CHARACTERIZATION OF THREE-DIMENSIONAL SCAFFOLDS OBTAINED BY DECELLULARIZATION OF KIDNEY AND LIVER

Héctor Martínez-Hernández¹, María-Luisa Del-Prado-Audelo¹, Karla-Karina Gómez-Lizárraga¹, Nayeli Rodríguez-Fuentes¹, David Giraldo-Gómez¹, María-Cristina Piña-Barba¹.

¹Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México, Ciudad Universitaria, Circuito Exterior s/n, Coyoacán, C.P. 04510, México D.F.

The general objective of this research is the characterization of 3D scaffolds obtained by decellularization of porcine kidneys and livers. The process is performed on a device named Bio-MEC, this guarantees obtaining the supporting structure called extracellular matrix (ECM), without damaging or changing its composition; the main composition is collagen, elastin and other signaling proteins, preserving the essential architecture of each organ [1,2]. The aim of this work is to obtain 3D scaffolds from organs, in order to recellularize and implant as first step in animals and after in humans. Three-dimensional scaffolds were evaluated by histological techniques in two-dimensional sections of tissue. Samples were fixed in 7.5 % formaldehyde neutral buffer solution, embedded in paraffin, cut into 5-mm slices and stained with Masson’s Trichrome. The scaffold architecture was analyzed by scanning electron microscopy (SEM). Presence of collagen in the obtained scaffold was confirmed with infrared (IR) spectroscopy. Sections of decellularized organs were frozen for 24 h at -20 °C and freeze-dried for 24 h. Differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA) were performed with a heating rate of 5 °C/min.

With Masson’s Trichrome staining was observed an efficient decellularization of kidney and liver by the absence of the cell nucleus and cytoplasm and the presence of the extracellular matrix. By SEM images was confirmed that the structure of each organ was maintained after decellularization process. The infrared pattern shows the presence of collagen in the following bands: amide I at 3290 cm⁻¹, amide II at 3075 cm⁻¹, amide I at 1533 cm⁻¹, amide II at 1552 cm⁻¹ and amide III at 1402 cm⁻¹. The DSC graphic shows that the scaffold presents the following processes as function of temperature: gelatin transition (20-70 °C), denaturalization (96-137 °C), degradation (190-220 °C) and combustion (T > 245 °C). Finally, the TGA profile shows that the scaffold presents different weight decreases as function of temperature increase: loss of physisorbed water between 30-96 °C (10 wt. %), denaturalization from 96 to 137 °C (1 wt. %) and combustion processes at higher temperatures than 137 °C (68 wt. %). The IR spectrum shows the presence of collagen and DSC shows that the collagen has a gel transition at the end of the decellularization process, due to the presence of a shoulder in the profile between 50-70 °C and with a maximum located at 63 °C.

Using the Bio-MEC device it can be obtained 3D scaffolds that maintain the desirable characteristics of extracellular matrix for organ regeneration: the internal architecture and structural proteins intrinsic to each organ. Also, it shows that the decellularization is useful to obtain three-dimensional scaffolds appropriated for use in organ regeneration.

**Keywords:** Decellularization, 3D scaffolds, Characterization

**References:**

Presenting author’s email:  heftor_mh@live.com