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Preparative Synthesis of 2-[3-Alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles Proceeding from Substituted Benzaldehydes

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Abstract—New functionally-substituted 2-[3-alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles were synthesized in preparative yields from aldehydes of vanillin series, their ethers and esters by the reaction with 1,2-phenylenediamine in the presence of sodium hydrogen sulfite in DMF solution at 80°C.

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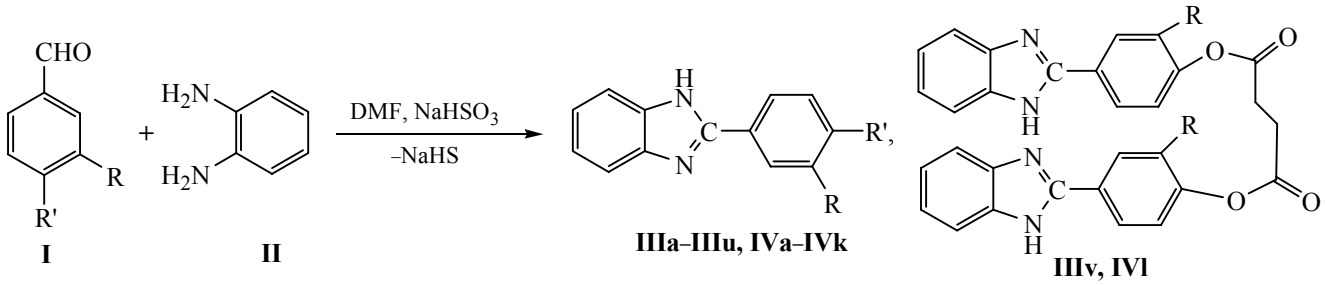
We formerly reported on the synthesis of 2-[3-alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-2,3-dihydro-1*H*-benzimidazoles, unstable compounds quickly darkening in the light and at contact with the air oxygen with the formation of tarry products [1]. Yet it is known that many functionally substituted 1*H*-benzimidazoles are stable compounds exhibiting a high antiviral action; the latter fact stimulates the studies on their synthesis [2]. However our attempts failed to adjust the procedure of synthesis of 1*H*-benzimidazoles published in [2] that was aimed to preparation of semimicro quantities of the target products (up to 0.5 mmol) for the preparative synthesis of functionally substituted 2-[3-alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles **IIIa–IIIv**, **IVa–IVl** using benzaldehydes of the vanillin series, their ethers and esters **I**.

The target of the present study was the development of a preparative synthesis of functionally substituted 2-[3-alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles **IIIa–IIIv**, **IVa–IVl** by oxidative condensation of benzaldehydes of the vanillin series, their ethers and esters **I** with 1,2-phenylenediamine (**II**) in the presence of a mild and selective oxidant, sodium hydrogen sulfite, in DMF solution at 80°C. We employed the



III, R = H, R[1] = MeO (**a**); R = MeO, R[1] = HO (**b**), MeO (**c**), MeC(O)O (**d**), EtC(O)O (**e**), PrC(O)O (**f**), $Me_2CHC(O)O$ (**g**), BuC(O)O (**h**), $Me_2CHCH_2C(O)O$ (**i**), $Me(CH_2)_6C(O)O$ (**j**), $Me(CH_2)_8C(O)O$ (**k**), $Me(CH_2)_{16}C(O)O$ (**l**), $H_2C{=}C(Me)C(O)O$ (**m**), $C_6H_5CH_2C(O)O$ (**n**), $C_6H_5CH(Me)CH_2C(O)O$ (**o**), $C_6H_5C(O)O$ (**p**), 2,4-$Cl_2C_6H_3C(O)O$(**q**), 4-$BrC_6H_4C(O)O$ (**r**), 3-$O_2NC_6H_4C(O)O$ (**s**), MeOC(O)O (**t**), EtOC(O)O (**u**); R = MeO (**v**); **IV**, R = EtO, R[1] = HO (**a**), MeO (**b**), MeC(O)O (**c**), EtC(O)O (**d**), PrC(O)O (**e**), $Me_2CHC(O)O$ (**f**), BuC(O)O (**g**), $Me_2CHCH_2C(O)O$ (**h**), 4-$MeC_6H_4C(O)O$ (**i**), MeOC(O)O (**j**), EtOC(O)O (**k**); R = EtO (**l**).

preparative stoichiometric ratio of reagents (5 mol of aldehyde I, 5 mol of phenylenediamine **II**, and 1.67 mmol of $NaHSO_3$), the reaction time was 1 h. The yields of target compounds **IIIa–IIIv**, **IVa–IVl** attained 75–85%. The sodium hydrogen sulfite in the course of the oxidative condensation was quantitatively reduced to sodium hydrogen sulfide as was proved by the gravimetric determination of S^{2-} after its precipitation in the form of ZnS from the water solutions obtained after the isolation of compounds **IIIa** and **IVa** [3].

