

## Porous PVA-Chitosan Based Hydrogel as an Extracellular Matrix Scaffold for Cartilage Regeneration

AA. Abbas<sup>1</sup>, SY Lee<sup>1</sup>, L. Selvaratnam<sup>2</sup>, N. Yusof<sup>3</sup>, T. Kamarul<sup>1</sup>

<sup>1</sup> *Department of Orthopaedic Surgery, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia,* <sup>2</sup> *School of Medicine and Health Sciences, Monash University Malaysia, Petaling Jaya, Malaysia,* <sup>3</sup> *Malaysian Nuclear Agency, Ministry of Science, Technology & Innovation, Bangi, Malaysia*

**INTRODUCTION:** Cartilage engineering benefits from the fabrication of random fibrous constructs, mimicking the structures found in the extracellular matrix of natural tissue, to support the attachment and proliferation of cells and ultimately convert the implanted cell-scaffold into native cartilage during cartilage repair.

### METHODS: Preparation of hydrogels

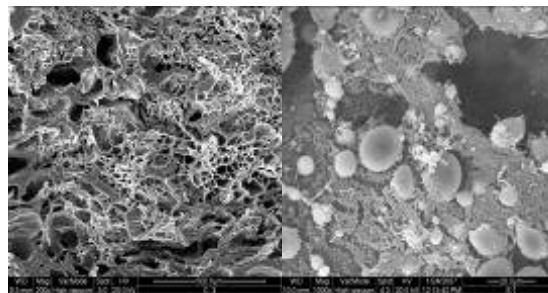
PVA-117 ( $M_w = 74,000\text{g/mol}$ ) was obtained from Kuraray Co. Ltd, Japan. Derivative chitosan (NOCC) was obtained from the Standards and Industrial Research Institute (SIRIM), Malaysia. The porous hydrogels were prepared from blends of PVA and NOCC in ratios (w/v) of 20-g PVA to 5% NOCC solution. The control PVA hydrogel was prepared in ratio of 20-g PVA to 100-ml of water. The polymer solutions were then cast into cylindrical molds and physically crosslinked by irradiation. The hydrogels were frozen prior to lyophilisation. Subsequently, the hydrogels were cut into discs approximately 2-mm in height, with a diameter of 5-mm.

Chondrocytes derived from New Zealand White rabbits were seeded at a density of  $5 \times 10^6$  cells on each pre-wetted scaffold and constructs cultured for 35 days prior to SEM.

The structure of the hydrogels was examined using scanning electron microscopy (SEM), followed by pore size measurement and swelling test. Data was compared and statistical significance was measured using parametric analyses ( $p \leq 0.05$ ) and ANOVA.

**RESULTS:** SEM analysis revealed that PVA-chitosan based hydrogel contained an interconnecting porous structure ranging between 1-200 $\mu\text{m}$  in size unlike the PVA hydrogel which showed a non-porous structure with smooth and homogenous morphology. Penetration of chondrocytes and abundant extracellular matrix were observed in PVA-chitosan hydrogel constructs. Chondrocytes adhered to the scaffold covering large areas of

the scaffold's surface, forming colonies while retaining their round morphology.



*Fig. 1: The porous structure of PVA-chitosan hydrogel and cultured chondrocytes grow abundantly on the scaffold.*

**DISCUSSION & CONCLUSIONS:** A novel porous PVA-chitosan based hydrogel has been developed which has the desired structure and pore size and enhances chondrogenesis of implanted cells. PVA-chitosan based hydrogel scaffold shows great potential as a cell carrier for cartilage tissue engineering. Swelling test will be relevant for biomechanical testing of the novel scaffold in future.

**REFERENCES:** <sup>1</sup> Griffon DJ, Reza-Sedighi M, Schaeffer DV, et al (2006) Chitosan scaffold: interconnective pore size and cartilage engineering *Acta Biomaterialia* **2**:313-320. <sup>2</sup>Hutmacher DW (2000) Scaffold in tissue engineering bone and cartilage *Bomaterial* **21**:2529-2543.

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