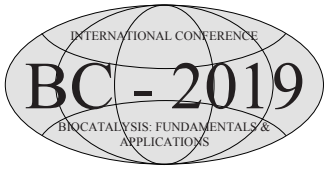
12th INTERNATIONAL CONFERENCE

BIOCATALYSIS-2019:

FUNDAMENTALS & APPLICATIONS

ABSTRACTS

June, 24-28, 2019
St. Petersburg - Valaam - Kizhi
Russian Federation



12th INTERNATIONAL CONFERENCE
BIOCATALYSIS-2019:
FUNDAMENTALS & APPLICATIONS

ORGANIZING COMMITTEE

***Chairman:* Prof. S. Varfolomeyev**
***Vice-Chairman:* Prof. I. Kurochkin**
***Scientific Secretary:* Dr. T. Osipova**

Members:

Prof. Gabibov A.
Prof. Bachurin S.
Prof. Klyachko N.
Dr. Gachok I.
Prof. Sinyashin O.
Prof. Bonch-Osmolovskaya E.
Prof. Nemukhin A.
Dr. Zaitseva E.
Prof. Popov V.
Prof. Tishkov V.
Dr. Knorre V.
Mr. Rybalov A.

PROGRAMME COMMITTEE

***Chairman:* Prof. V. Tishkov**
***Vice-Chairman:* Dr. A.Pometun**

Members:

Prof. Gabibov A.
Prof. Klyachko N.
Prof. Bonch-Osmolovskaya E.
Prof. Kurochkin I.
Prof. Ugarova N.
Prof. Švedas V.
Dr. Belogurov A.
Dr. Savin S.

Sponsored by

MAKO Congress Management
Technical secretariat

QIWI

TATNEFT

INTERNATIONAL CONFERENCE

BC - 2019

BIOCATALYSIS: FUNDAMENTALS & APPLICATIONS

12th INTERNATIONAL CONFERENCE

BIOCATALYSIS-2019:

FUNDAMENTALS & APPLICATIONS

ABSTRACTS

St.Petersburg – Valaam – Kizhi
June, 24-28, 2019

УДК 577(035.3)

Biocatalysis-2019: Abstracts of 12th International Conference “Biocatalysis: Fundamentals and Applications” / Editor V. Tishkov [Electronic resource] – Moscow:
Innovations and High Technologies MSU Ltd, 2019
– 1 electronic optical disk (CD-ROM); 12 cm.
– System requirements: Personal computer with processor 486+, Windows 95,
CD-drive; Adobe Acrobat Reader.
ISBN 978-5-9651-1245-6

Биокатализ – 2019: Тезисы 12-й Международной конференции «Биокатализ: Фундаментальные основы и применение» / Редактор В.И.Тишков
[Электронный ресурс] – М.: ООО «Иннотех МГУ», 2019.
– 1 электрон. опт. диск (CD-ROM); 12 см.
– Системные требования: ПК с процессором 486+; Windows 95; дисковод CD-ROM; Adobe Acrobat Reader.
– 250 экз. ISBN 978-5-9651-1245-6

The development of magnetic liposomes-based nanoparticles iron oxide with different anisomeria

S.Ch. Vanzarakshaeva[1], K.Yu. Vlasova[1], I.M. Le-Deygen[1], A.D. Usvaliev[1], Yu.I. Golovin[1,2], A.V. Kabanov[1,3], N.L. Klyachko[1,2,3]

[1]*Lomonosov Moscow State University, Moscow, Russia*
[2] *G.R. Derzhavin Tambov State University, Tambov, Russia*
[3] *University of North Carolina at Chapel Hill, Chapel Hill, U.S.A.*

Keywords: magnetic nanoparticles, magnetic liposomes, low-frequency alternating magnetic field

Biocompatible magnetic nanoparticles (MNPs) have a great potential in the field of pharmaceuticals and biomedical research. In particular, MNPs are used in the development of containers for drug delivery. Their application helps to solve the topical problems such as drug inactivation and degradation in the bloodstream.

Different types of nanocontainers are investigated to solve this issue. Liposomes are one of the promising and well-studied forms of nanocontainer. This type of containers delivers both hydrophilic and hydrophobic molecules of various sizes, but one of the significant drawback is the slow release or complete lack of the release of active molecules. To date, an approach to simplify and improve the release of the drug from liposomal containers, which are functionalized with MNPs under the action of low-frequency alternating magnetic field (LF AMF). The approach is based on the mechanical rotation of the MNPs in the LF AMF, leading to disordering of the lipid membrane of the nanocontainer.

The aim of the work was to obtain and study a model for the release of molecules from liposomes with immobilized MNPs of various shapes – "spheres" and "rods" - on their surface under the exposures to LF AMF.

Within the framework of this study, the following problems are considered: synthesis of MNPs by thermal decomposition for spherical particles and two-stage synthesis (hydrolysis and microwave radiation) for MNPs in the form of rods; preparation of magnetic liposomes by hydration of the lipid film; immobilization of MNPs, which are stabilized by nitrodophamine, to carboxyl groups, which are located on the surface of the liposomes, by carbodiimide method; study of membrane permeability under the LF AMF on the kinetics of suppression of the enzymatic reaction with alpha-chymotrypsin and the method of ATR-FTIR.

As a result of the work, MNPs of iron oxide of spherical shape and in the form of rods were synthesized. Magnetic liposomes with the size of 200±15 nm and low PDI were obtained. Under the action of LF AMF (110 Hz, 90 mT), the release of high molecular weight protein (the Bowman-Birk Inhibitor, 6-8 kDa) from magnetic liposomes with immobilized spherical MNPs were observed. In the case of MNPs in the form of rods, there is no statistically significant effect of AMF action, but there is a tendency to improve protein release in comparison to control experiments without field stimulation. According to ATR FTIR, MNPs that were immobilized on the surface of liposomes interact mainly with lipid phosphates and polyethylene glycol "coat". In this case, there was no disordering of the lipid membrane under the action of LF AMF observed. Nevertheless, the effect observed indicates the release of protein from the surface of the liposomes membrane. The possibility of release of protein due to the magneto-mechanical actuation of MNPs in the LF AMF was demonstrated.

Investigation was supported by RFBR 17-54-33027 and 18-29-09154 grants.