The obtained compounds **IIIa–IIIv**, **IVa–IVl** are stable yellow crystalline substances, their structure was confirmed by elemental analysis, measurement of the molecular mass by cryoscopy and GC-MS method, and IR, UV, ^{1}H NMR spectra. The purity of compounds obtained according to ^{1}H NMR spectra and GC-MS analysis reached 95±1%. Functionally substituted 2-[3-alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles **IIIa–IIIv**, **IVa–IVl** are interesting for testing their biological activity [4].

EXPERIMENTAL

IR spectra were recorded on an IR Fourier spectrophotometer Nicolet Protege-460 from pellets with KBr, UV spectra were taken on a spectrophotometer Specord UV Vis from 1×10^{-4} M solutions of compounds in methanol. ^{1}H NMR spectra were registered on a spectrometer Tesla BS-587A (100 MHz) from 5% solutions in DMSO-d_6 or deuterochloroform, the chemical shifts were measured from an internal reference TMS. Mass spectra were obtained on a GC-MS instrument Hewlett Packard 5890/5972 in the electron impact ionization mode at the electrons energy 70 eV; capillary column HP-5MS 30 m×0.25 mm, stationary phase (5% PhMe Silicone) 0.25 μm, vaporizer temperature 250°C. Elemental analyses were carried out on a C,H,N,O,S-analyzer Elementar Vario EL-III, error of the determination 0.1%. The molecular mass of compounds was measured by cryoscopy in benzene.

The vanillin and vanillal esters **I** were obtained by procedures [5–8], 1,2-phenylenediamine (**II**) used was of "pure for analysis" grade, purity 98%, mp 102–103°C, sodium hydrogen sulfite was of "pure" grade, purity 97%.

2-[3-Alkoxy-4-(hydroxy, alkoxy, acyloxy)phenyl]-1*H*-benzimidazoles IIIa–IIIv, **IVa–IVl. General procedure.** A mixture of 5 mol of the functionally substituted benzaldehyde of the vanillin series **I**, 5 mol of 1,2-phenylenediamine (**II**), 1.67 mol of sodium hydrogen sulfite, and 2 ml of DMF was stirred for 1 h at 80°C, cooled to 20–23°C, and diluted with 20 ml of methanol to prevent too fast coagulation of a precipitate, the solution obtained was added dropwise over 30–45 min to 200 ml of distilled water at vigorous stirring. In the syntheses of compounds **IIIv** and **IVl** per 5 mol of initial dialdehyde **I** was taken a double amount of the other reagents. The separated fine crystalline precipitate of compounds **IIIa–IIIv**, **IVa–IVl** was filtered off, washed with water, and dried in air at 20–23°C for 5–7 days.

2-(4-Methoxyphenyl)-1*H*-benzimidazole (IIIa). Yield 76%, mp 222–223°C. IR spectrum, cm^{-1}: 3085, 3054, 3033, 3005 (CH_{arom}); 2952, 2923, 2855, 2835 (CH_{aliph}); 1627 (C=N); 1611, 1501 (C=C_{arom}); 1296, 1255, 1179, 1125, 1034, 966 (CO); 845, 790, 760, 746, 740 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 213 (14000), 250 (9000), 305 (16000). ^{1}H NMR spectrum, δ, ppm: 3.84 s (3H, MeO), 6.95–8.25 m (9H, NH and H_{arom}). Mass spectrum: *m*/*z* 224 $[M]^+$. Found, %: C 75.17; H 5.53; N 2.13. *M* 216.8. $C_{14}H_{12}N_2O$. Calculated, %: C 74.98; H 5.39; N 12.49. *M* 224.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenol (IIIb). Yield 78%, mp 84–85°C. IR spectrum, cm^{-1}: 3405 (OH); 3060, 3030, 3004 (CH_{arom}); 2960, 2927, 2852 (CH_{aliph}); 1624 (C=N); 1601, 1515, 1501, 1495 (C=C_{arom}); 1274, 1213, 1154, 1124, 1032 (CO); 870, 815, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (18000), 302 (10000), 358 (1000). ^{1}H NMR spectrum, δ, ppm: 3.74 s (3H, MeO), 5.39 s (1H, OH), 6.60–7.95 m (8H, NH and H_{arom}). Found, %: C 70.28; H 5.17; N 11.32. *M* 228.4. $C_{14}H_{12}N_2O_2$. Calculated, %: C 69.99; H 5.03; N 11.66. *M* 240.3.

