectra, and hydrogen atoms bound to it are observed at 6.10—6.66 ppm in the ^1H NMR spectra. The mass spectra contain intense peaks of the molecular ion and fragment ions $[M - NMe_2]^+$ and $[M - Me_2NCN]^+$.

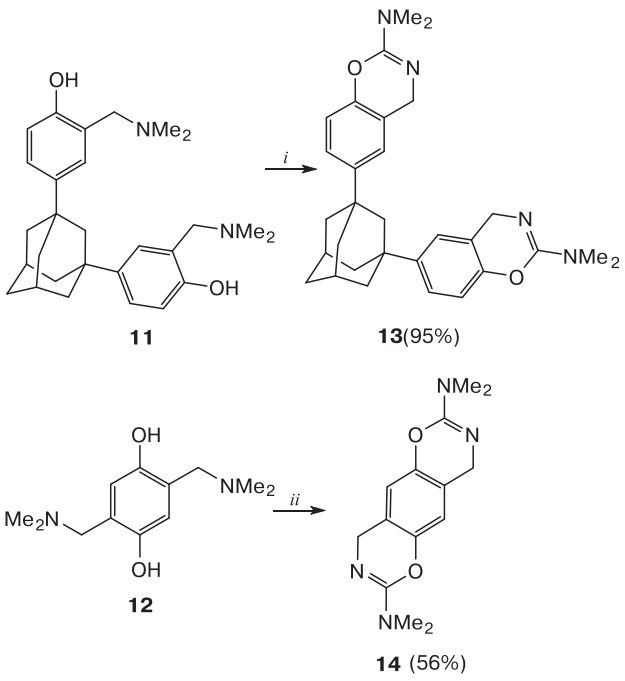
The reaction can be considered as a concerted but asynchronous [4+2]-cycloaddition between the *in situ* generated *o*-quinone methide **A** and TMG as a dienophile (Scheme 6). The initially formed cycloadducts **B**

Scheme 4



Conditions: 2 equiv. TMG, DMF, reflux for 10 h (*i*), 4 h (*ii*) and 1 h (*iii*).

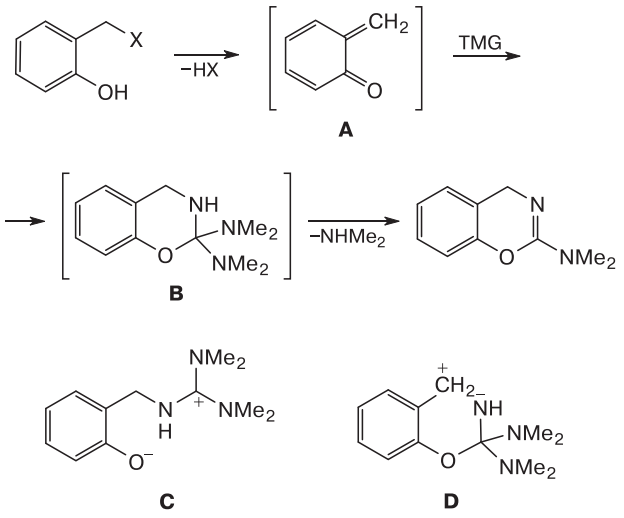
Scheme 5



Reagents and conditions: TMG (4 equiv.), DMF, reflux for 5 h (*i*) and 1 h (*ii*).

are stabilized *via* elimination of dimethylamine to give 2-dimethylamino-4*H*-1,3-benzoxazines. In this case, apparently, the bond is primarily formed between the exocyclic carbon atom of *o*-quinone methide and the imino nitrogen atom rather than between the oxygen and carbon atoms. This is clearly seen in the example of zwitterionic structures **C** and **D**, which are extreme cases when the process becomes unconcerted. In the first case, the positive charge is mesomerically stabilized by three nitrogen atoms, whereas in the second case, an energetically unfavorable amide-type anion is generated. At the same time, zwitterionic intermediates of the type **C** have not been detected (see Scheme 6).

Scheme 6



To conclude, the developed method for the synthesis of fused 2-dimethylamino-4*H*-1,3-oxazines features the ease of implementation, high yields of the products, the use of readily available reagents, and no need for a catalyst. Moreover, the purification of the product is usually achieved through a single recrystallization, the synthesis is easily scalable. This procedure allows the use of substrates bearing bulky substituents to prepare fused 4*H*-1,3-oxazines both unsubstituted in methylene moiety and those containing an aryl substituent in the 4-position of the 1,3-oxazine ring.

Experimental

IR spectra were obtained on a Shimadzu IRAffinity-1 spectrometer for sample pellets in KBr. Mass spectra were recorded on a Thermo Finnigan Trace DSQ spectrometer using the direct sample injection into ion source with ionizing energy of 70 eV. ^{1}H and ^{13}C NMR spectra (400 and 100 MHz respectively), and also DEPT-135 were recorded on a JEOL JNM-ECX400 spectrometer using $SiMe_4$ as an internal standard. Elemental analysis was performed on a automatic Euro Vector EA-3000 CHNS-analyzer. Melting points were measured in open cappillaries on a PTP-M melting point apparatus. Thin layer chromatography was performed on Silufol UV-254 plates, which were visualized with UV and iodine vapors. The starting Mannich bases of phenol and naphthalene series, and salicylic alcohols were prepared according to the known procedures.[22,30,31]

Synthesis of arene-fused 2-dimethylamino-4*H*-1,3-oxazines 2a—m, 4a—c,g,h,i, 6, 8, 10 (general procedure). Method *A*. A mixture of a precursor to *o*-quinone methide (1 mmol, Mannich base or salicylic alcohol) and TMG (2 mmol, 0.23 g, 0.25 mL) in DMF (3 mL) was heated under reflux for 1—10 h in an argon atmosphere. If a precipitate was formed upon cooling, it was filtered off, washed with cold (0 °C) methanol, and purified by recrystallization (Purification method I). Otherwise, the reaction mixture was poured under stirring in the saturated solution of NaCl (10 mL), the precipitate was filtered off, washed with water, dried in air, and purified by recrystallization (Purification method II). If no precipitate formed when poured into NaCl solution, the product was extracted with ethyl acetate, the extract was dried over Na_2SO_4, the solvent was distilled *in vacuo*, and the residue was purified either by recrystallization or by column chromatography followed by recrystallization (Purification method III).

