New Biodegradable Polyester Blend As a Potential Material for Myocardial Patches

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Introduction
The heart does not regenerate new functional tissue when myocardium dies following a coronary artery occlusion, or is defective. Myocardial patches emerge as potential alternatives to heart transplantation. It is necessary to have polymers with higher flexibility for use in the engineering of soft tissues, like heart, since cardiac cells need to retract and extend on the surface to function properly. The purpose of the study was to augment the hydrophilicity and softness of P(L-D,L)LA and PHBV, biodegradable polyesters widely used in tissue engineering, by using low molecular weight Poly(glycerol sebacate) (PGS) as a plasticizer in their blend.

Materials and Methods
PHBV (5% HV, Aldrich Co.)-P(L-D,L)LA (70:30, Boehringer Ingelheim Co.)-PGS blends were used to obtain micron-size (dia 1.16 - 1.37 µm) aligned fiber mats through electrospinning and macroporous tubings were obtained from a P(L-D,L)LA-PGS blend by dip coating on a wire and subsequent freeze drying. Tg value and mechanical strength of P(L-D,L)LA-PGS blend films were determined via DSC and mechanical analyses, respectively. 3D myocardial constructs obtained by wrapping cell (Wharton’s Jelly MSCs) seeded, aligned fiber mats around the macroporous tubings (Figure 1).

Results
For P(L-D,L)LA and the P(L-D,L)LA-PGS (96:4 w/w) blend the midpoint Tg values were obtained as 42.11 and 40.65 °C, respectively. The modulus of elasticity and UTS values decreased upon addition of PGS to P(L-D,L)LA (Table 1). A little decrease in the water contact angle (from 86.98 ± 2.45 to 81.98 ± 1.30) was observed in presence of 4% PGS, which contains –OH groups, in the blend films. A decrease in storage modulus of P(L,D,L)LA:PHBV:PGS (49:49:2 w/w) aligned fiber mats was observed upon increase in temperature from 25°C to 37°C.

Table 1. Tensile mechanical properties of polymer films.

<table>
<thead>
<tr>
<th>Sample</th>
<th>UTS (MPa)</th>
<th>E (MPa)</th>
<th>δ (%)</th>
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<tbody>
<tr>
<td>P(L-D,L)LA</td>
<td>28.1 ± 7.1</td>
<td>395.0 ± 35.8</td>
<td>307.7 ± 21.4</td>
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<tr>
<td>P(L-D,L)LA-PGS (96:4 w/w)</td>
<td>23.4 ± 4.2</td>
<td>228.5 ± 25.3</td>
<td>379.5 ± 42.5</td>
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</table>

Conclusions
Low molecular weight PGS acted as a plasticizer in its blends with P(L-D,L)LA and PHBV-P(L-D,L)LA and augmented their softness, making them more suitable for use in myocardial patches.

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Disclosures
Authors have nothing to disclose.