2-(3,4-Dimethoxyphenyl)-1*H*-benzimidazole (IIIc). Yield 80%, mp 83–84°C. IR spectrum, cm^{-1}: 3060, 2999 (CH_{arom}); 2960, 2932, 2901, 2835 (CH_{aliph}); 1623 (C=N); 1605, 1591, 1503 (C=C_{arom}); 1264, 1233, 1176, 1138, 1023 (CO); 860, 810, 765, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 219 (18000), 306 (14000), 358 (1000). ^{1}H NMR spectrum, δ, ppm: 3.90 s (3H, 3-MeO), 3.93 s (3H, 4-MeO), 6.80–7.78 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 254 $[M]^+$. Found, %: C 71.09; H 5.58; N 10.82. *M* 244.0. $C_{15}H_{14}N_2O_2$. Calculated, %: C 70.85; H 5.55; N 11.02. *M* 254.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl acetate (IIId). Yield 84%, mp 95–96°C. IR spectrum, cm^{-1}: 3061, 3009 (CH_{arom}); 2961, 2935, 2848 (CH_{aliph}); 1766 (C=O); 1624 (C=N); 1501 (C=C_{arom}; 1268, 1214, 1197, 1214, 1197, 1173, 1122, 1032, 1010 (CO); 877, 830, 766, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 217

(21000), 242 (7000), 280 (13000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 2.29 c (3H, Me), 3.92 c (3H, MeO), 6.85–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 282 $[M]^+$. Found, %: C 68.41; H 5.19; N 9.64. *M* 273.6. $C_{16}H_{14}N_2O_3$. Calculated, %: C 68.08; H 5.00; N 9.92. *M* 282.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl propionate (IIIe). Yield 82%, mp 44–45°C. IR spectrum, cm^{-1}: 3062, 3002 (CH_{arom}); 2978, 2940, 2922, 2883, 2850 (CH_{aliph}); 1763 (C=O); 1624 (C=N); 1606, 1501 (C=C_{arom}); 1267, 1203, 1172, 1129, 1075, 1032 (CO); 884, 860, 830, 809, 760, 756 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (21000), 242 (7000), 280 (13000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.16 t (3H, Me), 2.55 q (2H, CH_2), 3.91 s (3H, MeO), 6.85–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 296 $[M]^+$. Found, %: C69.20; H 5.48; N 9.12. *M* 282.7. $C_{17}H_{16}N_2O_3$. Calculated, %: C 68.91; H 5.44; N 9.45. *M* 296.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl butyrate (IIIf). Yield 85%, mp 54–55°C. IR spectrum, cm^{-1}: 3061, 3007 (CH_{arom}); 2964, 2934, 2874, 2847 (CH_{aliph}); 1762 (C=O); 1624 (C=N); 1606, 1596, 1501 (C=C_{arom}); 1267, 1240, 1203, 1171, 1128, 1094, 1031 (CO); 871, 832, 802, 760, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 219 (21000), 242 (8000), 280 (13000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.03 t (3H, Me), 1.77 m (2H, $MeCH_2$), 2.54 t [2H, CH2C(O)], 3.91 s (3H, MeO), 6.84–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 310 $[M]^+$. Found, %: C 69.95; H 5.92; N 8.87. *M* 301.4. $C_{18}H_{18}N_2O_3$. Calculated, %: C 69.66; H 5.85; N 9.03. *M* 310.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl isobutyrate (IIIg). Yield 82%, mp 94–95°C. IR spectrum, cm^{-1}: 3066, 3035, 3007 (CH_{arom}); 2972, 2937, 2877, 2847 (CH_{aliph}); 1759 (C=O); 1624 (C=N); 1607, 1592, 1504 (C=C_{arom}); 1268, 1242, 1202, 1174, 1126, 1093, 1033 (CO); 867, 813, 783, 765, 743 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (21000), 243 (8000), 280 (13000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.38 d (6H, Me_2C), 2.90 m (1H, CH), 3.92 s (3H, MeO), 6.84–8.02 m (8H, NH and H_{arom}). Mass spectrum: 310 $[M]^+$. Found, %: C 69.98; H 5.96; N 8.80. *M* 303.2. $C_{18}H_{18}N_2O_3$. Calculated, %: C 69.66; H 5.85; N 9.03. *M* 310.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl pentanoate (IIIh). Yield 80%, mp 41–42°C. IR spectrum, cm^{-1}: 3098, 3060, 3006 (CH_{arom}); 2957, 2931, 2871 (CH_{aliph}); 1762 (C=O); 1624 (C=N); 1606, 1593, 1501 (C=C_{arom}); 1267, 1231, 1202, 1171, 1127, 1096, 1031 (CO); 868, 825, 784, 762, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 219 (20000), 243 (8000), 282 (13000), 308 (15000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 0.98 t (3H, Me), 1.12–1.95 m [4H, $(CH_2)_2$], 2.56 t[2H, $CH_2C(O)$], 3.92 s (3H, MeO), 6.85–8.04 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 324 $[M]^+$. Found, %: C 70.73; H 6.28; N 8.19. *M* 315.9. $C_{19}H_{20}N_2O_3$. Calculated, %: C70.35; H 6.21; N 8.64. *M* 324.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl isovalerate (IIIi). Yield 77%, mp 103–104°C. IR spectrum, cm^{-1}: 3067, 3035, 3007 (CH_{arom}); 2972, 2938, 2877, 2847 (CH_{aliph}); 1758 (C=O); 1624 (C=N); 1607, 1593, 1504 (C=C_{arom}); 1268, 1244, 1174, 1126, 1093, 1033 (CO); 867, 814, 783, 765, 743 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (22000), 243 (8000), 280 (14000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.14 d (6H, Me_2C), 1.45–2.92 m (3H, CH and CH_2), 3.92 s (3H, MeO), 6.85–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 324 $[M]^+$. Found, %: C 70.78; H 6.22; N 8.36. M 318.0. $C_{19}H_{20}N_2O_3$. Calculated, %: C 70.35; H 6.21; N 8.64. *M* 324.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl caproate (IIIj). Yield 79%, mp 59–60°C. IR spectrum, cm^{-1}: 3062, 3040, 3025, 3015, 3003 (CH_{arom}); 2955, 2927, 2867, 2855 (CH_{aliph}); 1756 (C=O); 1624 (C=N); 1606, 1504 (C=C_{arom}); 1269, 1246, 1200, 1172, 1131, 1104, 1033 (CO); 870, 825, 760, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (23000), 243 (8000), 280 (14000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 0.94 t (3H, Me), 1.34 m [8H, $(CH_2)_4$], 1.82 m (2H, $MeCH_2$), 2.60 t [2H, $CH_2C(O)$], 3.92 s (3H, MeO), 6.84–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 366 $[M]^+$. Found, %: C 72.56; H 7.28; N 7.30. *M* 352.5. $C_{22}H_{26}N_2O_3$. Calculated, %: C 72.11; H 7.15; N 7.64. *M* 366.5.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl octanoate (IIIk). Yield 78%, mp 43–44°C. IR spectrum, cm^{-1}: 3060, 3005 (CH_{arom}); 2954, 2925, 2854 (CH_{aliph}); 1764 (C=O); 1624 (C=N); 1606, 1503 (C=C_{arom}); 1270, 1232, 1202, 1175, 1134, 1106, 1034 (CO); 885, 860, 840, 812, 765, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (22000), 244 (8000), 280 (14000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 0.93 t (3H, Me), 1.35 m [12H, $(CH_2)_6$], 1.84 m(2H, $MeCH_2$), 2.60 t [2H, $CH_2C(O)$], 3.92 s (3H, MeO), 6.84–8.00 m (8H, NH and H_{arom}). Found, %: C 73.39; H 7.73; N 6.85. *M* 383.4. $C_{24}H_{30}N_2O_3$. Calculated, %: C 73.07; H 7.66; N 7.10. *M* 394.5.

