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# Controlling the stiffness and porosity of Polyacrylamide hydrogel matrices and evaluating their effect on podocyte-behavior

Chronic kidney disease (CKD) is characterized by reduced kidney function that progresses to end-stage renal disease (ESRD). Podocytes are highly specialized glomerular epithelial cells which form with the glomerular basement membrane (GBM) and capillary endothelium the glomerular filtration barrier (GFB). Extracellular matrix (ECM) acts as a scaffold support and provides both mechanical and biophysical signals in order to control podocytes molecular behavior, essential for normal kidney filtration. Many materials have been used as ECM like Polyethylene Glycol (PEG) and Gelatin. The modulus of elasticity E or stiffness is an essential characteristic of the ECM that controls the cell function. Among these materials, hydrolyzed polyacrylamide (PAAm) hydrogel is a non-toxic cross-linked polymer, which is characterized by its high water content, non-biodegradability and biocompatibility. The hydrogel properties provide a resemblance to in vivo setting for tissues opening great opportunities for biomedical applications. Therefore, hydrolyzed PAAm hydrogel is investigated for its potential use as a new construct to engineer a functional in vitro glomerular-like filtration barrier and to regulate podocyte cell functions by controlling the physical properties (stiffness, swelling and porosity) of PAAm membrane acting as an ECM.

In the present work, several PAAm hydrogels layers were prepared by changing the crosslinker concentration. The macromolecular microstructure and stiffness are evaluated by Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) techniques respectively. The physicochemical properties of PAAm hydrogels were tailored over a wide range of crosslinker amount (0.5 to 30□l). We showed that by controlling the crosslinker concentration, the swelling degree, the mechanical properties and the polymeric network porosity can also be controlled. Swelling test indicated that an increase in crosslinker concentration contributed to a significant decrease in the swelling ratio, and this variation is due to network rigidity that diminishes the network chain movement. In addition, PAAm Hydrogel with the highest amount of crosslinker (30□l) is a very connected network with pore size of 29 □m and represents a high rigidity with a young modulus of 46 KPa. We are currently in the process of optimizing podocytes culture on PAAm membranes with the aim of understanding the molecular mechanisms by which podocytes respond and react to the mechanical properties of the substrate