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MECHANICAL AND BIOLOGICAL EVALUATION OF POLY(L-LACTIDE) WITH CO_2 LASER SURFACE MODIFICATION

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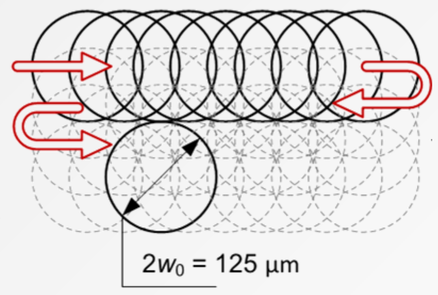
MATERIAL

The polymer sheets having an average thickness of 350μm were extruded from commercial medical poly(L-lactide) (PLLA Evonik L210S) by compression molding of the granules pre-heated up to 200° C. This procedure allowed to obtained amorphous poly(L-lactide) ($PLLA_{AMO}$) sheds having the degree of crystallinity Xc ≈ 2% ± 0.5% . In order to obtain crystalline polymer ($PLLA_{CRY}$) amorphous specimens underwent thermal crystallization process for 5h in 100° C.

LASER IRRADIATION

Laser surface modification of the polymers can significant influence their physicochemical and mechanical properties. Depending on the used laser as well process parameters e.g. the length of the light wave, pulse duration, number of pulses or pulse energies obtained results may be different.

To investigate the influence of the CO_2 laser surface modification on material properties specimens were irritated with three laser powers Fa_1=24 J/cm², Fa_2=48 J/cm² and Fa_3=71 J/cm².

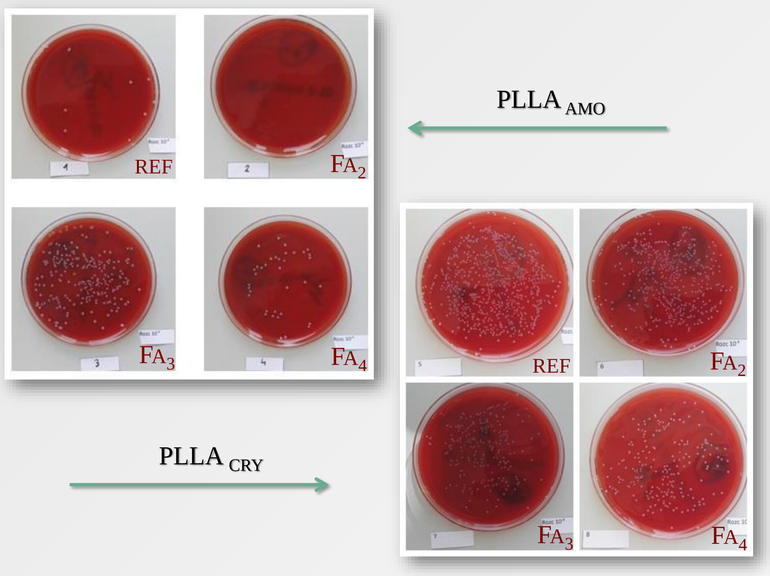


TESTING

The mechanical properties of the specimens were determined in uniaxial tensile test. Biological evaluation was carried out with use of on mouse fibroblast line Balb/3T3 in order to determinate influence of material irradiation on the cytotoxicity.

BACTERIA

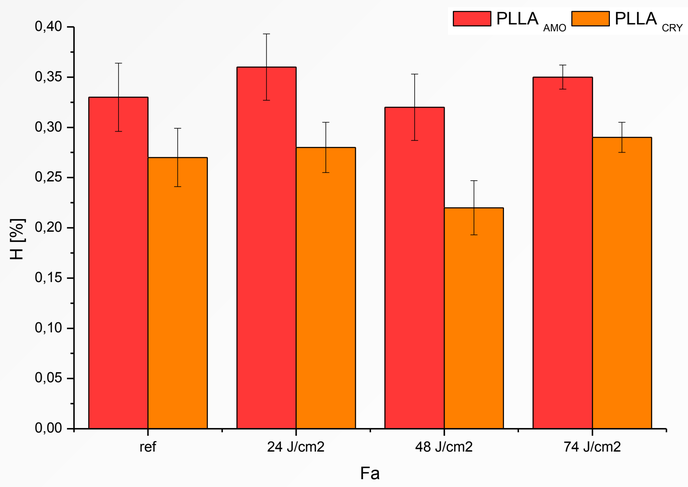
Macroscopic image of bacterial colony desorbed from speciments surface under the influence of saponin