4-(1H-Benzimidazol-2-yl)-2-methoxyphenyl stearate (IIIl). Yield 81%, mp 42–43°C. IR spectrum, cm^{-1}: 3076, 3060, 3004 (CH_{arom}); 2965, 2918, 2850 (CH_{aliph}); 1765 (C=O); 1624 (C=N); 1602, 1503 ($C=C_{arom}$); 1268, 1240, 1202, 1174, 1128, 1031 (CO); 870, 835, 760, 745, 730 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (2100), 243 (8000), 280 (1300), 308 (14000), 320 (600). ^1H NMR spectrum, δ, ppm: 0.91 t(3H, Me), 1.10–2.14 m [30H, $(CH_2)_{15}$], 2.68 t [2H, $CH_2C(O)$], 3.92 s (3H, MeO), 6.84–8.04 m (8H, NH and H_{arom}). Found, %: C 76.04; H 9.29; N 5.33. *M* 482.0. $C_{32}H_{46}N_2O_3$. Calculated, %: C 75.85; H 9.15; N 5.53. *M* 506.7.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl methacrylate (IIIm). Yield 80%, mp 119–120°C. IR spectrum, cm^{-1}: 3090, 3080, 3070, 3060, 3030, 3004 (CH_{arom}); 2962, 2924, 2852 (CH_{aliph}); 1739 (C=O); 1636 (C=C); 1624 (C=N); 1607, 1501 ($C=C_{arom}$); 1267, 1203, 1175, 1126, 1032 (CO); 880, 820, 760, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 213 (24000), 244 (7000), 308 (13000). ^1H NMR spectrum, δ, ppm: 2.10 s (3H, Me), 3.92 s (3H, MeO), 5.81 s and 6.41 s 1H and 1H, $C=CH_2$), 6.85–8.00 m (8H, NH and H_{arom}). Found, %: C 70.42; H 5.24; N 8.78. *M* 288.1. $C_{18}H_{16}N_2O_3$. Calculated, %: C 70.12; H 5.23; N 9.09. *M* 308.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl phenylacetate (IIIn). Yield 82%, mp 56–57°C. IR spectrum, cm^{-1}: 3090, 3070, 3045, 3006 (CH_{arom}); 2961, 2934, 2849 (CH_{aliph}); 1760 (C=O); 1624 (C=N); 1605, 1498 (C=Carom); 1267, 1233, 1202, 1174, 1120, 1030 (CO); 840, 827, 760, 745, 730, 700 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 210 (30000), 245 (7000), 308 (12000). ^1H NMR spectrum, δ, ppm: 3.82 s (2H, CH_2), 3.93 s (3H, MeO), 6.90–8.00 m (13H, NH and H_{arom}). Found, %: C 74.10; H 5.13; N 8.49. *M* 343.7. $C_{22}H_{18}N_2O_3$. Calculated, %: C 73.73; H 5.06; N 7.82. *M* 358.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl 3-phenylbutyrate (IIIo). Yield 80%, mp 59–60°C. IR spectrum, cm^{-1}: 3090, 3060, 3026, 3003 (CH_{arom}); 2961, 2925, 2890, 2870, 2850 (CH_{aliph}); 1759 (C=O); 1624 (C=N); 1605, 1499 ($C=C_{arom}$); 1266, 1233, 1201, 1175, 1081, 1032 (CO); 880, 840, 765, 745, 700 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 210 (29000), 244 (7000), 308 (12000). ^1H NMR spectrum, δ, ppm: 1.45 d(3H, Me), 2.92 d (2H, CH_2), 3.40 q (1H, CH), 3.93 s (3H, MeO), 6.90–8.00 m (13H, NH and H_{arom}). Found, %: C 74.83; H 5.80; N 7.00. *M* 372.5. $C_{24}H_{22}N_2O_3$. Calculated, %: C 74.59; H 5.74; N 7.25. *M* 386.4.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl benzoate (IIIp). Yield 85%, mp 82–83°C. IR spectrum, cm^{-1}: 3090, 3061, 3040, 3008 (CH_{arom}); 2961, 2933, 2850 (CH_{aliph}); 1743 (C=O); 1625 (C=N); 1501 ($C=C_{arom}$); 1263, 1202, 1174, 1122, 1079, 1058, 1024 (CO); 872, 818, 799, 760, 746, 706, 685 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 204 (30000), 210 (25000), 308 (16000). ^1H NMR spectrum, δ, ppm: 3.94 s (3H, MeO), 6.90–8.18 m (13H, NH and H_{arom}). Found, %: C 73.56; H 4.82; N 7.86. *M* 331.8. $C_{21}H_{16}N_2O_3$. Calculated, %: C 73.24; H 4.68; N 8.13. *M* 344.4.

