1-[3-(2-ALKOXYPHENOXY)-3-PHENYLPROPYL]PIPERAZINES AND SOME RELATED COMPOUNDS*

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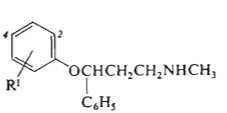
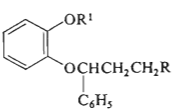
Amino alcohols *VIIIa—c*, prepared by reduction of the Mannich bases *VIa—c*, were transformed by treatment with thionyl chloride to the chloro derivatives *IXa—c* which were subjected to substitution reactions with the sodium salts of guaiacol, 2-ethoxyphenol and 2-benzyloxyphenol giving the title compounds *IIIb,c*, *IVb,c* and *Va—c*. N,N-Dimethyl-3-(2-benzyloxyphenoxy)-3-phenylpropylamine (*Va*) was partially demethylated by treatment with ethyl chloroformate and by the following alkaline hydrolysis to the secondary amine *XI*. Amines *III—V* and *XI* in high doses exhibit central excitation but do not show antireserpine activity; they have several structurally less specific effects (hypotensive, local anaesthetic, spasmolytic).

In one of the preceding communications of this series[1] we have described the synthesis of several 3-(2-alkoxyphenoxy)-2-methyl (or phenyl)propylamines as open models of the antidepressant agent viloxazine and have mentioned a similarly oriented investigation of the research team of Eli Lilly[2] in the series of analogous 3-aryloxy-2-phenylpropylamines out of which the experimental agents nisoxetine (*I*) (ref.[3]) and fluoxetine (*II*) (ref.[4]) were described as the most interesting ones. A number of 3-aryl-3-aryloxypropylamines was prepared[5–9] in the search after new spasmo-

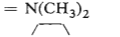


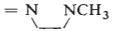
I, $R^1 = 2\text{-}OCH_3$
II, $R^1 = 4\text{-}CF_3$



III, $R^1 = CH_3$
IV, $R^1 = C_2H_5$
V, $R^1 = CH_2C_6H_5$

a, $R = N(CH_3)_2$

b, R = 

c, R = 

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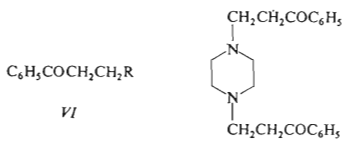
lytic agents. The present paper deals with the synthesis of several new 3-aryloxy--3-phenylpropylamines in which the amino group is mostly a part of the piperazine ring. The tertiary amines *Ibc*, *IIbc* and *IIIa–c* have been prepared in the first line.

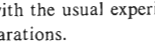
Our synthesis started from the Mannich bases *VIa–c* which were obtained by reactions of acetophenone and paraformaldehyde with hydrochlorides of dimethylamine, 1-methylpiperazine and 1-benzylpiperazine in boiling ethanol. Compound *VIa* has been prepared in this way according to the literature[10,11]. The preparation of compound *VIb* was described several times in the literature[12–14] but the melting point values reported for the dihydrochloride differ and our value does not agree with any of them. Our crude product was found to be inhomogeneous and its chromatography separated a small amount of a base $C_{22}H_{26}N_2O_2$, which was identified as 1,4-bis-(2-benzoylethyl)piperazine (*VII*). This compound is known as the product of a double Mannich reaction of piperazine dihydrochloride with acetophenone[15]. In our case its formation has to be explained by the presence of piperazine in the 1-methylpiperazine used which was prepared by methylation of piperazine with dimethyl sulfate[16] (*cf.*[17]). The preparation of compound *VIc* was also described in the literature[18,19].



VI

VII

The Mannich bases *VIa–c* have been reduced with sodium borohydride in boiling ethanol to the amino alcohols *VIIIa–c*. The preparation of compound *VIIIa* by reduction of the ketone *VIa* by different methods was described[2,10]; compound *VIIIc* was mentioned in two papers[20,21]. For converting the amino alcohols *VIIIa–c* to hydrochlorides of the chloro derivatives *IXa–c*, the treatment with thionyl chloride in chloroform was used, which is the method described[2] for the preparation of compound *IXa*. The final products *III–V* have been obtained by reactions of the sodium salts of guaiacol, 2-ethoxyphenol[22] and 2-benzyloxyphenol[23] with the chloro compounds *IXa–c* in boiling ethanol (method *A*). Compounds prepared in this way are summarized in Table I with the usual experimental data; the Experimental contains an example of these preparations.



