IOCFB 2024 Conference

The 1st International Online Conference on Functional Biomaterials

10–12 July 2024 | Online

Thermoplastic and biocompatible materials based on block copolymers of chitosan and polycaprolactone

Ivan Lednev, Sergey Zaitsev, Ekaterina Maltseva, Larisa Smirnova

Chemistry Department, Lobachevsky State University of Nizhny Novgorod, 23 Gagarin Ave, 603022 Nizhny Novgorod, Russia

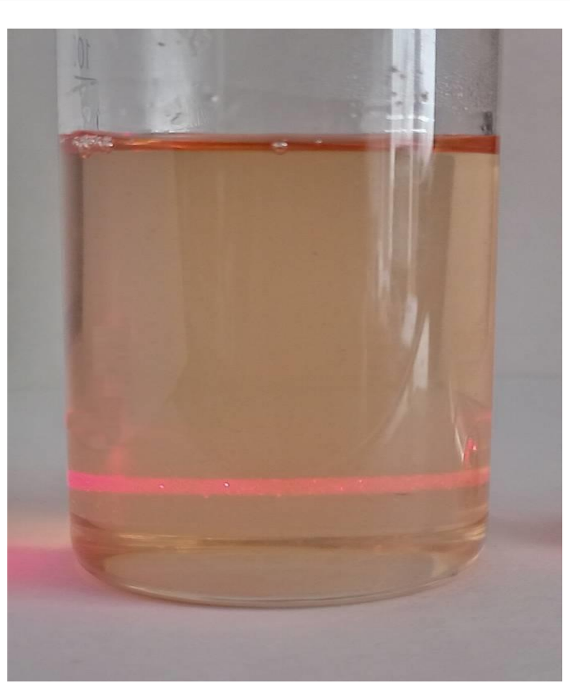
INTRODUCTION & AIM

The relevance of the research topic is related to the demand of polymer materials for biomedical applications and suitable for use as scaffolds for regenerative medicine.

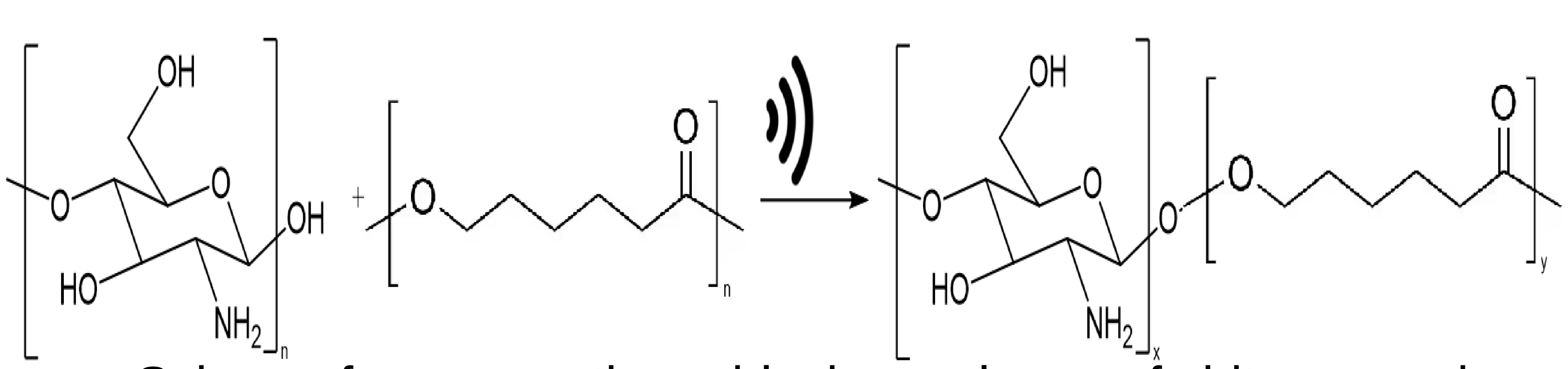
Polyesters are convenient due to their processability, since materials based on them have good mechanical properties, however, high hydrophobicity and low cell adhesion limit the use for solving a number of medical problems, which can be solved by the addition of chitosan.

