

Editor's Foreword

This special issue comprises reviews and experimental studies that were presented at the 3rd International Conference “Biotechnology of New Materials – Environment – Quality of Life” held at the Siberian Federal University (Krasnoyarsk, Russia).

Current changes in the biosphere lead to excessive accumulation of waste (such as heavy metals, toxins, and synthetic plastics) in the environment and a reduction in nutrient-rich food. Noncommunicable diseases, which are responsible for almost 70% of global deaths, are mainly caused by modifiable risk factors. Metabolomics, the quantitative and comprehensive evaluation of metabolites, has emerged as a novel and powerful tool in precision medicine. The review “Anthropogenic pressure and lifestyle are the underlying cause of pandemic chronic diseases” by D. Tsoukalas et al. discusses lifestyle interventions that may improve longevity and metabolic balance. To improve people's quality of life and health, it is necessary to develop new molecular methods for diagnosing socially significant diseases. The paper “Bioluminescent binding microassay using aptamers as biospecific elements” by L.A. Frank et al. reported results using an aptamer sensors and a highly sensitive bioluminescent reporter Ca²⁺-regulated photoprotein obelin for the detection of diagnostically important targets in the blood of patients. The developed solid-phase bioluminescent assay provides fast monitoring of an oligonucleotide library enriched with oligonucleotides affine to the target, evaluation of the affinity of individual aptamers and their shortened variants, and definition of the relative position of the aptamers on the target molecule.

A number of papers address the potential of novel biomaterials and composites for creating new-generation drug systems and biomedical products and improving health-related environmental conditions, including hygienic conditions in biotechnological industries. These are the papers “Synthesis and study of the properties of amphiphilic poly-N-vinylpyrrolidone with terminal thioalkyl groups” by M.I. Shtilman et al., “Silver nanoparticles as a new generation of antimicrobial prophylaxis” by I.T. Garipov et al., and “Antimicrobial activity of biogenic hop-based silver nanoparticles for application in sugar and alcohol industries” by T.C. Borsari et al. The paper “Early assessment of health technologies” by O.N. Shishatskiy analyzes contemporary views of an early assessment of new health technologies and products with the aim of developing medical services that have additional value. The paper describes methods that can be used to determine the commercial effectiveness of medical products and services in the early stages of their development and can be used for comparison with potential competitors.

Currently, among the most hazardous contaminants of the biosphere are chemical pesticides, which are applied in enormous quantities and are indispensable to effective modern farming. The review “Nanotechnology-based delivery systems: highlights in agricultural applications” by J.L. de Oliveira et al. addresses the problem related to pesticide contamination of the biosphere and food and prospects of using new technologies, including nanotechnologies, to create safe systems for protecting crops against pests and pathogens. The paper “Design and application of slow-release pesticide formulations embedded in a biodegradable matrix based on poly(3-hydroxybutyrate)” by S.V. Prudnikova and T.G. Volova reports experimental results of constructing controlled-release fungicide and herbicide formulations based on the degradable material poly(3-hydroxybutyrate) and natural materials. The experimental formulations were effective in plant communities over long time periods (two or more months), controlling pathogenic microorganisms and weeds. The paper “Thermal and mechanical

studies of biofiller/poly-3-hydroxybutyrate biocomposites” by E.G. Kiselev et al. describes the properties of a new composite based on degradable poly(3-hydroxybutyrate) blended with birch wood flour, which was constructed to reduce the cost, increase the availability, and widen the applications of “green” bioplastics. The composite is a promising nontoxic material for producing wood-based panels for the construction industry and the manufacturing of furniture in place of materials produced using toxic polyester resins. A similar ecofriendly nanocomposite based on glycerol-plasticized thermoplastic potato starch is described in the paper “Mechanical and permeability properties of thermoplastic starch composites reinforced with cellulose nanofiber for packaging applications” by P. Balakrishnan et al. The composite is a promising material for fabricating high-quality films, including degradable packaging.

One of the problems of global ecology is the sustainability of the biosphere, which has been functioning for several tens of thousands of years owing to its closure and natural global material cycling. This is the subject of the review “Closure of Earth’s biosphere: evolution and current state” by S.I. Bartsev et al., which discusses stages of the formation of the biosphere in the context of closure – a key property and parameter of the biosphere – and possible approaches to resolving the Vernadsky-Darwin paradox.

The subjects discussed in this issue will be of interest to specialists in biology, biotechnology, ecology, materials science and to the teachers and students of biological schools of universities.

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