VIII, $R^1 = OH$
IX, $R^1 = Cl$

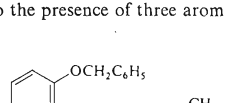
TABLE I

3-(2-Alkoxyphenoxy)-3-phenylpropylamines Prepared by Method *A*

Compound (yield, %)	M.p., °C (solvent)	Formula (mol.wt.)	Calculated/Found			
			% C	% H	% N	% Cl
IIIb·2 HCl[a] (75)	189—191[b] (ethanol–ether)	$C_{21}H_{30}Cl_2N_2O_2 + 0.5\ H_2O$ (422·4)	59·71 59·81	7·39 7·30	6·63 6·75	16·78 16·75
IIIc·2 HCl[c] (89)	207—209[d] (2-propanol)	$C_{27}H_{34}Cl_2N_2O_2 + 1·5\ H_2O$ (516·5)	62·78 62·63	7·22 6·98	5·42 5·39	13·73 13·71
IVb·2 HCl[e] (80)	182—186 (2-propanol)	$C_{22}H_{32}Cl_2N_2O_2 + H_2O$ (445·4)	59·32 59·84	7·69 7·70	6·29 6·16	15·92 15·97
IVc·2 HCl[e] (91)	201[f] (2-propanol–ether)	$C_{28}H_{36}Cl_2N_2O_2 + H_2O$ (521·5)	64·48 64·86	7·35 7·28	5·37 5·34	13·60 13·93
Va[g] (98)	70—72 (light petroleum)	$C_{24}H_{27}NO_2$ (361·5)	79·74 79·62	7·53 7·59	3·87 3·70	— —
Va·HCl	158—161 (2-propanol–ethyl acetate)	$C_{24}H_{28}ClNO_2$ (397·9)	72·43 71·99	7·09 7·15	3·52 3·40	8·91 8·81
Va·HOx[h]	148—150 (2-propanol–ethyl acetate)	$C_{26}H_{29}NO_6$ (451·5)	69·16 68·54	6·47 6·42	3·10 2·92	— —
Vb·2 HCl (76)	204—205·5 (2-propanol)	$C_{27}H_{34}Cl_2N_2O_2$ (489·5)	66·25 65·70	7·00 7·09	5·72 5·84	14·49 14·40
Vc·2 HCl[a] (81)	191—193[i] (2-propanol–ether)	$C_{33}H_{38}Cl_2N_2O_2 + 0·5\ H_2O$ (574·6)	68·98 69·04	6·84 6·76	4·88 5·04	12·34 12·53

[a] Hemihydrate. [b] IR spectrum: 700, 749 (5 and 4 adjacent Ar—H), 1259 (ArOR), 1500, 1596, 3055 (Ar), 2295, 2395 (NH^+), 3400 cm^{-1} (H_2O). [c] Sesquihydrate. [d] ^{1}H-NMR spectrum of the base: δ 7·30 (bs, 10 H, 2 C_6H_5), 6·78 (m, 4 H, remaining Ar—H), 5·16 (t, 1 H, Ar—CH—O), 3·80 (s, 3 H, OCH_3), 3·45 (s, 2 H, $ArCH_2N$), *c.* 2·50 (bm, 10 H, remaining 5 NCH_2), *c.* 2·10 (m, 2 H, CH_2 in the middle of the propane chain). [e] Monohydrate. [f] ^{1}H-NMR spectrum of the base: δ 7·30 (bs, 10 H, 2 C_6H_5), 6·78 (m, 4 H, remaining Ar—H), 5·15 (t, 1 H, Ar—CH—O), 4·05 (q, J = 7·0 Hz, 2 H, OCH_2), 3·50 (s, 2 H, $ArCH_2N$), *c.* 2·50 (bm, 10 H, remaining 5 NCH_2), *c.* 2·10 (m, 2 H, CH_2 in the middle of the propane chain), 1·41 (t, J = 7·0 Hz, 3 H, CH_3). [g] See Experimental. [h] Hydrogen oxalate. [i] IR spectrum: 700, 734, 756 (5 and 4 adjacent Ar—H), 1260 (ArOR), 1504, 1600, 3020, 3052 (Ar), 2310, 2390 (NH^+), 3400 cm^{-1} (H_2O).