The aim of this work was to obtain compositions based on biodegradable polymers – chitosan and polycaprolactone: mixtures and block copolymers, investigation of their properties

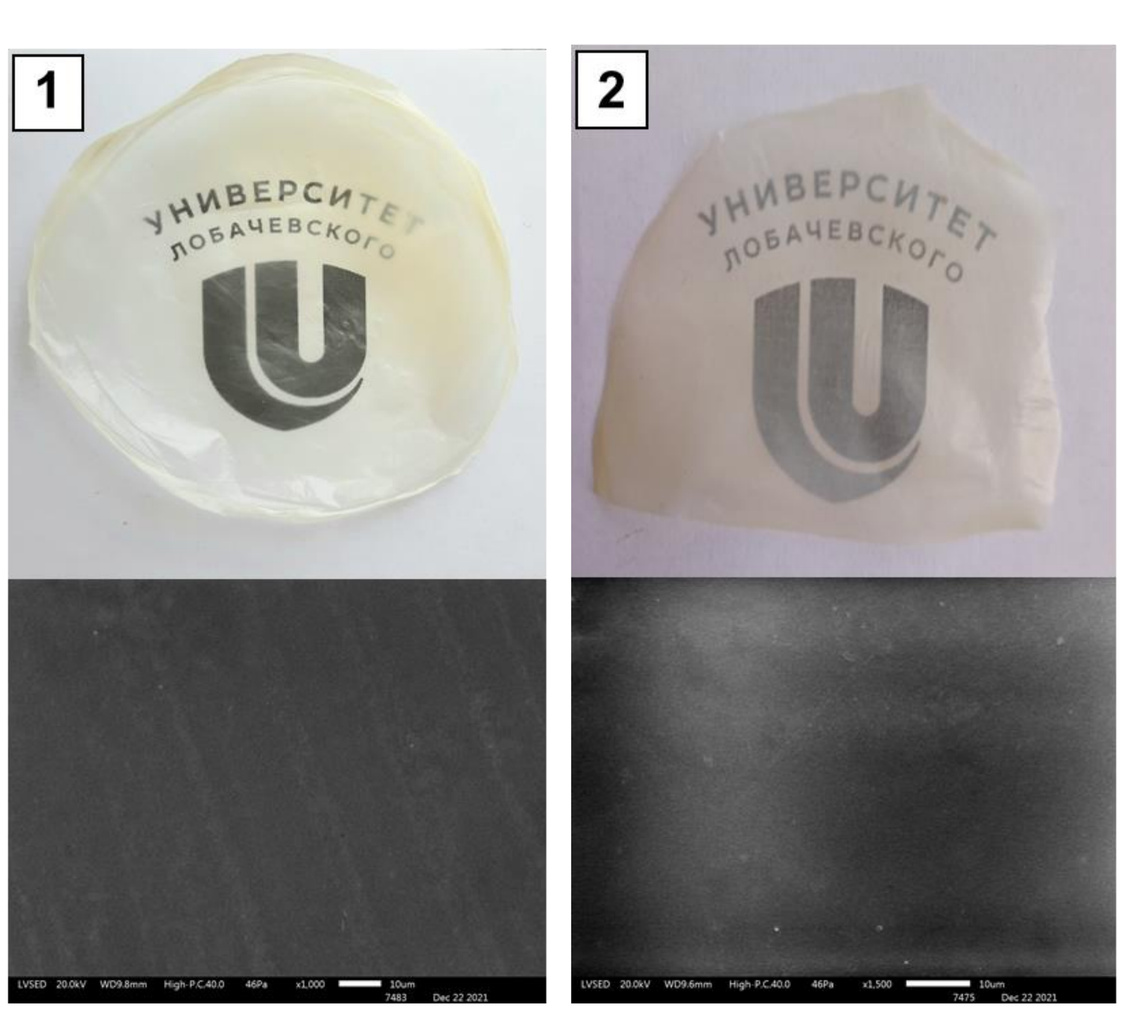
METHOD



The photo of chitosan and polycaprolactone (1:2) mixture in DMSO solution



Scheme for preparation a block copolymer of chitosan and polycaprolactone by ultrasonic irradiation