Synthesis of compounds 4d—f,i. Method *B*. A mixture of a quaternary ammonium salt (1 mmol) and TMG (2 mmol, 0.23 g, 0.25 mL) in MeCN (5 mL) was stirred under reflux for 2 h, and kept for 1 h at −30 °C. The precipitate was filtered off, washed with cold (0 °C) MeCN. The precipitate was suspended in CH_2Cl_2 (10 mL), the undissolved TMG iodohydrate was filtered off, the filtrate was washed with water, and dried over Na_2SO_4. After distilling off the solvent, the product was obtained, which was purified by recrystallization from a suitable solvent.

Synthesis of compounds 13 and 14. Method *C*. A mixture of a bis-Mannich base **11** or **12** (1 mmol) and TMG (4 mmol, 0.46 g, 0.50 mL) in DMF (3 mL) was heated under reflux for 1—5 h in an argon atmosphere, then kept for 2 h at —30 °C. The precipitate was filtered off, washed with cold (0 °C) methanol, and purified by recrystallization.

***N*,*N*-Dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2a)** was prepared from the Mannich base **1a**. The reaction time was 4 h. Purification method II. Yield 180 mg (80%), colorless crystals, m.p. 97—98 °C (MeOH). IR, ν/cm^{-1}: 2932, 1680 (C=N), 1518, 1400, 1381, 1362, 1231, 1182, 1088, 928, 881, 820, 804, 768, 748. ^{1}H NMR ($CDCl_3$), δ: 3.04 (s, 6 H, NMe_2); 4.93 (s, 2 H, C(1)H); 7.11 (d, 1 H, C(5)H, ^3J = 8.7 Hz); 7.43 (td, 1 H, CH_{arom}, ^3J = 8.2 Hz, ^3J = 6.9 Hz); 7.53 (ddd, 1 H, CH_{arom}, ^3J = 8.5 Hz, ^3J = 6.9 Hz, ^4J = 1.4 Hz); 7.67 (d, 1 H, C(6)H, ^3J = 8.7 Hz); 7.71 (d, 1 H, CH_{arom}, ^3J = 8.2 Hz); 7.81 (d, 1 H, CH_{arom}, ^3J = 8.5 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.2 (NMe_2); 42.6 (C(1)H_2); 112.8; 116.3 (CH); 122.3 (CH); 124.7 (CH); 126.9 (CH); 128.2 (CH); 128.5 (CH); 130.1; 130.7; 146.9; 150.3. Found (%): C, 74.27; H, 6.20; N, 12.27. $C_{14}H_{14}N_2O$. Calculated (%): C, 74.31; H, 6.24; N, 12.38.

8-Bromo-*N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2b) was prepared from the Mannich base **1b**. The reaction time was 4 h. Purification method I. Yield 223 mg (73%), colorless crystals, m.p. 158—159 °C (DMF—EtOH). IR, ν/cm^{-1}: 2835, 1676 (C=N), 1626, 1585, 1489, 1450, 1398, 1381, 1356, 1281, 1229, 1192, 1165, 1092, 1072, 993, 926, 874, 862, 800. ^{1}H NMR ($CDCl_3$), δ: 2.97 (s, 6 H, NMe_2); 4.82 (s, 2 H, CH_2); 7.05 (d, 1 H, CH_{arom}, ^3J = 8.9 Hz); 7.48 (d, 1 H, CH_{arom}, ^3J = 8.9 Hz); 7.52—7.55 (m, 2 H, CH_{arom}); 7.89 (d, 1 H, C(7)H, ^4J = 1.1 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.1 (NMe_2); 42.6 (CH_2); 113.1; 117.5 (CH); 118.5; 124.0 (CH); 127.2 (CH); 128.6; 130.1 (CH); 130.4 (CH); 131.8; 147.2; 149.9. Found (%): C, 55.18; H, 4.25; N, 9.10. $C_{14}H_{13}BrN_2O$. Calculated (%): C, 55.10; H, 4.29; N, 9.18.

8-(*tert*-Butyl)-*N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2c) was prepared from the Mannich base **1c**. The reaction time was 4 h. Purification method II. Yield 255 mg (90%), colorless crystals, m.p. 125—126 °C (EtOH). IR, ν/cm^{-1}: 2957, 2903, 2868, 1674 (C=N), 1609, 1506, 1452, 1383, 1371, 1362, 1234, 1198, 1173, 1157, 1086, 935, 887, 876, 818, 808, 698, 675. ^{1}H NMR ($CDCl_3$), δ: 1.41 (s, 9 H, Bu^t); 3.01 (s, 6 H, NMe_2); 4.91 (s, 2 H, CH_2); 7.07 (d, 1 H, C(5)H, ^3J = 8.9 Hz); 7.60—7.67 (m, 3 H, C(6)H, C(9)H, C(10)H); 7.73 (d, 1 H, C(7)H, ^4J = 1.4 Hz). ^{13}C NMR ($CDCl_3$), δ: 31.3 ($\underline{Me}_3C$); 34.8 ($Me_3\underline{C}$); 37.2 (NMe_2); 42.8 (CH_2); 112.6; 116.2 (CH); 122.1 (CH); 123.6 (CH); 125.7 (CH); 128.1 (CH); 128.2; 130.7; 146.6; 147.3; 150.2. Found (%): C, 76.57; H, 7.74; N, 9.83. $C_{18}H_{22}N_2O$. Calculated (%): C, 76.56; H, 7.85; N, 9.92.

8-(Adamantan-1-yl)-*N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2d) was prepared from the Mannich base **1d**. The reaction time was 4 h. Purification method I. Yield 220 mg (61%), colorless crystals, m.p. 202—203 °C (dec., EtOH). IR, ν/cm^{-1}: 2905, 2847 (CH_{Ad}), 1678 (C=N), 1508, 1450, 1396, 1387, 1368, 1236, 1217, 1180, 1092, 978, 934, 883, 804, 700, 671. ^{1}H NMR ($CDCl_3$), δ: 1.76—1.84 (m, 6 H, H_2C_{Ad}); 1.98—2.02 (m, 6 H, H_2C_{Ad}); 2.13 (br.s, 3 H, CH_{Ad}); 3.00 (s, 6 H, NMe_2); 4.90 (s, 2 H, CH_2); 7.06 (d, 1 H, C(5)H, ^3J = 8.7 Hz); 7.59—7.68 (m, 4 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 29.0 (3 CH_{Ad}); 36.3 (C_{Ad}); 36.9 (3 H_2C_{Ad}); 37.2 (NMe_2); 42.8 (3 H_2C_{Ad}); 43.2 (C(1)H_2); 112.5; 116.1 (CH); 122.0 (CH); 123.6 (CH); 125.1 (CH); 128.2 (CH); 128.3; 130.8; 146.6; 147.5; 150.3. Found (%): C, 79.88; H, 7.90; N, 7.65. $C_{24}H_{28}N_2O$. Calculated (%): C, 79.96; H, 7.83; N, 7.77.