4-(1H-Benzimidazol-2-yl)-2-methoxyphenyl 2,4-dichlorobenzoate (IIIq). Yield 83%, mp 77–78°C. IR spectrum, cm^{-1}: 3090, 3069, 3009 (CH_{arom}); 2960, 2924, 2851 (CH_{aliph}); 1753 (C=O); 1625 (C=N); 1606, 1584, 1500 ($C=C_{arom}$); 1266, 1236, 1199, 1173, 1147, 1121, 1085, 1031 (CO); 873, 822, 760, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 220 (40000), 244 (22000), 309 (16000). ^1H NMR spectrum, δ, ppm: 3.94 s (3H, MeO), 6.90–8.16 m (11H, NH and H_{arom}). Found, %: C 61.32; H 3.58; Cl 16.90; N 6.29. *M* 395.5. $C_{21}H_{14}Cl_2N_2O_3$. Calculated, %: C 61.03; H 3.41; Cl 17.16; N 6.78. *M* 413.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl 4-bromobenzoate (IIIr). Yield 84%, mp 108–109°C. IR spectrum, cm^{-1}: 3090, 3070, 3060, 3040, 3005 (CH_{arom}); 2970, 2921, 2860, 2850 (CH_{aliph}); 1740 (C=O); 1627 (C=N); 1609, 1589, 1508 ($C=C_{arom}$); 1261, 1202, 1172, 1122, 1071, 1032, 1011 (CO); 876, 840, 804, 747 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 203 (32000), 248 (22000), 308 (18000). ^1H NMR spectrum, δ, ppm: 3.94 s (3H, MeO), 6.90–8.24 m (12H, NH and H_{arom}). Found, %: C 59.84; H 3.66; Br 18.31; N 6.34. *M* 415.7. $C_{21}H_{15}BrN_2O_3$. Calculated, %: C 59.59; H 3.57; Br 18.88; N 6.62. *M* 423.3.

4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl 3-nitrobenzoate (IIIs). Yield 83%, mp 70–71°C. IR spectrum, cm^{-1}: 3084, 3070, 3010 (CH_{arom}); 2980, 2932, 2872, 2853 (CH_{aliph}); 1746 (C=O); 1627 (C=N); 1616, 1608, 1500 ($C=C_{arom}$); 1532, 1350 (NO2); 1291, 1254, 1201, 1175, 1114, 1056, 1032 (CO); 862, 811, 785, 746, 715 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 217 (34000), 242 (13000), 309 (16000). ^1H NMR spectrum, δ, ppm: 3.94 s (3H, MeO), 6.90–8.42 m (12H, NH and H_{arom}). Found, %: C 65.06; H 3.87; N 10.30. *M* 380.1. $C_{21}H_{15}N_3O_5$. Calculated, %: C 64.78; H 3.88; N 10.79. *M* 389.4.

