Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Comenius University, Bratislava, Slovak Republic

The critical micellar concentration of derivatives of piperidinoethylesters of 2-alkoxyphenylcarbamic acid

Study of local anesthetics. Part 162

F. ANDRIAMAINTY, J. ČIŽMÁRIK

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Dr. Fils Andriamainty, PhD., Department of Pharmaceutical Chemistry, Odbojárov 10, SK-832 32 Bratislava, Slovakia

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In the series of alkyloxy derivatives of piperidinoethyl esters of 2-alkoxyphenylcarbamic acid, the local anesthetic potency [1, 2] increases with the number (n) of carbon atoms in the alkoxy substituent only up to heptyloxy and hexyloxy substituents, respectively, and then it decreases. This phenomenon often is called cut-off effect [3].

The aim of the present paper was to study the critical micellar concentration (c.m.c.) of homologues of heptacaine (19), employing UV spectrophotometry at $T = 21$ °C and pH $\approx 4.5–5.0$. We found a quasi-parabolic dependence of the c.m.c. on the length of the carbon chain in the alkoxy sustituent.

Comparing the dependences of the c.m.c. on (n) at particular substances in distilled water and in 0.1 mol/l NaCl solution (Table), we found that in a homologous series of alkyloxy substituents, the c.m.c. decreases with the number of the carbon atoms up to heptyloxy ($n = 7$) and then increases. This behaviour reminds to the cut-off effect which has been observed not only in their potency in local anesthesia and inhibition of the ATPase activity [5] but also in their antimicrobial activity [6]. We suppose that the cut-off is caused by c.m.c..

Experimental

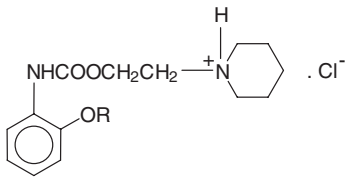
The derivatives of piperidinoethyl esters of 2-alkoxyphenylcarbamic acid (compared 4: R=C_2H_5, 10: R=C_4H_9, 13: R=C_5H_{11}, 16: R=C_6H_{13}, 19: R=C_7H_{15}, 22: R=C_8H_{17}, 25: R=C_9H_{19}) were synthesised according to [7].

Destilled water was used to prepare stock solutions (10^{-3} mol/l). From the particular stock solutions various concentrations of diluted solutions with pH $\approx 4.5–5.0$ at $T = 21$ °C were prepared. pH was measured with a pH meter (Portamess 943 pH, Elekronische Messgeräte GmbH Co., Berlin) and the temperature was controlled by a Thermostat (Veb ML W Prüfgerate-Werk Medingen/Sity/Freital (BRD)). The critical micellar concentration was determined using a spectrophotometer HP 8452 A Diode Array (Hewlett Packard, BRD) [8].

Table: C.m.c. (mol/l) in dependence on the number of the carbon atoms (n) of the alkoxy chain

Compd.	n	C.m.c. (mol/l)	*C.m.c. (mol/l)
4	2	4.447×10^{-4}	3.046×10^{-4}
10	4	4.370×10^{-4}	3.193×10^{-4}
13	5	3.990×10^{-4}	2.460×10^{-4}
16	6	3.708×10^{-4}	2.516×10^{-4}
19	7	3.151×10^{-4}	9.018×10^{-5}
22	8	3.914×10^{-4}	3.036×10^{-4}
25	9	4.763×10^{-4}	3.288×10^{-4}

* C.m.c. were the c.m.c. values of the derivatives of heptacainium chloride (0.1 (mol/l) NaCl solution [4])



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