***N*,*N*-Dimethyl-1-phenyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2e)** was prepared from the Mannich base **1e**. The reaction time was 8 h. Purification method II. Yield 263 mg (87%), colorless crystals, m.p. 141—142 °C (EtOH; Ref. 18: m.p. 141—143 °C). IR, ν/cm^{-1}: 3059, 3024, 2922, 1672 (C=N), 1599, 1516, 1491, 1452, 1435, 1387, 1354, 1236, 1196, 1175, 1063, 833, 812, 745, 696. ^{1}H NMR ($CDCl_3$), δ: 3.00 (s, 6 H, NMe_2); 6.21 (s, 1 H, C(1)H); 7.15 (tt, 1 H, CH_{arom}, ^3J = 7.3 Hz, ^4J = 1.4 Hz); 7.21—7.25 (m, 3 H, CH_{arom}); 7.29—7.32 (m, 2 H, CH_{arom}); 7.34—7.43 (m, 2 H, CH_{arom}); 7.74—7.80 (m, 3 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.3 (NMe_2); 56.4 (C(1)H); 116.5 (CH); 116.7; 123.2 (CH); 124.6 (CH); 126.9 (CH); 127.0 (CH); 127.4 (2 CH_{Ph}); 128.6 (CH); 128.6 (2 CH_{Ph}); 128.9 (CH); 130.4; 131.1; 145.4; 147.3; 150.7. Found (%): C, 79.38; H, 6.09; N, 9.17. $C_{20}H_{18}N_2O$. Calculated (%): C, 79.44; H, 6.00; N, 9.26.

***N*,*N*-Dimethyl-1-(*p*-tolyl)-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2f)** was prepared from the Mannich base **1f**. The reaction time was 8 h. Purification method II. Yield 225 mg (71%), colorless crystals, m.p. 113—114 °C (DMF—MeOH). IR, ν/cm^{-1}: 2916, 2868, 1663 (C=N), 1601, 1514, 1400, 1391, 1236, 1209, 1175, 1092, 930, 895, 808, 743, 698. ^{1}H NMR ($CDCl_3$), δ: 2.27 (s, 3 H, Me); 3.01 (s, 6 H, NMe_2); 6.22 (s, 1 H, C(1)H); 7.05 (d, 2 H, CH_{arom}, ^3J = 8.0 Hz); 7.22 (d, 2 H, CH_{arom}, ^3J = 8.0 Hz); 7.24 (d, 1 H, CH_{arom}, ^3J = 8.7 Hz); 7.37 (ddd, 1 H, CH_{arom}, ^3J = 8.2 Hz, ^3J = 6.9 Hz, ^4J = 1.2 Hz); 7.42 (ddd, 1 H, CH_{arom}, ^3J = 8.0 Hz, ^3J = 6.9 Hz, ^4J = 1.4 Hz); 7.75—7.81 (m, 3 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 21.2 (Me); 37.3 (NMe_2); 56.1 (C(1)H); 116.5 (CH); 117.0; 123.2 (CH); 124.6 (CH); 127.0 (CH); 127.3 (2 CH); 128.6 (CH); 128.8 (CH); 129.3 (2 CH); 130.4; 131.1; 136.5; 142.6; 147.3; 150.6. Found (%): C, 79.66; H, 6.29; N, 8.73. $C_{21}H_{20}N_2O$. Calculated (%): C, 79.72; H, 6.37; N, 8.85.

***N*,*N*-Dimethyl-1-(4-chlorophenyl)-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2g)** was prepared from the Mannich base **1g**. The reaction time was 10 h. Purification method II. Yield 310 mg (92%), colorless crystals, m.p. 134—135 °C (EtOH; Ref. 18: m.p. 154—157 °C). IR, ν/cm^{-1}: 1682 (C=N), 1516, 1489, 1435, 1383, 1352, 1231, 1192, 1174, 1165, 1088, 1060, 1014, 901, 844, 823, 810, 740. ^{1}H NMR ($CDCl_3$), δ: 3.00 (s, 6 H, NMe_2); 6.18 (s, 1 H, C(1)H); 7.18—7.24 (m, 5 H, CH_{arom}); 7.36—7.44 (m, 2 H, CH_{arom}); 7.68 (d, 1 H, CH_{arom}, ^3J = 8.2 Hz); 7.77—7.81 (m, 2 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.2 (NMe_2); 55.8 (C(1)H); 116.1; 116.5 (CH); 123.0 (CH); 124.7 (CH); 127.1 (CH); 128.7 (CH); 128.8 (4 CH); 129.1 (CH); 130.3; 131.1; 132.6; 144.0; 147.3; 150.7. Found (%): C, 71.22; H, 5.01; N, 8.21. $C_{20}H_{17}ClN_2O$. Calculated (%): C, 71.32; H, 5.09; N, 8.32.

***N*,*N*-Dimethyl-1-(2-chlorophenyl)-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2h)** was prepared from the Mannich base **1h**. The reaction time was 10 h. Purification method II. Yield 125 mg (37%), colorless crystals, m.p. 169—170 °C (EtOH). IR, ν/cm^{-1}: 3059, 2924, 1670 (C=N), 1626, 1516, 1489, 1458, 1437, 1398, 1389, 1250, 1234, 1192, 1179, 1036, 831, 810, 756, 746, 702. ^{1}H NMR ($CDCl_3$), δ: 2.98 (s, 6 H, NMe_2); 6.66 (s, 1 H, C(1)H); 6.86 (d, 1 H, CH_{arom}, ^3J = 7.6 Hz); 7.00 (t, 1 H, CH_{arom}, ^3J = 7.4 Hz); 7.08 (t, 1 H, CH_{arom}, ^3J = 7.4 Hz); 7.24 (d, 1 H, CH_{arom}, ^3J = 8.7 Hz); 7.33—7.41 (m, 3 H, CH_{arom}); 7.61 (d, 1 H, CH_{arom}, ^3J = 8.0 Hz); 7.78 (d, 2 H, CH_{arom}, ^3J = 8.5 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.1 (NMe_2); 53.3 (C(1)H); 115.6; 116.4 (CH); 123.2 (CH); 124.7 (CH); 127.2 (CH); 127.4 (CH); 128.1 (CH); 128.5 (CH); 129.2 (CH); 129.4 (CH); 129.8 (CH); 130.3; 131.1; 132.9; 142.6; 147.8; 150.3. Found (%): C, 71.21; H, 5.01; N, 8.41. $C_{20}H_{17}ClN_2O$. Calculated (%): C, 71.32; H, 5.09; N, 8.32.