With regard to the fact that many of the active compounds described in the patent of Molloy[2] (*e.g.* compounds *I* and *II*) are secondary amines (methylamino compounds), a partial demethylation of compound *Va* was carried out by treatment with ethyl chloroformate in boiling benzene. An oily neutral product was obtained which was purified by chromatography and characterized by the ^{1}H-NMR spectrum as the carbamate *X*. Hydrolysis with a concentrated potassium hydroxide solution in ethanol gave the methylamino derivative *XI*. In the course of its isolation we were surprised by the solubility of its hydrochloride in benzene; this extreme hydrophobic character is evidently due to the presence of three aromatic residues in the relatively small molecule.



X, $R^1 = COOC_2H_5$
XI, $R^1 = H$

The salts of the compounds prepared were pharmacologically tested by methods of the general screening. With regard to their solubility in water, they were administered parenterally; numbers of compounds, their acute toxicities in mice on intravenous administration (LD_{50}, mg/kg) and the basic doses D (mg/kg, *i.v.*), which were used in the screening, are given: *IIIb*–2 HCl, 35, 7; *IIIc*–2 HCl, 15, 3; *IVb*–2 HCl, 40, 8; *IVc*–2 HCl, 12·5, 2; *Va* hydrogen oxalate, 20, 4; *Vb*–2 HCl, 30, 6; *Vc*–2 HCl, 20, 4; *XI*–HCl, 20, 4. All compounds in doses higher than D bring about a transient excitation (enhancement of activity and reactivity) in mice which is followed by a central depression, ataxia, tremor, convulsions and mydriasis. In the doses D, their pharmacodynamic activity is poor. Compound *IIIb*, being little toxic on oral administration (LD_{50} = 500 mg/kg), exhibits in an oral dose of 35 mg/kg anorectic activity in mice (the dose decreases food consumption by 50%; for dexphenmetrazine as a standard, ED = 25 mg/kg orally). Compound *IIIc* shows some structurally little specific effects: local anaesthetic, spasmolytic and hypotensive. In a concentration of 0·1–0·5% it brings about a complete anaesthesia of the eye cornea in 50% rabbits (for trimecaine as a standard, ED = 1%). In a concentration of 1 μg/ml it exhibits a reduction of the acetylcholine contractions of the isolated rat duodenum by 50% (for atropine as a standard, ED = 0·05 μg/ml) and in concentrations of 1 to 10 μg/ml it has a similar effect towards the barium chloride contractions (for papaverine as a standard, ED = 5 μg/ml). An *i.v.* dose of 3 mg/kg decreases the blood pressure of normotensive rats by 20% for at least 10 min. Compound *IVb* showed only a brief hypotensive effect (a drop of blood pressure by 44% for 1 min after the

dose D). Compound *IVc* is effective in the test of corneal anaesthesia (ED = 0·1 to. 0·5%), has spasmolytic effect towards acetylcholine (ED = 1–10 μg/ml) and barium chloride contractions (ED = 1–10 μg/ml) and is hypotensive (ED = 1 mg/kg). Compound *Va* in the dose D brings about ataxia in the rotarod test in mice and a brief and deep hypotension in rats. A similar hypotensive effect was seen after the dose D of compound *Vb*. Compound *XI* in the dose D administered intraperitoneally showed a sign of β-adrenolytic effect. None of the compounds revealed the desired antireserpine activity.

Some of the compounds were also tested for antimicrobial activity *in vitro* (Dr J. Turinová, bacteriological department of this institute). The used microorganisms, numbers of compounds and the minimum inhibitory concentrations in μg/ml (unless they exceed 100 μg/ml) are given: *Streptococcus β-haemolyticus. IIIc* 50, *IVc* 50; *Staphylococcus pyogenes aureus*, *IIIc* 100; *Escherichia coli*, *IIIc* 100; *Proteus vulgaris*, *IIIc* 100; *Mycobacterium tuberculosis* H37Rv, *IIIb* 100, *IIIc* 25, *IVc* 12·5, *Vc* 50; *Trichophyton mentagrophytes*, *Vc* 50.

EXPERIMENTAL

The melting points of analytical preparations were determined in Kofler's block and are not corrected; the samples were dried *in vacuo* of about 60 Pa at room temperature or at 77°C. The UV spectra (in methanol) were recorded with a Unicam SP 8000 spectrophotometer, the IR spectra (in Nujol) with a Unicam SP 200G spectrophotometer, the ^{1}H-NMR spectra (in $CDCl_3$ unless stated otherwise) with a Tesla BS 487C (80 MHz) spectrometer and the mass spectra with a MS 902 (AEI) spectrometer. The homogeneity of the compounds and composition of the reaction mixtures were checked by chromatography on thin layers of silica gel (Silufol).