CYTOTOXICITY

EVALUATION, PERFORMED ON THE CELL CULTURE AFTER 24H OF INCUBATION SHOWED THAT SAMPLES OF POLY(L-LACTIDE) IN BOTH PHASES IRRADIATED BY THE LASER WITH POWER FA_2 AND FA_3 WERE INSIGNIFICANTLY POSITIVE (CYTOTOXIC) WHILE REFERENCE SAMPLES AND ONE IRRADIATED WITH LOW LASER ENERGY (FA_1) WERE NEGATIVE (NOT CYTOTOXIC).

HAEMOLYSIS



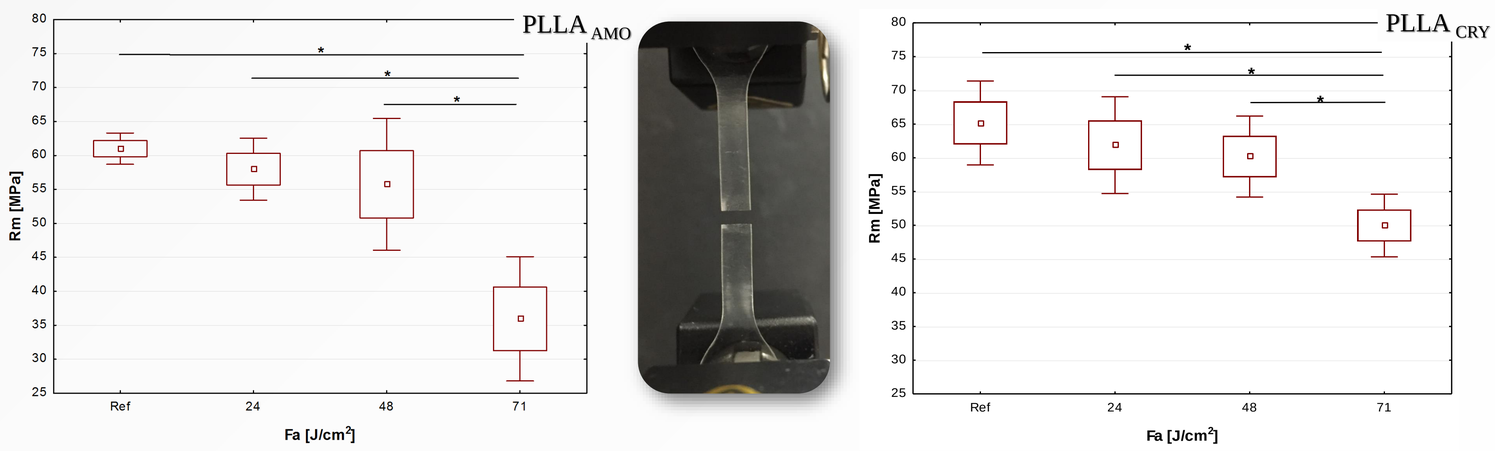
The percentage of haemolysis H [%] was calculated according to the formula:

H [%] = [(AB – AK) x 100] : (A100 –AK)

AB - Absorbance of the sample,
AK - Absorbance of the control sample,
A100 - Absorbance of the sample with 100 % of the hemolysis.

MECHANICAL STRENGTH

THE STRESS-STRAIN CURVES WERE DETERMINED AND THE TENSILE STRENGTH R_M. THE EXPERIMENT SHOWN THAT WITH THE INCREASE OF CO_2 LASER IRRADIATION FOR BOTH $PLLA_{AMO}$ AND $PLLA_{CRY}$ THE MECHANICAL TENSILE STRENGTH R_M GRADUALLY DECREASED.



The tensile strength Rm [MPa] of the biodegradable polymers: $PLLA_{AMO}$ and $PLLA_{CRY}$ irradiated by CO_2 laser of different powers Fa, *p<0,05

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