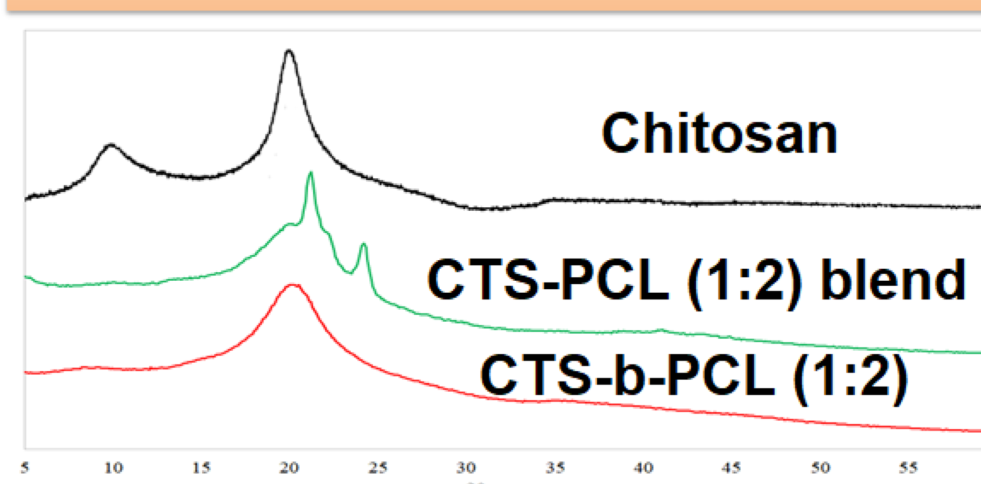
SEM-images and photos of the films
(1) – CTS-b-PCL (1:2)
(2) – CTS-PCL (1:2) blend

RESULTS & DISCUSSION

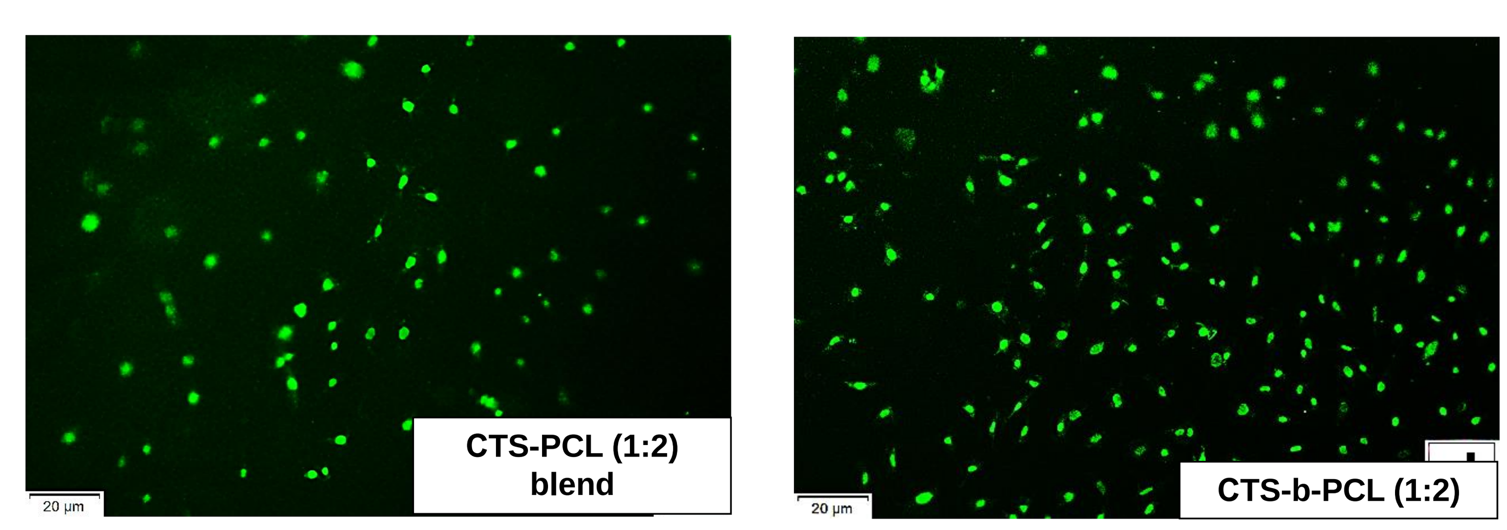
Mechanical properties

Compositin	Tensile strength, σ (MPa)	Elongation at break, ε (%)
CTS	14.4 ±0.8	1.2 ±0.1
PCL	32.3 ±1.5	45.9 ±2.0
CTS – PCL (1:1)	37.4 ±1.7	14.4 ±1.2
CTS – PCL (1:2)	63.2 ±2.8	33.6 ±1.6
CTS – b – PCL (1:1)	**42.1 ±2.1**	**15.2 ±1.1**
CTS – b – PCL (1:2)	**67.3 ±2.8**	**34.1 ±2.0**