3-(4-Methylpiperazino)propiophenone (*VIb*)

A mixture of 12·0 g acetophenone, 3·6 g paraformaldehyde, 21·2 g 1-methylpiperazine dihydrochloride (m.p. 225–230°C, prepared from 1-methylpiperazine[16] which was contaminated by small amounts of piperazine and 1,4-dimethylpiperazine), 150 ml ethanol and 0·3 ml hydrochloric acid was stirred and refluxed for 4·5 h. After standing overnight, the dihydrochloride was filtered, washed with ether and dried; 30·0 g (almost 100%), m.p. unsharply about 170°C. Repeated crystallization from ethanol gave a product melting at 164–166°C. For $C_{14}H_{22}Cl_2N_2O$ (305·3) talculated: 55·08% C, 7·27% H, 23·23% Cl, 9·18% N; found: 54·94% C, 7·06% H, 23·00% Cl, 875% N. The m.p. values reported in the literature: 182–184°C with decomposition (ref.[14]), 187·3–188·5°C (a solvate with 0·75 H_2O) (ref.[12]), 197°C (ref.[13]).

Treatment of the crude dihydrochloride with NH_4OH, extraction with benzene, re-extraction into 2·5M-HCl, a new releasing of the base with 5M-NaOH and extraction with benzene gave 7·7 g (33%) oil. This base was found to be inhomogeneous and was chromatographed on a column of 200 g silica gel. Elution with chloroform gave first 1·9 g oily impurities and then 0·6 g crystalline compound, m.p. 141·5–144°C (benzene–cyclohexane–light petroleum). Elution with a mixture of chloroform–methanol (1 : 1) gave 4·4 g homogeneous *VIb* which crystallized on standing, m.p. 38–40°C (lit.[14], m.p. 38–40°C). The compound melting at 141·5–144°C was identified as 1,4-bis(2-benzoylethyl)piperazine (*VII*). Mass spectrum, *m/e* (%): 350 (M^+ corresponding to $C_{22}H_{26}N_2O_2$), 176 (40), 133 (15), 132 (38), 105 (100), 99 (32), 77 (72), 56 (23), 51 (25). UV spectrum: λ_{max} 242 nm (log ε 4·39), infl. 276 nm (3·63). IR spectrum: 688, 748 (C_6H_5), 1586,

1 598, 3020, 3040 (Ar), 1 680 cm^{-1} (ArCO). ^{1}H-NMR spectrum: δ 7·92 (m, 4 H, 4 Ar—H adjacent to CO), 7·30—7·60 (m, 6 H, remaining Ar—H), 2·40—3·20 (m, 16 H, 6 NCH_2 and 2 CH_2CO). The literature[15] reported the m.p. of 141°C.

3-(4-Benzylpiperazino)propiophenone (*VIc*)

A mixture of 12·0 g acetophenone, 3·6 g paraformaldehyde, 30·0 g 1-benzylpiperazine dihydrochloride (m.p. 247—249°C with decomposition), 160 ml ethanol and 0·3 ml hydrochloric acid was stirred and refluxed for 4·5 h. Cooling and standing overnight gave 32·0 g (84%) dihydrochloride, m.p. 245—247°C. Lit.[18,19], m.p. 242—246°C. Decomposition of this salt with aqueous NH_4OH and extraction with benzene gave the oily base.

3-Dimethylamino-1-phenylpropanol (*VIIIa*)

A mixture of 33·2 g *VIa*-HCl (ref.[10,11]) and 190 ml ethanol was made alkaline with 37·5 ml 5M-NaOH and treated slowly under stirring with 14·1 g $NaBH_4$. The mixture was refluxed for 2·5 h, ethanol was distilled off, the residue diluted with 150 ml water and extracted with benzene. Evaporation of the extract gave 28·3 g (85%) crude base *VIIIa* which was dissolved in 100 ml ethanol and the solution treated with a slight excess of a solution of HCl in ether; 27·5 g hydrochloride, m.p. 131—134°C. Lit.[10], m.p. 135—136°C (prepared differently).

