# Study on the physical properties of intima-media of decellularized porcine aorta

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Decellularized blood vessels have recently been attracting increasing attention as alternative materials for artificial blood vessels because of their excellent biocompatibility and three-dimensional structure. Decellularized aorta and small-diameter blood vessels were studied in vivo and shown good performance with regard to thrombogenicity, long-term stability, and endothelial cell coverage. Understanding the fundamental properties of decellularized tissues that are relevant to their clinical application is therefore very important. Mechanical properties and mass transfer are 2 of the most important physical properties for an artificial blood vessel. The permeability has effects on the endothelial cell coverage on the lumen-facing side, with higher porosity increasing the number of endothelial cells infiltrating from the tissue to the luminal surface. The objective of the research is to investigate the physical properties of intima-media of decellularized porcine aorta.

**Methods:** The intima-media was cut form porcine aorta with the thickness of about 0.5 mm. Intima-media was decellularized by SDS method and HHP method and characterized by HE stained and SEM. Mechanical strength testing of the untreated aorta and decellularized aorta were performed in circumferential direction and longitudinal direction. Two-chamber diffusion system was used to measure the permeability, and we also investigated the effect of temperature on the measured permeability.

**Results:** The histological analysis shows that there were no cells in both of the samples decellularized by HHP method and SDS method (Fig. 1 A, B and C). There were many voids in the SDS treated samples and some extracellular components (Fig. 1 C and F) were removed. On the other hand, the HHP treated sample showed a similar histological structure to the non-treated sample (Fig. 1 B and E).

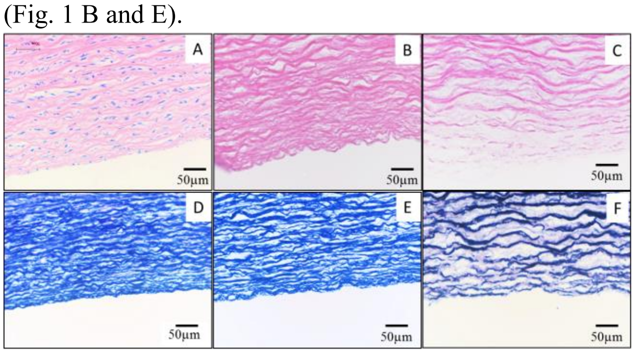


Fig.1 Histological characterization. A and D: Untreated; B and E: HHP treated; C, F: SDS treated. A, B and C: H&E staining; D, E and F: EVG staining. Scar bars in this picture are 50μm.

From the stress-strain curves, we can see that the HHP treated sample has no obvious changes and the SDS treated sample became soft (Fig.2) which is accordance with the histological characterization (Fig.1). Fig. 3 shows that mass transfer coefficient of BSA. The mass transfer coefficient increased with the temperature and shows significant difference between the samples treated by different methods. The mass transfer coefficients of SDS treated samples were the largest. SDS method removed some extracellular components in the tissue; the changes in the structure increased the protein permeability. Mass transfer coefficients showed a good agreement with the characterization results. Compared with the SDS treated

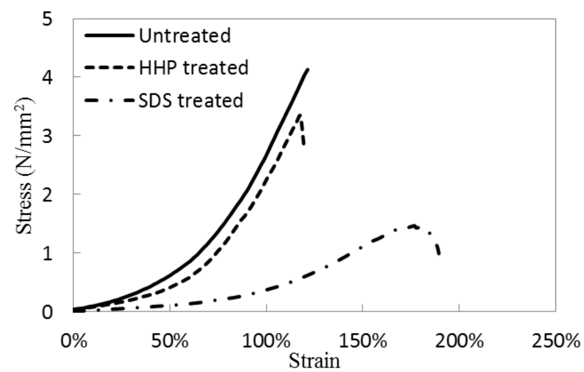


Fig.2 Strain-stress curves in circumferential direction

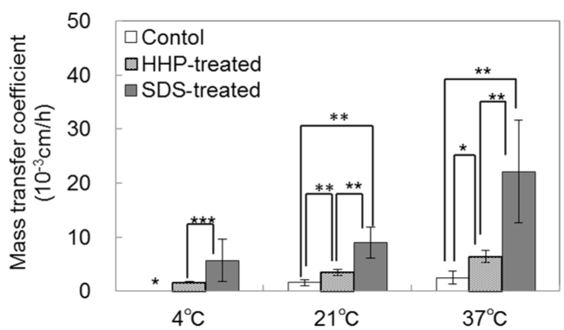


Fig. 3 Mass transfer coefficient of BSA. *: $P<0.02$; **: $0.02<P<0.05$; ***: $0.05<p<0.1$.

sample, the structure of HHP treated sample is similar to that of untreated sample and the physical properties are also similar to the untreated sample. It is clear that the physical properties can be controlled by changing decellularization method.

**Conclusions:** In the future, the combination of various decellularization methods could provide the designable physical properties.

**References:**

1) S. Funamoto, et al. Biomaterials (2010)
2) SA Korossis, et al. J Heart Valve Dis.(2005)