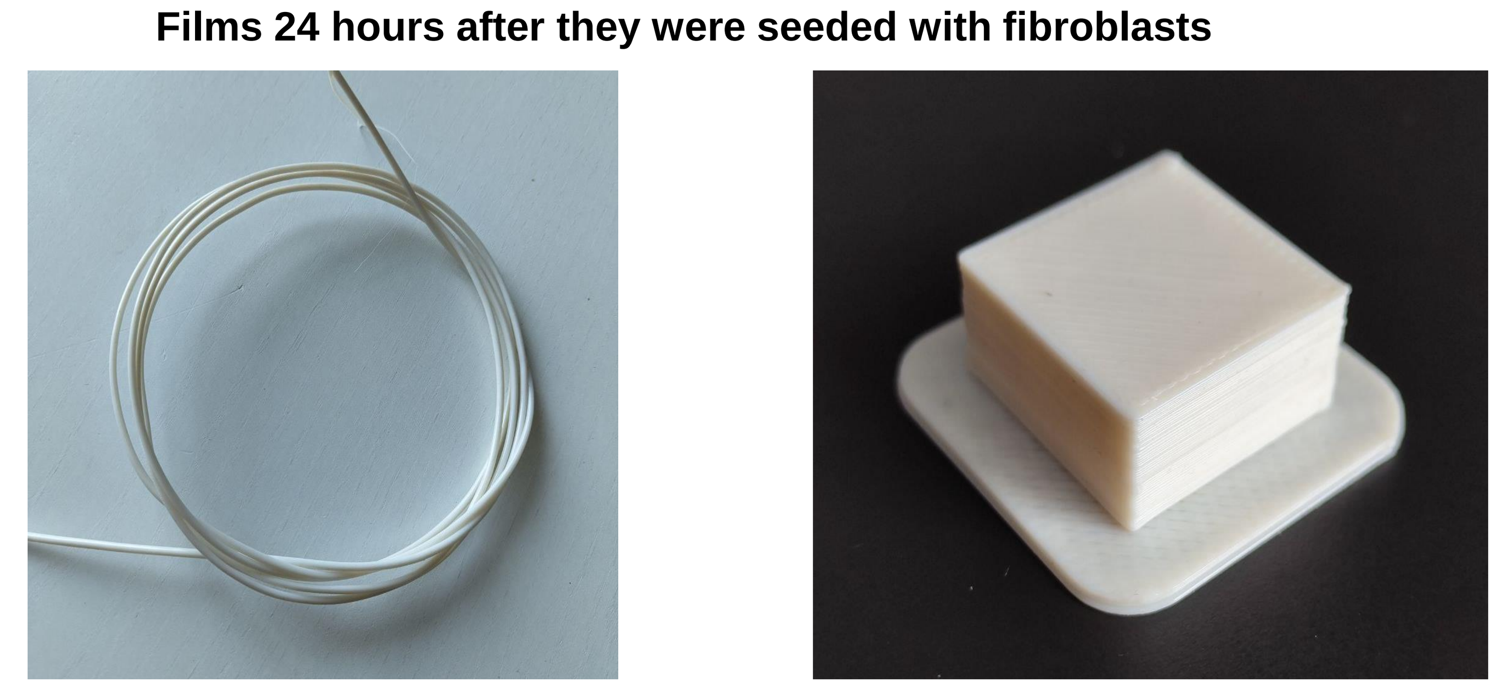
It can be seen an increase in the mechanical properties of the samples for the block copolymer, despite the decrease in molecular weight under the ultrasonic irradiation



XRD of samples



Films 24 hours after they were seeded with fibroblasts



Photos of extruded filament and printed sample from CTS-b-PCL (1:2) composition

CONCLUSION

The summary of the results shows that compositions based on block copolymers are superior to the blends in terms of mechanical properties, as well as thermoplasticity, which determines the prospect of their use in tissue engineering

This research was funded by the Russian Science Foundation, grant number 23-13-00342