Biodegradable Artificial Blood Vessels: A Breakthrough in Tissue Engineering

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Transplanting blood vessels frequently fails because the recipient rejects the donor arteries due to their genetic properties. In addition, many available synthetic products on the market have many shortcomings. The main aim of this research is the study of polymer blend solution process and the influence of different combinations of Poly(lactic acid) (PLA) and Polycaprolactone (PCL). In combination with N2-plasma treatment, it will create a biodegradable scaffold of an artificial blood vessel capable of all functionalities of an artery. The N2-plasma-enhanced chemical vapor deposition method created chemical bonds due to interaction between gases with the functional groups present close to the surface of the film. The results indicated that the best blend ratio of PCL/PLA was 25/75 with film thickness of 230 nm. It resulted in a scaffold with strength of 31.14 mPa and 62.36 % elas-ticity compared to 20.00 mPa and 30.00% elasticity for the majority of vessels available on the market today. The N2-plasma treatment was used to minimize crosslinking degrees, decrease cracking, minimize imperfections in the polymer films and increase the anti-clot characteristics of the scaffold. The polymer gels were imaged under Rat aortic smooth muscle cells and were seeded on the gels at a count of 50,000 cells per 10 cm2 of gel in a CO2 incubator at 37 °C. In addition, to promote cell adhesion, RGD Peptide was used. The positive results of this research, including the use of unique polymer blends of PLA/PCL with N2-plasma treatment and RGD Peptide had an exceptionally positive effect on both mechanical and surface properties of the scaffold, which will likely impact the future design of artificial cardiovascular products.