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EXPERIMENTAL PAPERS

Effect of Biopolymers and Functionalized by Them Vaterite Microparticles on Platelet Aggregation

D. V. Grigorieva[a,*], E. V. Mikhalchik[b], N. G. Balabushevich[b,c], D. V. Mosievich[c], M. A. Murina[b], O. M. Panasenko[b], A. V. Sokolov[b,d], and I. V. Gorudko[a]

[a] *Belarusian State University, Minsk, Belarus*

[b] *Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine of Federal Medical Biological Agency, Moscow, Russia*

[c] *Lomonosov Moscow State University, Moscow, Russia*

[d] *Institute of Experimental Medicine, St. Petersburg, Russia*
**e-mail: dargr@tut.by*

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Abstract—Vaterite microparticles, metastable form of calcium carbonate, are promising forms of delivery of medicinal compounds. For more efficient delivery of target molecules (increased incorporation and retention), vaterite microparticles must be functionalized with biopolymers. In this article the effect of polysaccharides, mucin and vaterite microparticles, as well as hybrid vaterite microparticles with the above-mentioned biopolymers was studied on platelet aggregation. It was found that fucoidan, heparin and dextran sulfate (when added to platelet-rich plasma) and mucin (when added to isolated platelets) initiated cell aggregation. Pectin and chondroitin sulfate inhibited ADP- and thrombin-induced aggregation in a dose-dependent manner, mucin suppressed ADP-induced, and dextran sulfate suppressed thrombin-induced platelet aggregation. Vaterite microparticles at a concentration of 100–1000 μg/mL did not affect the aggregation of isolated platelets, but caused 10–15% cell aggregation in plasma; at the same time, at a concentration of 1000 μg/mL vaterite microparticles prevented agonist-induced cell aggregation by ~30%. It has been established that hybrid vaterite microparticles with fucoidan or heparin, when added both to platelet-rich plasma and to isolated cells, are capable to initiate platelet aggregation. Vaterite microparticles functionalized with pectin or chondroitin sulfate had no effect on spontaneous cell aggregation, and did not affect (with chondroitin sulfate) or inhibit (with pectin) agonist-induced platelet aggregation. Thus, the use of hybrid vaterite microparticles with pectin or fucoidan/heparin may be promising for the delivery of drugs aimed at modulating (inhibition with pectin or activation with fucoidan/heparin) the platelet component of hemostasis.

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Keywords: platelet, aggregation, vaterite microparticle, polysaccharide, mucin, adenosine diphosphate, thrombin

INTRODUCTION

Among the new, rapidly evolving systems for the delivery of drug compounds, particular attention is being paid to those made from already approved materials for biomedical use. The latter include cal-