1-(2-Bromophenyl)-*N*,*N*-dimethyl-1*H*-naphtho[1,2-*e*][1,3]oxazin-3-amine (2i) was prepared from the Mannich base **1i**. The reaction time was 7 h. Purification method II. Yield 185 mg (49%), colorless crystals, m.p. 166—167 °C (EtOH). IR, ν/cm^{-1}: 1669 (C=N), 1605, 1516, 1464, 1437,

1383, 1352, 1314, 1227, 1190, 1178, 1163, 1092, 1063, 1024, 895, 829, 800, 773, 743. ^{1}H NMR ($CDCl_3$), δ: 2.98 (s, 6 H, NMe_2); 6.63 (d, 1 H, C(1)H, ^4J = 2.1 Hz); 6.82 (tt, 1 H, CH_{arom}, ^3J = 7.6 Hz, ^4J = 2.3 Hz); 6.97—7.05 (m, 2 H, CH_{arom}); 7.25 (d, 1 H, CH_{arom}, ^3J = 8.9 Hz); 7.34—7.42 (m, 2 H, CH_{arom}); 7.59—7.62 (m, 2 H, CH_{arom}); 7.78—7.81 (m, 2 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.1 (NMe_2); 55.9 (C(1)H); 115.7; 116.4 (CH); 123.4 (CH); 123.5; 124.7 (CH); 127.2 (CH); 128.1 (CH); 128.4 (CH); 128.5 (CH); 129.2 (CH); 129.4 (CH); 130.3; 131.1; 133.1 (CH); 144.1; 147.8; 150.2. Found (%): C, 62.95; H, 4.53; N, 7.29. $C_{20}H_{17}BrN_2O$. Calculated (%): C, 63.00; H, 4.49; N, 7.35.

***N,N*-Dimethyl-1-(4-methoxyphenyl)-1*H*-naphtho[1,2-*e*]-[1,3]oxazin-3-amine (2j)** was prepared from the Mannich base **1j**. The reaction time was 8 h. Purification method II. Yield 285 mg (85%), colorless crystals, m.p. 190—191 °C (EtOH; Ref. 18: m.p. 162—166 °C). IR, ν/cm^{-1}: 2931, 1674 (C=N), 1609, 1510, 1466, 1387, 1302, 1236, 1175, 1030, 818, 746. ^{1}H NMR ($CDCl_3$), δ: 2.99 (s, 6 H, NMe_2); 3.72 (s, 3 H, MeO); 6.16 (s, 1 H, C(1)H); 6.76 (d, 2 H, $CH_{MeOC_6H_4}$, ^3J = 8.7 Hz); 7.21 (d, 2 H, $CH_{MeOC_6H_4}$, ^3J = 8.7 Hz); 7.22 (d, 1 H, C(5)H, ^3J = 8.7 Hz); 7.34—7.43 (m, 2 H, CH_{arom}); 7.74 (d, 1 H, CH_{arom}, ^3J = 7.3 Hz); 7.76 (d, 1 H, CH_{arom}, ^3J = 8.7 Hz); 7.79 (d, 1 H, CH_{arom}, ^3J = 7.8 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.3 (NMe_2); 55.2 (C(1)H); 55.7 (MeO); 113.9 (2 CH); 116.5 (CH); 117.0; 123.2 (CH); 124.6 (CH); 126.9 (CH); 128.4 (2 CH); 128.6 (CH); 128.8 (CH); 130.4; 131.1; 137.9; 147.2; 150.6; 158.5. Found (%): C, 75.91; H, 6.02; N, 8.37. $C_{21}H_{20}N_2O_2$. Calculated (%): C, 75.88; H, 6.06; N, 8.43.

***N,N*-Dimethyl-1-(2-methoxyphenyl)-1*H*-naphtho[1,2-*e*]-[1,3]oxazin-3-amine (2k)** was prepared from the Mannich base **1k**. The reaction time was 7 h. Purification method II. Yield 232 mg (70%), colorless crystals, m.p. 137—138 °C (EtOH). IR, ν/cm^{-1}: 1667 (C=N), 1601, 1489, 1462, 1435, 1389, 1354, 1234, 1165, 1107, 1088, 1049, 1026, 926, 903, 853, 833, 818, 748. ^{1}H NMR ($CDCl_3$), δ: 2.98 (s, 6 H, NMe_2); 3.98 (s, 3 H, OMe); 6.65 (s, 1 H, C(1)H); 6.75 (t, 1 H, CH_{arom}, ^3J = 7.4 Hz); 6.90 (d, 1 H, CH_{arom}, ^3J = 8.0 Hz); 6.98 (dd, 1 H, CH_{arom}, ^3J = 7.8 Hz, ^4J = 1.6 Hz); 7.12 (ddd, 1 H, ^3J = 9.0 Hz, ^3J = 8.0 Hz, ^4J = 1.6 Hz); 7.22 (d, 1 H, CH_{arom}, ^3J = 9.0 Hz); 7.30—7.39 (m, 2 H, CH_{arom}); 7.71—7.76 (m, 2 H, CH_{arom}); 7.80 (d, 1 H, CH_{arom}, J = 8.3 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.3 (NMe_2); 49.7 (OMe); 55.9 (C(1)H); 111.1 (CH); 116.3 (CH); 117.1; 121.1 (CH); 123.4 (CH); 124.4 (CH); 126.8 (CH); 128.1 (CH); 128.4 (CH); 128.5 (CH); 129.0 (CH); 130.5; 131.0; 134.2; 147.4; 150.8; 156.1. Found (%): C, 75.83; H, 5.99; N, 8.36. $C_{21}H_{20}N_2O_2$. Calculated (%): C, 75.88; H, 6.06; N, 8.43.