3-(4-Methylpiperazino)-1-phenylpropanol (*VIIIb*)

VIb (14·2 g) was reduced similarly with 4·6 g $NaBH_4$ in 100 ml ethanol; 13·0 g (91%) oily base. Dihydrochloride, m.p. 198—199°C (ethanol). IR spectrum: 700, 758, 771 (C_6H_5), 1 106, 3 348 (CHOH), 2 372, 2 420 cm^{-1} (NH^+). For $C_{14}H_{24}Cl_2N_2O$ (307·3) calculated: 54·72% C, 7·87% H, 23·08% Cl, 9·12% N; found: 55·24% C, 7·77% H, 23·19% Cl, 8·57% N.

3-(4-Benzylpiperazino)-1-phenylpropanol (*VIIIc*)

Similar reduction of 7·8 g *VIc* with 1·86 g $NaBH_4$ in 60 ml ethanol gave 7·2 g (93%) base, m.p, 65—75°C. Analytical sample, m.p. 78·5—80°C (light petroleum). IR spectrum: 699, 740 (C_6H_5), 1 136, 1 145 (CHOH), 1 494, 1 587, 1 603, 3 010, 3 040, 3 075 (Ar), 2 760, 2 800 (NCH_2), 3 200 cm^{-1}, (OH). ^{1}H-NMR spectrum: δ 7·30 (bs, 10 H, 2 C_6H_5), 6·60 (bs, 1 H, OH), 4·90 (t, J = 6·0 Hz, 1 H, Ar—CH—O), 3·49 (s, 2 H, NCH_2Ar), *c.* 2·50 (bm, 10 H, remaining 5 NCH_2), 1·80 (m, 2 H. CH_2 in the middle of the propane chain). For $C_{20}H_{26}N_2O$ (310·4) calculated: 77·37% C, 8·44% H, 9·03% N; found: 77·85% C, 8·55% H, 8·89% N.

Dihydrochloride, m.p. 200—201° (ethanol). For $C_{20}H_{28}Cl_2N_2O$ (383·3) calculated: 62·66% C, 7·36% H, 18·50% Cl, 7·31% N; found: 62·33% C, 7·18% H, 18·37% Cl, 7·06% N.

3-(4-Methylpiperazino)-1-phenylpropyl Chloride (*IXb*)

A suspension of 11·7 g *VIIIb*.2 HCl in 150 ml chloroform was stirred and treated over 20 min at 30—35°C with a solution of 30·8 g $SOCl_2$ in 18 ml chloroform, added dropwise. The mixture was stirred for 20 min at 40—45°C and refluxed for 3 h. It was evaporated *in vacuo*, the residue mixed with acetone and filtered after 1 h standing. The dihydrochloride obtained was washed with acetone and dried; 11·8 g (95%), m.p. 245—253°C. Analytical sample, m.p. 251·5—254°C (ethanol). For $C_{14}H_{23}Cl_3N_2$ (325·7) calculated: 51·62% C, 7·12% H, 32·66% Cl, 8·60% N; found: 51·86% C, 7·64% H, 32·53% Cl, 8·45% N.

3-(4-Benzylpiperazino)-1-phenylpropyl Chloride (*IXc*)

A similar reaction of 41·5 g *VIIIc*·2 HCl with 71·5 g $SOCl_2$ in 470 ml chloroform gave 41·7 g (96%) dihydrochloride, m.p. 226°C. Analytical sample, m.p. 225—228°C with decomposition (aqueous ethanol). For $C_{20}H_{27}Cl_3N_2$ (401·8) calculated: 59·78% C, 6·77% H, 26·47% Cl, 6·97% N; found: 60·26% C, 6·70% H, 26·78% Cl, 7·03% N.

N,N-Dimethyl-3-(2-benzyloxyphenoxy)-3-phenylpropylamine (*Va*) (Method *A*)

2-Benzyloxyphenol[23] (14·0 g) was dissolved in a solution of 4·8 g NaOH in 170 ml ethanol, the solution was treated with 11·7 g *IXa*.HCl (ref.[2]) (m.p. 180—181°C) and the mixture was stirred and refluxed for 11 h. Ethanol was distilled off, the residue was treated with 100 ml 1M-NaOH and extracted with ether. The solid was filtered off, the extract was washed with water, dried with K_2CO_3 and evaporated; 17·8 g (98%) crude base which crystallized from cyclohexane, m.p. 65—69°C. Analytical sample, m.p. 70—72°C (light petroleum). IR spectrum: 700, 750 (5 and 4 adjacent Ar—H), 1122, 1209, 1244 (ArOR), 1500, 1588, 3008, 3040 (Ar), 2745, 2760, 2800 cm^{-1} (NCH_3). ^{1}H-NMR spectrum: δ 7·20—7·50 (m, 10 H, 2 C_6H_5), *c.* 6·80 (m, 4 H, remaining 4 Ar—H), 5·22 (t, 1 H, Ar—CH—O), 5·11 (s, 2 H, $ArCH_2O$), 2·10—2·60 (m, 4 H, CH_2CH_2N), 2·18 (s, 6 H, CH_3NCH_3). Hydrochloride, m.p. 158—161°C (2-propanol–ethyl acetate). Hydrogen oxalate, m.p. 148—150°C (2-propanol–ethyl acetate).