[4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl]-methylcarbonate (IIIt). Yield 77%, mp 58–59°C. IR spectrum, cm^{-1}: 3059, 3009 (CH_{arom}); 2956, 2940, 2890,

2848 (CH_{aliph}); 1768 (C=O); 1625 (C=N); 1608, 1502 (C=C_{arom}); 1259, 1204, 1176, 1124, 1056, 1030 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (21000), 242 (7000), 280 (13000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 3.92 (3H, 3-MeO), 3.96s [3H, 4-MeOC(O)O], 6.84–8.00 m (8H, NH and H_{arom}). Found, %: C 64.71; H 4.87; N 9.02. *M* 287.2. $C_{16}H_{14}N_2O_4$. Calculated, %: C 64.42; H 4.73; N 9.39. *M* 298.3.

[4-(1*H*-Benzimidazol-2-yl)-2-methoxyphenyl] ethylcarbonate (IIIu). Yield 79%, mp 50–51°C. IR spectrum, cm^{-1}: 3060, 3007 (CH_{arom}); 2979, 2936, 2874, 2850 (CH_{aliph}); 1764 (C=O); 1625 (C=N); 1608, 1503 (C=C_{arom}); 1251, 1203, 1177, 1122, 1095, 1053, 1030 (CO); 860, 834, 803, 775, 765, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (22000), 243 (7000), 280 (12000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.45 t (3H, Me), 3.92 s (3H, MeO), 4.18 q (2H, CH2), 6.85–8.00 m (8H, NH and H_{arom}). Found, %: C 65.70; H 5.26; N 8.50. *M* 304.6. $C_{17}H_{16}N_2O_4$. Calculated, %: C 65.38; H 5.16; N 8.97. *M* 312.3.

Bis[4-(1*H*-benzimidazol-2-yl)-2-methoxyphenyl] succinate (IIIv). Yield 80%, mp 92–93°C. IR spectrum, cm^{-1}: 3062, 3008 (CH_{arom}); 2960, 2927, 2851 (CH_{aliph}); 1762 (C=O); 1625 (C=N); 1606, 1501 (C=C_{arom}); 1267, 1231, 1201, 1126, 1032 (CO); 883, 824, 806, 760, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 216 (38000), 243 (12000), 280 (23000), 308 (20000), 318 (12000). ^{1}H NMR spectrum, δ, ppm: 3.06 s [4H, $(CH_2)_2$], 3.92 s (6H, 2MeO), 6.82–8.00 m (16H, 2NH and H_{arom}). Found, %: C 68.54; H 4.82; N 9.71. *M* 542.3. $C_{32}H_{26}N_4O_6$. Calculated, %: C 68.32; H 4.66; N 9.96. *M* 562.6.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenol(IVa). Yield 75%, mp 107–108°C. IR spectrum, cm^{-1}: 3374 (OH); 3061, 3040, 3002 (CH_{arom}); 2979, 2929, 2898, 2870, 2845 (CH_{aliph}); 1628 (C=N); 1601, 1501 (C=C_{arom}); 1271, 1232, 1209, 1125, 1041 (CO); 872, 810, 760, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 216 (18000), 304 (10000), 357 (1000). ^{1}H NMR spectrum, δ, ppm: 1.27 t (3H, Me), 4.06 q (2H, CH_2O), 6.04 br.s(1H, OH), 6.60–7.93 m (8H, NH and H_{arom}). Found, %: C 71.11; H 5.68; N 10.86. *M* 243.5. $C_{15}H_{14}N_2O_2$. Calculated, %: C 70.85; H 5.55; N 11.02. *M* 254.3.