***N,N*-Dimethyl-1-(3,4,5-trimethoxyphenyl)-1*H*-naphtho-[1,2-*e*][1,3]oxazin-3-amine (2l)** was prepared from the Mannich base **1l**. The reaction time was 8 h. Purification method I. Yield 283 mg (72%), colorless crystals, m.p. 160—161 °C (EtOH). IR, ν/cm^{-1}: 1657 (C=N), 1589, 1504, 1456, 1433, 1419, 1379, 1319, 1227, 1179, 1169, 1126, 1088, 1009, 989, 926, 889, 818, 781, 743, 706. ^{1}H NMR ($CDCl_3$), δ: 3.01 (s, 6 H, NMe_2); 3.71 (s, 6 H, 2 MeO); 3.77 (s, 3 H, MeO); 6.14 (s, 1 H, C(1)H); 6.51 (s, 2 H, $CH_{3,4,5\text{-}(MeO)_3C_6H_2}$); 7.23 (d, 1 H, C(5)H, ^3J = 9.0 Hz); 7.36—7.40 (m, 1 H, CH_{arom}); 7.43 (ddd, 1 H, CH_{arom}, ^3J = 8.2 Hz, ^3J = 6.9 Hz, ^4J = 1.4 Hz); 7.74 (d, 1 H, CH_{arom}, ^3J = 8.0 Hz); 7.76—7.81 (m, 2 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.3 (NMe_2); 56.1 (2 MeO); 56.5 (MeO); 60.8 (C(1)H); 104.5 (2 CH); 116.4 (CH); 116.5; 123.2 (CH); 124.7 (CH); 127.0 (CH); 128.6 (CH); 129.0 (CH); 130.5; 131.1; 136.9; 141.1; 147.4; 150.8; 153.2 (2 C). Found (%): C, 70.30; H, 6.07; N, 7.03. $C_{23}H_{24}N_2O_4$. Calculated (%): C, 70.39; H, 6.16; N, 7.14.

1-(1-Benzyl-1*H*-imidazol-5-yl)-*N,N*-dimethyl-1*H*-naphtho-[1,2-*e*][1,3]oxazin-3-amine (2m) was prepared from the Mannich base **1m**. The reaction time was 7 h. Purification method III (eluent — dichloroethane→dichloroethane/MeOH, 10 : 1). Yield 237 mg (62%), colorless crystals, m.p. 180—181 °C (EtOH). IR, ν/cm^{-1}: 1665 (C=N), 1601, 1493, 1483, 1452, 1437, 1391, 1356, 1263, 1233, 1186, 1171, 1107, 926, 893, 853, 829, 822, 750. ^{1}H NMR ($CDCl_3$), δ: 2.95 (s, 6 H, NMe_2); 5.42 (d, 1 H, C$\underline{H}_2$Ph, ^2J = 15.8 Hz); 5.73 (d, 1 H, C$\underline{H}_2$Ph, ^2J = 15.8 Hz); 6.00 and 6.10 (both s, 1 H each, C(1)H, C(4)$H_{imidazole}$); 7.07 (d, 1 H, CH_{arom}, ^3J = 8.2 Hz); 7.17 (d, 1 H, CH_{arom}, ^3J = 9.0 Hz); 7.23—7.28 (m 3 H, CH_{arom}); 7.32—7.43 (m, 4 H, CH_{arom}); 7.51 (s, 1 H, C(2)$H_{imidazole}$); 7.76 (d, 2 H, CH_{arom}, ^3J = 8.7 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.0 (NMe_2); 46.8 (C(1)H); 49.1 (CH_2); 113.7; 116.2 (CH); 122.9 (CH); 124.7 (CH); 127.0 (CH); 127.2 (2 CH); 127.7 (CH); 128.1 (CH); 128.4 (CH); 129.0 (2 CH); 129.4 (CH); 130.1; 130.9; 134.2; 137.2; 138.6 (CH); 147.8; 151.4. Found (%): C, 75.28; H, 5.90; N, 14.59. $C_{24}H_{22}N_4O$. Calculated (%): C, 75.37; H, 5.80; N, 14.65.

***N,N*-Dimethyl-4-phenyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4a)** was prepared from salicylic alcohol **3a**. The reaction time was 10 h. Purification method II. Yield 205 mg (81%), colorless crystals, m.p. 71—72 °C (EtOH). IR, ν/cm^{-1}: 3034, 2949, 2922, 2876, 1659 (C=N), 1599, 1589, 1485, 1456, 1387, 1325, 1267, 1221, 1182, 1175, 1155, 1088, 1070, 968, 860, 758, 696. ^{1}H NMR ($CDCl_3$), δ: 3.03 (s, 6 H, NMe_2); 5.62 (s, 1 H, C(4)H); 6.95—7.03 (m, 3 H, CH_{arom}); 7.14—7.24 (m, 2 H, CH_{arom}); 7.28—7.31 (m, 4 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.3 (NMe_2); 58.5 (C(4)H); 115.3 (CH); 124.2 (CH); 124.9; 127.0 (CH); 127.2 (3 CH); 127.8 (CH); 128.5 (2 CH); 145.8; 149.2; 150.9. Found (%): C, 76.10; H, 6.45; N, 11.01. $C_{16}H_{16}N_2O$. Calculated (%): C, 76.16; H, 6.39; N, 11.10.

***N,N*-Dimethyl-4,4-diphenyl-4*H*-1,3-benzo[*e*][1,3]ox-azin-2-amine (4b)** was prepared from salicylic alcohol **3b**. The reaction time was 10 h. Purification method II. Yield 260 mg (79%), colorless crystals, m.p. 130—131 °C (EtOH). IR, ν/cm^{-1}: 3078, 3020, 2951, 1665 (C=N), 1477, 1456, 1447, 1383, 1281, 1217, 1169, 1148, 1059, 972, 758, 702. ^{1}H NMR($CDCl_3$), δ: 3.03 (s, 6 H, NMe_2); 6.77 (dd, 1 H, CH_{arom}, ^3J = 7.9 Hz, ^4J = 1.5 Hz); 6.98—7.03 (m, 2 H, CH_{arom}); 7.18—7.27 (m, 11 H, CH_{arom}). ^{13}C NMR ($CDCl_3$), δ: 37.4 (NMe_2); 65.1 (C(4)); 115.4 (CH); 123.6 (CH); 126.5 (2 CH_{Ph}); 127.7 (4 CH_{Ph}); 127.9 (CH); 128.5 (4 CH_{Ph}); 128.8; 128.9 (CH); 148.4 (2 C_{Ph}); 149.8; 151.1. Found (%): C, 80.40; H, 6.12; N, 8.45. $C_{22}H_{20}N_2O$. Calculated (%): C, 80.46; H, 6.14; N, 8.53.

