Synthesis and characterization of polyglycerols dendrimers for applications in tissue engineering biological.

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Introduction: Over the last twenty years is the growing development in the manufacture of synthetic scaffold in tissue engineering applications. These new materials are based on polyglycerol dendrimers (PGLD’s). PGLD’s are highly functional polymers with hydroxymethyl side groups, fulfill all structural prerequisites to replace poly(ethylene glycol)s in medical applications. Furthermore, since these materials are based on naturally occurring compounds that degrades over time in the body and can be safely excreted. The objective of this work was the synthesis, physicochemical, biological characterization of HPGL’s with potential use as scaffolds in tissue engineering. HPGL’s with oligomeric cores, of diglycerol triglycerol and tetruglycerol was used. Theoretical and Experimental Simulation Details: The synthesis of PGLD procedures involves the etherification of glycerol through anionic polymerization of glycidol. The PGLD’s were characterized by chromatographic techniques (SEC and HPLC), spectroscopic (FTIR, 1H-NMR and 13C - NMR) electrochemical (zeta potential) and thermal analysis (DSC and TGA) techniques. The structure- activity relationships (SAR’s) of compound prototype and its analogs were studied to determine the generation number (G) of the molecule responsible for the biological activity on the adhesion and cell proliferation process. A detailed study of the structure of PGLD’s of G=0-4 was performed using the Hyperchem 7. 5 and Gromacs 4 software packages. The biocompatibility studies were studied by scanning electron microscopy (SEM) and fluorescence microscopy (EPF) technique after PGLD (G=0-4) blood contact. The overall electro-negativity/total charge density, dipole moment, frontier orbital’s (HOMO - LUMO) and electrostatic potential maps (EPM) were calculated. The most stable form of the resulting compounds was determined by estimating the hydration energy and energy conformation. Results and Discussion: The techniques SEM and EPF microscopies indicated that the compatibility with the blood of PGLD appears to be dependent on dendrimer generation. The protein adsorption experiments suggest that PGLD of G=4 preferentially adsorbed fibrinogen respect to human albumin. After blood contact with PGLD was verified by in vitro assays that PGLD with G > 4 activated platelet adhesion and activation suggesting that this dendrimer generation is not suitable for cardiovascular applications. The in vitro blood compatibility properties were theoretically analyzed by MNDO/d methods semi-empirical quantum chemistry. There was a relationship between the frontier orbitals (HOMO - LUMO) and compatibility with the blood of PGLD. The local PGLD properties were calculated to describe the regions of the donor / acceptor dendrimer characters. It was demonstrated a strong relationship between the descriptors of blood compatibility of the experimental results and quantum chemistry calculations, suggesting that compatibility with the blood of PGLD is characterized by electronic effects in PGLD periphery.