

Selected Biological Properties and Practical Importance of Polylactide Films Containing Dyes

Agnieszka Richert¹, Natalia Hejda¹, Maria Swiontek Brzezinska², Aidana Rysbek³

1. Nicolaus Copernicus University, Faculty of Biology and Veterinary Science, Department of Genetics, Gagarina 11, 87-100 Toruń, Poland, a.richert@umk.pl

2. Nicolaus Copernicus University, Department of Environmental Microbiology and Biotechnology, Gagarina 11, 87-100 Toruń, Poland

3A. National Center for Biotechnology, 13/5 Kurgalzhynskoye Road, Nur-Sultan 010000, Kazakhstan

3B. Department of General Biology and Genomics, L.N. Gumilyov Eurasian National University, Kazhymukan 13 St., Nur-Sultan 010000, Kazakhstan

Abstract

Film materials were made of biodegradable polylactide and dyes, which were introduced into a polymer matrix. The additional substances used were fuchsin, crystal violet, safranin and malachite green. The aim of this work was to produce colored films and analyze them from a biological perspective.

Materials



Figure 1. PLA films

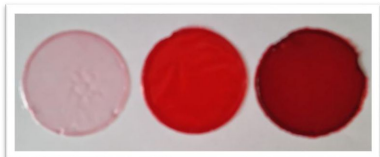


Figure 2. PLA films with safranin

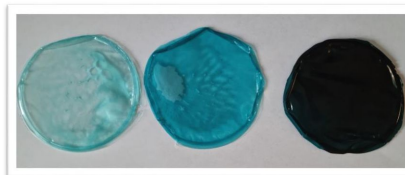


Figure 3. PLA films with malachite green

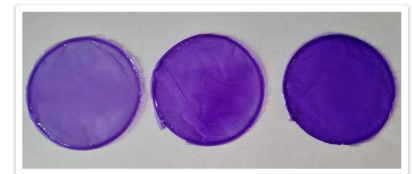


Figure 4. PLA films with crystal violet

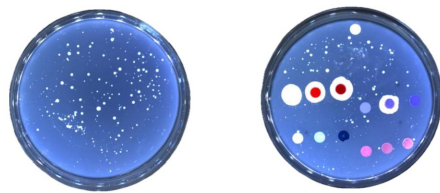


Figure 5. PLA films with fuchsin

Methods

We measured the biological oxygen consumption of microorganisms (BOD) using an OxiTop Control measurement system. The structure of the film was checked using SEM. The NGS sequencing of the 16SrRNA gene was performed. Mutagenicity analyses were performed according to the Ames test. Biocidal properties were confirmed according to ISO standards.

Results



A. *Salmonella typhimurium* TA98

C. *Salmonella typhimurium* TA98 + samples

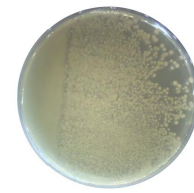
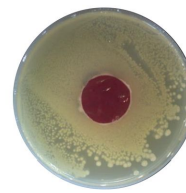


Figure 7. Control plate for *Escherichia coli*

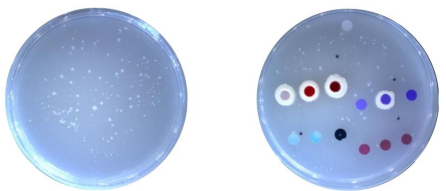


A.

B.

C.

Figure 8. Bacterial (*E. coli*) growth in the presence of samples with A. fuchsin, B. crystal violet, C. malachite green.

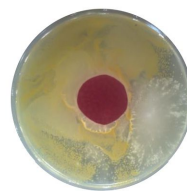


B. *Salmonella typhimurium* TA100

D. *Salmonella typhimurium* TA100 + samples



Figure 9. Control plate for *Staphylococcus aureus*



A.

B.

C.

Figure 10. Bacterial (*S. aureus*) growth in the presence of samples with A. fuchsin, B. crystal violet, C. malachite green.

Conclusions

During the biodegradation processes, the colonization of the film by specific strains was observed, thanks to which it was possible to select a vaccine influencing the biodegradability of the given films. The films can be used in the food packaging industry due to their biocidal properties and lack of mutagenicity.