2-(4-Methoxy-3-ethoxyphenyl)-1*H*-benzimidazile (IVb). Yield 78%, mp 72–73°C. IR spectrum, cm^{-1}: 3060, 3030, 3002 (CH_{arom}); 2982, 2928, 2902, 2880, 2860, 2840 (CH_{aliph}); 1625 (C=N); 1606, 1590, 1501 (C=C_{arom}); 1263, 1138, 1027 (CO); 878, 811, 766, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (17000), 305 (14000), 358 (1000). ^{1}H NMR spectrum, δ, ppm: 1.28 t (3H, Me), 3.82 s (3H, MeO), 3.90 q (2H, CH2O), 6.55–7.85 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 268 $[M]^+$. Found, %: C 71.92; H 6.16; N 10.05. *M* 258.7. $C_{16}H_{16}N_2O_2$. Calculated, %: C 71.62; H 6.01; N 10.44. *M* 268.3.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl acetate (IVc). Yield 82%, mp 66–67°C. IR spectrum, cm^{-1}: 3060, 3038, 3002 (CH_{arom}); 2979, 2928, 2901, 2845 (CH_{aliph}); 1767 (C=O); 1627 (C=N); 1605, 1501 (C=C_{arom}); 1269, 1212, 1187, 1123, 1040, 1010 (CO); 870, 830, 808, 760, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 218 (22000), 243 (8000), 280 (14000), 308 (14000), 320 (7000). ^{1}H NMR spectrum, δ, ppm: 1.27 t (3H, Me), 2.32 s (3H, Me), 3.95 q (2H, CH_2O), 7.00–7.95 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 296 $[M]^+$. Found, %: C 69.14; H 5.62; N 9.06. *M* 284.0. $C_{17}H_{16}N_2O_3$. Calculated, %: C 68.91; H 5.44; N 9.45. *M* 296.3.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl propionate (IVd). Yield 81%, mp 63–64°C. IR spectrum, cm^{-1}: 3059, 3025, 3006 (CH_{arom}); 2980, 2939, 2898, 2880, 2850 (CH_{aliph}); 1764 (C=O); 1627 (C=N); 1607, 1501 (C=C_{arom}); 1268, 1173, 1125, 1076, 1042 (CO); 885, 835, 812, 760, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 219 (22000), 244 (7000), 292 (14000), 308 (16000), 325 (7000). ^{1}H NMR spectrum, δ, ppm: 1.32 t [3H, $MeCH_2C(O)$], 1.37 t (3H, $MeCH_2O$), 2.60 q [2H, $CH_2C(O)$], 4.14 q (2H, CH_2O), 7.05–7.90 m (8H, NH and H_{arom}). Mass spectrum: *m/z* 310 $[M]^+$. Found, %: C69.93; H 5.99; N 8.86. *M* 301.6. $C_{18}H_{18}N_2O_3$. Calculated, %: C 69.66; H 5.85; N 9.03. *M* 310.4.

4-(1H-Benzimidazol-2-yl)-2-ethoxyphenyl butyrate (IVe). Yield 82%, mp 52–53°C. IR spectrum, cm^{-1}: 3065, 3049, 3004 (CH_{arom}); 2970, 2933, 2878, 2855 (CH_{aliph}); 1752 (C=O); 1627 (C=N); 1605, 1591, 1504 (C=C_{arom}); 1270, 1247, 1198, 1134, 1108, 1096, 1041 (CO); 869, 823, 790, 760, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 222 (22000), 241 (15000), 290 (22000), 308 (24000), 321 (17000). ^{1}H NMR spectrum, δ, ppm: 1.03 t [3H, $MeCH_2C(O)$], 1.37 t (3H, $MeCH_2O$), 1.71 m (2H, $MeCH_2CH_2$), 2.52 t [2H, $CH_2C(O)$], 4.16 q (2H, CH_2O), 7.05–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m*/*z* 324 $[M]^+$. Found, %: C 70.74; H 6.35; N 8.28. *M* 313.8. $C_{19}H_{20}N_2O_3$. Calculated, %: C 70.35; H 6.21; N 8.64. *M* 324.4.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl isobutyrate (IVf). Yield 80%, mp 161–162°C. IR

spectrum, cm^{-1}: 3062, 3030, 3003 (CH_{arom}); 2977, 2933, 2900, 2877, 2855 (CH_{aliph}); 1763 (C=O); 1628 (C=N); 1608, 1592, 1500 (C=C_{arom}); 1266, 1179, 1124, 1092, 1040 (CO); 866, 810, 761, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 220 (22000), 242 (15000), 290 (21000), 308 (24000), 321 (16000). ^{1}H NMR spectrum, δ, ppm: 1.35 d (6H, Me_2C), 1.42 t (3H, Me), 2.86 m (1H, CH), 4.16 q (2H, CH_2O), 7.02–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m/z* 324 $[M]^+$. Found, %: C 70.78; H 6.31; N 8.37. *M* 316.3. $C_{19}H_{20}N_2O_3$. Calculated, %: C 70.35; H 6.21; N 8.64. *M* 324.4.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl valerate (IVg). Yield 84%, mp 138–139°C. IR spectrum, cm^{-1}: 3057, 3031, 3003 (CH_{arom}); 2955, 2926, 2901, 2971, 2863 (CH_{aliph}); 1766 (C=O); 1627 (C=N); 1608, 1595, 1503 (C=C_{arom}); 1254, 1232, 1192, 1131, 1096, 1039 (CO); 893, 870, 830, 760, 755 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 220 (23000), 242 (15000), 290 (21000), 307 (24000), 321 (16000). ^{1}H NMR spectrum, δ, ppm: 0.96–1.50 m (6H, 2Me), 1.55–2.20 m [4H, $(2CH_2)_2$], 2.52 t [2H, $CH_2C(O)$], 4.16 q (2H, CH_2O), 7.00–8.00 m (8H, NH and H_{arom}). Mass spectrum: *m/z* 338 $[M]^+$. Found, %: C 71.25; H 6.63; N 8.07. *M* 322.5. $C_{20}H_{22}N_2O_3$. Calculated, %: C 70.99; H 6.55; N 8.28. *M* 338.4.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl isovalerate (IVh). Yield 81%, mp 56–57°C. IR spectrum, cm^{-1}: 3061, 3030, 3004 (CH_{arom}); 2961, 2931, 2900, 2873, 2850 (CH_{aliph}); 1761 (C=O); 1627 (C=N); 1607, 1501 (C=C_{arom}); 1265, 1181, 1151, 1121, 1091, 1040 (CO); 867, 831, 766, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 220 (24000), 243 (15000), 290 (22000), 307 (24000), 321 (16000). ^{1}H NMR spectrum, δ, ppm: 1.12 d (6H, Me_2C), 1.42 t (3H, Me), 1.40–2.90 m (3H, CH and CH_2), 4.15 q (2H, CH_2O), 7.00–8.02 m (8H, NH and H_{arom}). Mass spectrum: m/z 338 $[M]^+$. Found, %: C 71.18; H 6.67; N 7.54. *M* 329.1. $C_{20}H_{22}N_2O_3$. Calculated, %: C 70.99; H 6.55; N 8.28. *M* 338.4.

