**Biocompatibilty of Segmented Poly(urethane-urea) Elastomers Based on Polycaprolactone**

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**Statement of Purpose:** Cardiac affections are the leading cause for death in men and women in México and the U.S [1, 2]. When the myocardium is injured by a wound, i.e. myocardial infarct, the muscular tissue dies and in its place a scar is formed that does not allow for normal heart function. A large number of patients would benefit from small structures like pieces of muscle. The properties of the materials have to guide stem cell differentiation and provide mechanical stability during tissue integration. Our approach is to seed scaffolds with cardiac progenitors that will differentiate in vitro prior to implantation. The objectives of this work were to synthesize poly(urethane-urea) (PUUs) polymers from PCL2000, HMDI and BDA with different hard segment (HS) contents, characterize them, and, prove biocompatibility by seeding them with Sca1+/CD31- cardiac progenitor cells (CPCs) isolated from infarcted hearts.

**Methods:** PUU multiblock co-polymers were synthesized via a two-step polycondensation reaction using Polycaprolactone Diol (MW 2000 g/mol, Sigma-Aldrich) endcapped with Methylene bis-(4-cyclohexylisocyanate) (Sigma-Aldrich) and chain extended with Butanediamine (Sigma-Aldrich). The details of the synthesis procedure can be found in a previous publication [3]. Dynamic mechanical analysis (DMA) was performed using a DMA-7 (Perkin-Elmer, USA) at a frequency of 1 Hz. From -100 C to 100 C at a heating rate of 1 C/min. Samples were cut, from films made by solvent casting a 10% W/V solution, with dimensions of 15x3x.06 mm. Thin films of the PUUs were also deposited on the glass coverslips by a spin-coater (Headway Research, USA), 50 µL of the polymer solution were applied to the center of the coverslips and spun for 30 s at 3000 rpm. Murine Sca1+/Cd45- CPCs were plated at a density of 3000 cells/cm$^2$ for coverslip samples in 3 mL of culture media, consisting of Iscove's Modified Dulbecco's Medium (Invitrogen) supplemented with 10% Fetal Bovine Serum (Gibco), 1% penicillin - streptomycin (Invitrogen).

**Results:** A series of four PUUs were synthesized (Table I). The PUUs obtained were linear and soluble in polar solvents such as DMAc, THF, DMF, and DMSO.

**Table I. Synthesized Polymer Composition**

| Sample | Mol. Composition HMDI/PCL/BDA | HS Content | Characteristics |
|---|---|---|---|
| PUU14 | 1.2/1/0.2 | 14% | Brittle, opaque |
| PUU23 | 2/1/1 | 23% | Flexible, clear |
| PUU32 | 3/2/1 | 32% | Elastic, clear |
| PUU40 | 4.5/1/3.5 | 40% | Elastic, opaque |

The glass transition was identified from DMA. The DMA results of PUU samples (Fig. 1) present this relaxation process between -70 C and -10 C. The temperature of the maximum of the loss tangent peak was higher in the sample containing 14% HS than in the rest of the samples.

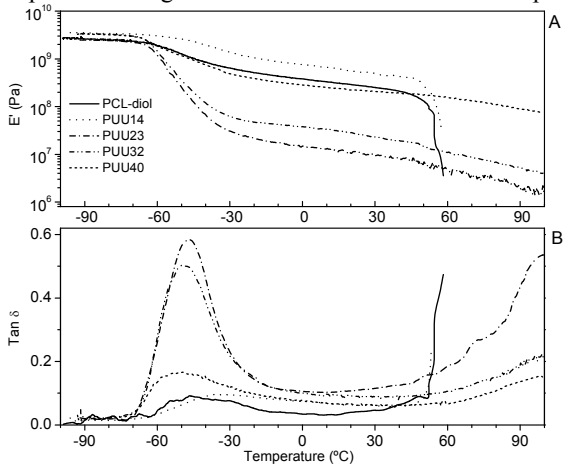


**Figure 1. DMA curves of PUUs: (A) storage modulus, (B) tan δ.**

The cultured cells were monitored by phase microscopy during 7 days and were found to have similar morphology to the control PS ones (Fig. 2). CPCs were capable of proliferating on the PUUs. The HS content doesn't appear to have a direct influence on this.

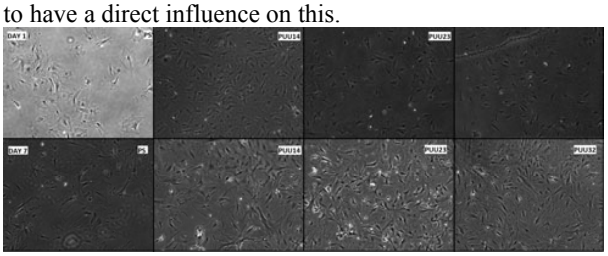

**Figure 2. Sca1+/CD31- Cell cultures on the different PUUs at day 1 and day 7.**

**Conclusions:** The PUUs synthesized in this work are promising materials for biomedical applications in which fatigue resistance is required. The survival of CPCs on these PUUs suggests that further applications as scaffolds for a cardiac patch may be possible.

**References:**

1. INSP. Salud Pública de México. 2002;44:266-282
2. American Heart Association. Heart Disease and Stroke Statistics – 2010 Update; 2010.
3. May-Hernández L. J Appl Polym Sci. 2011;119:2093 2104.