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Title of the doctoral dissertation: *Stabilization of bacteriophages against adverse conditions*

Abstract

The spread of drug resistance among microbes has become the modern-day plague and forced the entire scientific community to search for alternative methods for bacteria elimination. Bacteriophages – a group of viruses that infect bacterial cells – came out of the depths of history and appeared as the light at the end of the tunnel for this struggle. Phages are natural antimicrobials. As biological beings, they can evolve as fast as pathogenic bacteria do, giving humanity a chance to catch up in this arms race. However, this property remains their weak point, for the components of bacteriophages' virion (proteins and nucleic acids) can be damaged by adverse conditions, such as temperature, radiation, or chemical compounds. Therefore, efficient methods for phage stabilization against adverse conditions are essential to fully embrace the potential of those exceptional viruses.

This thesis aims to combine molecular biology and physical chemistry methods to develop novel and more efficient methods for bacteriophage stabilization. Effectively stabilized, phages could be applied in laboratory, industrial, and environmental conditions to fight bacterial infections.

The following chapters of this thesis describe the use of nanomaterials, small molecular dyes, and polymers against selected adverse conditions. An inorganic nanocomposite BOA was to improve long-term phage storage in plastic labware. The stabilization of bacteriophages from UV irradiation was provided using small molecular

dyes, including Congo red and selected food colorants (brilliant blue FCF in particular). Polymers provided stabilization during the exposure to elevated temperature.

Along with the real-life applications of the described methods, I also explained the mechanism behind the stabilizing properties of each of the examined factors. In the case of dye-mediated UV stabilization, the results presented in this thesis are the first to deal with such an issue.

The methods proposed in this thesis are based on compounds that are harmless to animals and the environment or designed to reduce the release of harmful substances outside the experimental systems. Successfully applied, the methods proposed in this thesis would allow the introduction of bacteriophages to sterilize flow bioreactor systems, preserve food, and be used in agriculture.