4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl 4-methylbenzoate (IVi). Yield 80%, mp 86–87°C. IR spectrum, cm^{-1}: 3090, 3060, 3040, 3005 (CH_{arom}); 2978, 2925, 2905, 2880, 2850 (CH_{aliph}); 1741 (C=O); 1626 (C=N); 1610, 1504 (C=C_{arom}); 1263, 1194, 1177, 1122, 1062, 1039, 1019 (CO); 873, 840, 830, 811, 760, 744 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 309 (30000), 340 (19000). ^{1}H NMR spectrum, δ, ppm: 1.44 t (3H, $MeCH_2$), 2.49 s (3H, MeC_6H_4), 4.18 q (2H, CH_2O), 7.00–8.22 m (12H, NH and H_{arom}). Found, %: C 74.45; H 5.46; N 7.23. *M* 360.8. $C_{23}H_{20}N_2O_3$. Calculated, %: C 74.18; H 5.41; N 7.52. *M* 372.4.

[4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl] methylcarbonate (IVj). Yield 75%, mp 71–72°C. IR spectrum, cm^{-1}: 3060, 3030, 3004 (CH_{arom}); 2980, 2956, 2931, 2898, 2853 (CH_{aliph}); 1770 (C=O); 1626 (C=N); 1608, 1501 (C=C_{arom}); 1259, 1197, 1125, 1055, 1039 (CO); 874, 830, 820, 776, 767, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 223 (22000), 241 (15000), 290 (22000), 308 (24000), 321 (17000). ^{1}H NMR spectrum, δ, ppm: 1.27 t (3H, Me), 3.95 q (2H, CH_2O), 3.96 s (3H, MeO), 7.00–7.94 m (8H, NH and H_{arom}). Found, %: C 65.57; H 5.22; N 8.64. *M* 313.6. $C_{17}H_{16}N_2O_4$. Calculated, %: C 65.38; H 5.16; N 8.97. *M* 312.3.

[4-(1*H*-Benzimidazol-2-yl)-2-ethoxyphenyl] ethylcarbonate (IVk). Yield 77%, mp 56–57°C. IR spectrum, cm^{-1}: 3061, 3027, 3003 (CH_{arom}); 2981, 2931, 2900, 2855 (CH_{aliph}); 1765 (C=O); 1626 (C=N); 1608, 1503 (C=C_{arom}); 1249, 1195, 1124, 1095, 1040 (CO); 867, 830, 809, 772, 760, 745 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 222 (21000), 242 (15000), 290 (22000), 308 (24000), 322 (17000). ^{1}H NMR spectrum, δ, ppm: 1.20–1.72 m (6H, 2Me), 4.00–4.54 m (4H, $2CH_2O$), 7.00–7.96 m (8H, NH and H_{arom}). Found, %: C 66.59; H 5.64; N 8.19. *M* 318.2. $C_{18}H_{18}N_2O_4$. Calculated, %: C 66.25; H 5.56; N 8.58. *M* 326.3.

Bis[4-(1*H*-benzimidazol-2-yl)-2-ethoxyphenyl] succinate (IVl). Yield 83%, mp 111–112°C. IR spectrum, cm^{-1}: 3062, 3030, 3002 (CH_{arom}); 2979, 2928, 2897, 2855 (CH_{aliph}); 1764 (C=O); 1627 (C=N); 1610, 1501 (C=C_{arom}); 1265, 1232, 1194, 1123, 1039 (CO); 885, 838, 803, 762, 746 (CH_{arom}). UV spectrum, λ_{max}, nm (ε): 214 (39000), 242 (13000), 280 (24000), 308 (20000), 318 (13000). ^{1}H NMR spectrum, δ, ppm: 1.26 t (6H, Me), 3.06 s [4H, $(CH_2)_2$], 3.95 q (4H, $2CH_2O$), 6.82–8.02 m (16H, 2NH and H_{arom}). Found, %: C 69.47; H 5.21; N 9.18. M 576.7. $C_{33}H_{30}N_4O_6$. Calculated, %: C 69.14; H 5.12; N 9.49. *M* 590.6.

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