***N,N*-Dimethyl-4-isopropyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4c)** was prepared from salicylic alcohol **3c**. The reac-

tion time was 10 h. Purification method III (eluent — $CHCl_3$). Yield 155 mg (71%), light-yellow oil. IR, ν/cm^{-1} (thin film): 2959, 2928, 2870, 1670 (C=N), 1481, 1458, 1381, 1227, 1196, 1169, 756. ^{1}H NMR ($CDCl_3$), δ: 0.78 (d, 3 H, Me, ^3J = 6.9 Hz); 0.93 (d, 3 H, Me, ^3J = 6.9 Hz); 1.85—1.93 (m, 1 H, C<u>H</u>Me$_2$); 2.95 (s, 6 H, NMe$_2$); 4.31 (d, 1 H, C(4)H, ^3J = 4.1 Hz); 6.88 (d, 1 H, C(8)H, ^3J = 7.8 Hz); 7.00—7.04 (m, 2 H, CH$_{arom}$); 7.12—7.17 (m, 1 H, CH$_{arom}$). ^{13}C NMR ($CDCl_3$), δ: 17.3 (Me); 18.8 (Me); 36.9 (<u>C</u>HMe$_2$); 37.2 (NMe$_2$); 60.0 (C(4)H); 114.9 (CH); 123.7 (CH); 124.4; 126.9 (CH); 127.3 (CH); 150.2; 150.8. MS (EI, 70 eV), *m/z* (I_{rel} (%)): 175 [M – C_3H_7]$^+$ (100), 159 (2), 132 (6), 104 (4), 91 (4), 77 (4). Found (%): C, 71.60; H, 8.36; N, 12.74. $C_{13}H_{18}N_2O$. Calculated (%): C, 71.53; H, 8.31; N, 12.83.

***N*,*N*-Dimethyl-6-phenyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4d)** was prepared from the quaternary salt **3d**. Yield 108 mg (43%), colorless crystals, m.p. 74—75 °C (hexane). IR, ν/cm^{-1}: 2916, 2839, 1672 (C=N), 1614, 1477, 1450, 1381, 1304, 1233, 1173, 1076, 1020, 961, 872, 824, 785, 758, 698. ^{1}H NMR ($CDCl_3$), δ: 2.97 (s, 6 H, NMe$_2$); 4.57 (s, 2 H, CH_2); 6.96 (d, 1 H, C(8)H, ^3J = 8.5 Hz); 7.26—7.28 (m, 1 H, C(5)H); 7.29—7.34 (m, 1 H, CH$_{arom}$); 7.38—7.43 (m, 3 H, CH$_{arom}$); 7.51—7.54 (m, 2 H, CH$_{arom}$). ^{13}C NMR ($CDCl_3$), δ: 37.2 (NMe$_2$); 45.1 (CH_2); 115.5 (CH); 121.9; 124.6 (CH); 126.3 (CH); 127.0 (2 CH$_{Ph}$); 127.2 (CH); 128.9 (2 CH$_{Ph}$); 137.2; 140.6; 149.7; 151.0. Found (%): C, 76.22; H, 6.34; N, 11.04. $C_{16}H_{16}N_2O$. Calculated (%): C, 76.16; H, 6.39; N, 11.10.

6-(Adamantan-1-yl)-*N*,*N*-dimethyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4e) was prepared from the quaternary salt **3e**. Yield 183 mg (59%), colorless crystals, m.p. 162—163 °C (EtOH). IR, ν/cm^{-1}: 2903, 2847 (CH$_{Ad}$), 1665 (C=N), 1599, 1503, 1479, 1450, 1387, 1342, 1315, 1252, 1217, 1169, 1101, 1076, 1038, 962, 872, 841, 824, 804, 704. ^{1}H NMR ($CDCl_3$), δ: 1.70—7.79 (m, 6 H, H_2C_{Ad}); 1.86—1.87 (m, 6 H, H_2C_{Ad}); 2.07 (br.s, 3 H, CH$_{Ad}$); 2.93 (s, 6 H, NMe$_2$); 4.49 (s, 2 H, CH_2); 6.83 (d, 1 H, C(8)H, ^3J = 8.5 Hz); 7.01 (d, 1 H, C(5)H, ^4J = 2.3 Hz); 7.15 (dd, 1 H, C(7)H, ^3J = 8.5 Hz, ^4J = 2.3 Hz). ^{13}C NMR ($CDCl_3$), δ: 29.0 (3 CH$_{Ad}$); 35.9 (C$_{Ad}$); 36.8 (3 H_2C_{Ad}); 37.2 (NMe$_2$); 43.4 (3 H_2C_{Ad}); 45.4 (C(4)H_2); 114.6 (CH); 121.0; 122.3 (CH); 123.9 (CH); 147.4; 148.0; 151.3. Found (%): C, 77.30; H, 8.41; N, 8.95. $C_{20}H_{26}N_2O$. Calculated (%): C, 77.38; H, 8.44; N, 9.02.

8-(Adamantan-1-yl)-*N*,*N*,6-trimethyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4f) was prepared from the quaternary salt **3f**. Yield 273 mg (84%), colorless crystals, m.p. 167—168 °C (EtOH). IR, ν/cm^{-1}: 2901, 2849 (CH$_{Ad}$), 1667 (C=N), 1605, 1452, 1383, 1281, 1229, 1202, 1173, 1152, 1088, 964, 860, 802, 704. ^{1}H NMR ($CDCl_3$), δ: 1.77 (br.s, 6 H, H_2C_{Ad}); 2.10 (br.s, 9 H, H_2C_{Ad}, CH$_{Ad}$); 2.26 (s, 3 H, Me); 3.03 (s, 6 H, NMe$_2$); 4.48 (s, 2 H, CH_2); 6.68 (s, 1 H, CH$_{arom}$); 6.90 (s, 1 H, CH$_{arom}$). ^{13}C NMR ($CDCl_3$), δ: 21.1 (Me); 29.0 (3 CH$_{Ad}$); 36.6 (C$_{Ad}$); 37.0 (3 H_2C_{Ad}); 38.0 (NMe$_2$); 40.6 (3 H_2C_{Ad}); 45.4 (CH_2(4)); 120.8; 124.2 (CH); 125.8 (CH); 132.8; 136.3; 146.8; 151.0. Found (%): C, 77.65; H, 8.64; N, 8.55. $C_{21}H_{28}N_2O$. Calculated (%): C, 77.74; H, 8.70; N, 8.63.

