

Modification of Silica and Cellulose Surface by Polyhexamethyleneguanidine Hydrochloride and Its Determination

O.O. Siryk[†], V.N. Losev[‡], S.L. Didukh[‡], E. V. Elzuf'ev[‡], A.K. Trofimchuk^{*§}

[†] F.D. Ovcharenko Institute of Biocolloid Chemistry of NAS of Ukraine, Kyiv, Vernadsky Ave, 42, 03142, Ukraine;

[‡] Kristall Research and Engineering Center, Siberian Federal University, Svobodnyi pr. 79, Krasnoyarsk, 660041 Russia;

[§] Taras Shevchenko National University of Kyiv, Kyiv, 12, Lva Tolstogo str, 01033 Ukraine; *e-mail: aktrof@ernv.biz

Received: January 31, 2018; Accepted: March 29, 2018

DOI: 10.17721/moca.2018.71-78

The adsorption of polyhexamethyleneguanidine hydrochloride (PHMGC) from aqueous solutions on silica and crystalline cellulose (CC) surfaces in batch and dynamic modes have been studied. The formation of PHMGC sorbates is due to an interaction of highly basic amino groups of PHMGC ($pK_a = 13.5$), which are protonated in wide range pH and capable of forming hydrogen bonds with a hydroxylated surface. Quantitative sorption of PGMGC on silica gels occurs in the pH range 2-8 while on CC – only in the pH range 6-9. This difference in PHMGC sorption behavior can be explained by different bond strengths, since the pK_a of silica gel hydroxyl groups is 7.1, and CC is 10, 12 – for the secondary groups and 14 – for the primary groups. By a capillary electrophoresis method, it has been shown that there is a tendency for more "light" polyguanidine oligomers to concentrate on silica, with their subsequent displacement by more "heavy" oligomers that do not desorb even from concentrated HCl solutions. Sorption of PHMGC on cellulose, unlike silica, is completely reversible. The use of cellulose for preconcentration of PHMGC with its subsequent determination in a sorbent phase by sorption-photometric, colorimetric and test-methods, as well as photometric method in solution after desorption (limit of detection = 0.012 mg/l) is proposed.

Keywords: silica, cellulose, sorption, polyhexamethyleneguanidine hydrochloride, photometry