N-Methyl-3-(2-benzyloxyphenoxy)-3-phenylpropylamine (*XI*)

A solution of 7·0 g *Va* in 32 ml benzene was stirred and treated dropwise over 50 min with a solution of 2·1 g ethyl chloroformate in 20 ml benzene at 70—75°C. The mixture was then refluxed for 1·5 h, diluted with 50 ml benzene and washed with 25 ml 2·5M-HCl. In addition to the organic and aqueous layers there was formed a thick oily layer of hydrochloride of the starting *Va* which crystallized from a mixture of 2-propanol and ethyl acetate and melted at 158—161°C. The organic layer, containing the neutral reaction product, was evaporated and the residue (4·9 g) was chromatographed on a column of 160 g neutral Al_2O_3 (activity II). Benzene eluted first 1·4 g least polar impurities and then 1·2 g homogeneous oily ethyl N-methyl-N-[3-(2-benzyloxyphenoxy)-3-phenylpropyl]carbamate (*X*) which was characterized by the ^{1}H-NMR spectrum: δ *c.* 7·30 (m, 10 H, 2 C_6H_5), 6·60—7·00 (m, 4 H, remaining 4 Ar—H), 5·10 (s, 2 H, $ArCH_2O$), 5·10 (t, J = 6·0 Hz, 1 H, Ar—CH—O), 4·00 (q, J = 7·0 Hz, 2 H, $COOCH_2$), 3·41 (bt, 2 H, CH_2N), 2·80 (s, 3 H, NCH_3), 2·12 (bm, 2H, CH_2 in the middle of the propane chain), 1·16 (t, J = 7·0 Hz, 3 H, $C—CH_3$).

A mixture of 4·5 g crude carbamate *X*, 5·6 g KOH and 7 ml ethanol was refluxed for 1·5 h in a bath of 105—115°C. It was diluted with water and extracted with benzene. The extract was shaken with 100 ml 1M-HCl but the hydrochloride formed did not enter the aqueous layer. It was obtained by evaporation of the benzene layer; 4·0 g oil which was dissolved in 10 ml 2-propanol and the solution slowly crystallized at room temperature; 1·7 g hydrochloride of *XI*, m.p. 151—153°C. Analytical sample, m.p. 152—153·5°C (2-propanol). Mass spectrum, *m/e*: 347 (M^+ corresponding to $C_{23}H_{25}NO_2$), 277, 243, 200, 148, 91. UV spectrum. λ_{max} 229 nm (log ε 4·02) (infl.), 273·5 nm (3·42). IR spectrum: 702, 749, 754 (5 and 4 adjacent Ar—H), 1251 (ArOR), 1500, 1597, 3000, 3032 (Ar), 2420, 2680, 2720 cm^{-1} (NH_2^+). ^{1}H-NMR spectrum (CD_3SOCD_3): δ 9·25 (bs, 2 H, NH_2^+), 7·20—7·60 (m, 10 H, 2 C_6H_5), 6·60—7·10 (m, 4 H, remaining Ar—H), 5·48 (t, 1 H, Ar—CH—O), 5·12 (s, 2 H, $ArCH_2O$), 3·00 (bt, 2 H, CH_2N), 2·40 (s, 3 H, NCH_3), 2·20 (m, 2 H, CH_2 in the middle of the propane chain). For $C_{23}H_{26}ClNO_2$ (383·9) calculated: 71·95% C, 6·83% H, 9·23% Cl, 3·65% N; found: 72·10% C, 6·94% H, 9·14% Cl, 3·64% N.

The spectra were registered and interpreted by Drs J. Holubek, E. Svátek and M. Ryska (department of physical chemistry of this institute). The technical assistance with the synthesis by Mrs M. Vlková is being acknowledged. The analyses were carried out by Mrs J. Komancová, Mrs V. Šmídová and Mrs J. Kropáčová (analytical department of this institute).

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