8-(Adamantan-1-yl)-6-(*tert*-butyl)-*N*,*N*-dimethyl-4*H*-1,3-benzo[*e*][1,3]oxazin-2-amine (4g) was prepared from the Mannich base **3g**. The reaction time was 8 h. Purification method II. Yield 323 mg (88%), colorless crystals, m.p. 205—207 °C (MeOH). IR, ν/cm^{-1}: 2905, 2851 (CH$_{Ad}$), 1670 (C=N), 1601, 1477, 1450, 1381, 1281, 1169, 1080, 872. ^{1}H NMR ($CDCl_3$), δ: 1.28 (s, 9 H, Bu^t); 1.77 (br.s, 6 H, H_2C_{Ad}); 2.10 (br.s, 3 H, CH$_{Ad}$); 2.12 (br.s, 6 H, H_2C_{Ad}); 3.03 (s, 6 H, NMe$_2$); 4.52 (s, 2 H, CH_2); 6.86 (d, 1 H, CH$_{arom}$, ^4J = 2.3 Hz); 7.13 (d, 1 H, CH$_{arom}$, ^4J = 2.3 Hz). ^{13}C NMR ($CDCl_3$), δ: 29.1 (3 CH$_{Ad}$); 31.6 (C<u>Me</u>$_3$); 34.6; 36.9; 37.1 (3 H_2C_{Ad}); 38.1 (NMe$_2$); 40.7 (3 H_2C_{Ad}); 45.8 (C(4)H_2); 120.3; 120.6 (CH); 122.2 (CH); 135.9; 146.1; 146.8; 151.0. MS (EI, 70 eV), *m/z* (I_{rel} (%)): 366 [M]$^+$ (82), 365 [M – H]$^+$ (15), 296 [M – Me_2NCN]$^+$ (24), 281 [M$^+$ – Me_2NCN – Me]$^+$ (100), 239 [M – Me_2NCN – CMe_3]$^+$ (54), 231 [M – Ad]$^+$ (17), 71 (8), 57 [CMe_3]$^+$ (6). Found (%): C, 78.71; H, 9.30; N, 7.72. $C_{24}H_{34}N_2O$. Calculated (%): C, 78.64; H, 9.35; N, 7.64.

6,8-Di(*tert*-butyl)-*N*,*N*-dimethyl-4*H*-1,3-benzo[*e*][1,3]-oxazin-2-amine (4h) was prepared from the Mannich base **3h**. The reaction time was 4 h. Purification method II. Yield 245 mg (85%), colorless crystals, m.p. 67—68 °C (CCl_4—hexane). IR, ν/cm^{-1}: 2967, 2909, 2870, 1678 (C=N), 1477, 1377, 1265, 1223, 1204, 1169, 1084, 968, 876. ^{1}H NMR ($CDCl_3$), δ: 1.28 (s, 9 H, Bu^t); 1.42 (s, 9 H, Bu^t); 3.00 (s, 6 H, NMe$_2$); 4.52 (s, 2 H, CH_2); 6.88 (d, 1 H, CH$_{arom}$, ^4J = 2.3 Hz); 7.18 (d, 1 H, CH$_{arom}$, ^4J = 2.3 Hz). ^{13}C NMR ($CDCl_3$), δ: 29.9 (C<u>Me</u>$_3$); 31.6 (C<u>Me</u>$_3$); 34.6 (<u>C</u>Me$_3$); 34.7 (<u>C</u>Me$_3$); 37.8 (NMe$_2$); 45.7 (CH_2); 120.4; 120.7 (CH); 122.1 (CH); 135.4; 146.0; 146.5; 151.0. MS (EI, 70 eV), *m/z* (I_{rel} (%)): 288 [M]$^+$ (42), 287 [M – H]$^+$ (34), 246 (8), 231 [M – CMe_3]$^+$ (12), 218 [M – Me_2NCN]$^+$ (9), 203 [M – Me_2NCN – Me]$^+$ (100), 187 [M – CMe_3 – NMe_2]$^+$ (4), 162 (14), 161 [M – Me_2NCN – – CMe_3]$^+$ (27), 57 [CMe_3]$^+$ (10). Found (%): C, 75.04; H, 9.83; N, 9.65. $C_{18}H_{28}N_2O$. Calculated (%): C, 74.96; H, 9.78; N, 9.71.

***N*,*N*,6,7-Tetramethyl-4*H*-benzo[*e*][1,3]oxazin-2-amine (4i)** was prepared from the Mannich base **3i**. The reaction time was 10 ч. Purification method II. Yield 140 mg (69%). Prepared from the quaternary salt **3j**. Yield 125 mg (62%). Colorless crystals, m.p. 82—83 °C (hexane; Ref. 32: m.p. 82—83 °C). IR, ν/cm^{-1}: 2851, 1674 (C=N), 1504, 1487, 1462, 1450, 1389, 1373, 1269, 1254, 1202, 1175, 1099, 959, 880, 866. ^{1}H NMR ($CDCl_3$), δ: 2.18 (s, 3 H, Me); 2.20 (s, 3 H, Me); 2.93 (s, 6 H, NMe$_2$); 4.43 (s, 2 H, CH_2); 6.68 (s, 1 H, CH$_{arom}$); 6.77 (s, 1 H, CH$_{arom}$). ^{13}C NMR ($CDCl_3$), δ: 19.1 (Me); 19.6 (Me); 37.2 (NMe$_2$); 44.7 (CH_2(4)); 116.0 (CH); 118.5; 126.6 (CH); 132.0; 135.8; 148.1; 151.2. MS, *m/z* (I_{rel} (%)): 204 [M]$^+$ (82), 203 [M – H]$^+$ (78), 190 (10), 160 [M – Me_2N]$^+$ (14), 134 [M – Me_2NCN]$^+$ (48), 106 [M – Me_2NCN – CO]$^+$ (100), 91 [C_7H_7]$^+$ (43). Found (%): C, 70.60; H, 7.92; N, 13.80. $C_{12}H_{16}N_2O$. Calculated (%): C, 70.56; H, 7.90; N, 13.71.

***N*,*N*-Dimethyl-4*H*-pyrido[2,3-*e*][1,3]oxazin-2-amine (6)** was prepared from the Mannich base **5**. The reaction time was 10 h. Purification method III. After distillation of ethyl acetate the product was immediately recrystallized from water and then from aqueous methanol. Yield 62 mg (35%), colorless crystals, which darkens upon storage, m.p. 54—55 °C. IR, ν/cm^{-1}: 2926, 1676 (C=N), 1449, 1393, 1260,

1190, 1171, 1080, 961, 866, 810, 719. ^{1}H NMR ($CDCl_3$), δ: 2.96 (s, 6 H, NMe_2); 4.62 (s, 2 H, CH_2); 7.11 (dd, 1 H, C(7)H, ^3J = 8.2 Hz, ^3J = 4.6 Hz); 7.15 (dd, 1 H, C(8)H, ^3J = 8.2 Hz, ^4J = 1.4 Hz); 8.27 (dd, 1 H, C(6)H, ^3J = 4.6 Hz, ^4J = 1.4 Hz). ^{13}C NMR ($CDCl_3$), δ: 37.5 (NMe_2); 47.2 (CH_2); 122.2 (CH); 122.8 (CH); 143.2; 145.2 (CH); 146.3; 149.2. Found (%): C, 60.92; H, 6.33; N, 23.61. $C_9H_{11}N_3O$. Calculated (%): C, 61.00; H, 6.26; N, 23.71.

Ethyl 3-dimethylamino-7,8-dimethyl-1,7-dihydro[1,3]-oxazino[5,6-*e*]indole-9-carboxylate (8) was prepared from the Mannich base **7**. The reaction time was 4 h. Purification method I. Yield 210 mg (67%), colorless crystals, m.p. 204—205 °C (EtOH). IR, ν/cm^{-1}: 2978, 2928, 1695 (C=O), 1672 (C=N), 1510, 1483, 1450, 1433, 1412, 1393, 1310, 1236, 1190, 1152, 1086, 1026, 922, 814, 783. ^{1}H NMR ($CDCl_3$), δ: 1.39 (t, 3 H, $CH_2C\underline{H}_3$, ^3J = 7.1 Hz); 2.63 (s, 3 H, CH_3); 2.97 (s, 6 H, NMe_2); 3.63 (s, 3 H, MeN); 4.36 (q, 2 H, $C\underline{H}_2CH_3$, ^3J = 7.1 Hz); 4.89 (s, 2 H, CH_2); 6.82 and 7.07 (both d, 1 H each, C(5)H, C(6)H, ^3J = 8.7 Hz). ^{13}C NMR ($CDCl_3$), δ: 12.2 (Me); 14.7 (Me); 29.9 (NMe); 37.2 (NMe_2); 45.2 (CH_2(1)); 60.0 (CH_2O); 105.7 (C); 108.1 (CH); 111.1 (CH); 113.5; 122.2; 133.7; 144.6; 145.6; 151.5; 166.0 (C=O). Found (%): C, 67.69; H, 6.67; N, 13.25. $C_{17}H_{21}N_3O_3$. Calculated (%): C, 67.74; H, 6.71; N, 13.32.

3-Dimethylamino-7,9,10,11-tetrahydro[1,3]oxazino[5,6-*e*]-pyrido[3,4-*b*]indol-8(1*H*)-one (10) was prepared from the Mannich base **9**. The reaction time was 1 h. Purification method I. Yield 245 mg (86%), colorless crystals, m.p. 274—275 °C (EtOH). IR, ν/cm^{-1}: 3300—3100 (NH), 1684, 1655 (C=O, C=N), 1541, 1501, 1458, 1437, 1389, 1379, 1362, 1344, 1304, 1288, 1219, 1182, 1161, 1088, 907, 797. ^{1}H NMR (DMSO-d_6), δ: 2.85 (s, 6 H, NMe_2); 3.00 (t, 2 H, CH_2, ^3J = 6.9 Hz); 3.44 (td, 2 H, CH_2, ^3J = 6.9 Hz, ^4J = 2.3 Hz); 4.74 (s, 2 H, C(1)H); 6.83 and 7.17 (both d, 1 H each, C(5)H, C(6)H, ^3J = 8.7 Hz); 7.52 (s, 1 H, NHCO); 11.58 (s, 1 H, NH). Found (%): C, 63.44; H, 5.71; N, 19.60. $C_{15}H_{16}N_4O_2$. Calculated (%): C, 63.37; H, 5.67; N, 19.71.

6,6′-(Adamantan-1,3-diyl)bis(*N*,*N*-dimethyl-4*H*-1,3-benzo-[*e*][1,3]oxazin-2-amine) (13) was prepared from the Mannich base **11**. The reaction time was 5 h. Purification method I. Yield 460 mg (95%), colorless crystals, m.p. 232—233 °C (DMF). IR, ν/cm^{-1}: 2913, 2897, 2849 (CH_{Ad}), 1668 (C=N), 1504, 1485, 1447, 1387, 1244, 1217, 1177, 1080, 962, 874, 824, 808. ^{1}H NMR ($CDCl_3$), δ: 1.75 (br.s, 2 H, Ad); 1.89 (br.s, 8 H, Ad); 1.94 (br.s, 2 H, Ad); 2.28 (br.s, 2 H, Ad); 2.93 (s, 12 H, NMe_2); 4.49 (s, 4 H, CH_2); 6.84 (d, 2 H, CH_{arom}, ^3J = 8.5 Hz); 7.04 (d, 2 H, CH_{arom}, ^4J = 1.8 Hz); 7.18 (dd, 2 H, CH_{arom}, ^3J = 8.5 Hz, ^4J = 1.8 Hz). ^{13}C NMR ($CDCl_3$), δ: 29.6 (2 CH_{Ad}); 35.8 ($H_2C(6)_{Ad}$); 37.0 ($C(1)_{Ad}$, $C(3)_{Ad}$); 37.2 (2 NMe_2); 42.4 (4 H_2C_{Ad}); 45.3 (2 CH_2(4)); 49.4 ($H_2C(2)_{Ad}$); 114.7 (2 CH); 121.1 (2 C); 122.4 (2 CH); 124.0 (2 CH); 146.5 (2 C); 148.2 (2 C); 151.2 (2 C). Found (%): C, 74.33; H, 7.39; N, 11.44. $C_{30}H_{36}N_4O_2$. Calculated (%): C, 74.35; H, 7.49; N, 11.56.

***N*^{2},*N*^{2},*N*^{7},*N*^{7}-Tetramethyl-4,9-dihydrobenzo[1,2-*e*:4,5-*e*′]bis([1,3]oxazine)-2,7-diamine (14)** was prepared from the Mannich base **12**. The reaction time was 1 h. Purification method I. Yield 154 mg (56%), colorless crystals, m.p. 176—177 °C (EtOH). IR, ν/cm^{-1}: 2920, 2843, 1672 (C=N), 1491, 1445, 1381, 1275, 1207, 1171, 1082, 972, 891, 858, 698. ^{1}H NMR ($CDCl_3$), δ: 2.95 (s, 12 H, NMe_2); 4.44 (s, 4 H, CH_2); 6.59 (s, 2 H, C(5)H, C(10)H). ^{13}C NMR ($CDCl_3$), δ: 37.2 (2 NMe_2); 44.8 (2 CH_2); 112.1 (2 CH); 120.9 (2 C); 146.2 (2 C); 151.2 (2 C). Found (%): C, 61.21; H, 6.57; N, 20.33. $C_{14}H_{18}N_4O_2$. Calculated (%): C, 61.30; H, 6.61; N, 20.42.

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