Hydrogel porosity arise from perfect and imperfect 3D molecular networks

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Extracellular matrix (ECM)-mimetic hydrogels have been widely used to understand many biological activities *in vitro*. Characterisation of the properties of hydrogel is vital to evaluate the success of the material design and to gain insights on how the changes in ECM properties influence biological activities. Porosity is an important ECM property to characterise. The pore space within the ECM mimic facilitates the transport of fluids that deliver oxygen and nutrients to the cells. Migrating cells also use these pores to navigate toward their destinations. [1] However, porosities of ECM mimics are not as well characterised as other ECM properties such as stiffness and biocompatibility. This could be due to the difficulty in measuring the pore dimensions of the hydrogel. [2] Here, we aim to measure the porosity of PEG hydrogel using equilibrium swelling, particle tracking, and cryo-SEM. Consolidating the measurements obtained from these methods, we learned that the measured pore sizes for PEG hydrogel can range from nanometres to micrometres, indicating that pores arise from successful formation of 3D molecular network (nanometre scale) and from imperfect networks (micrometre scale). These methods were also applied to widely used natural hydrogels such as collagen, alginate, and GelMA to compare their porosities with the synthetic PEG hydrogel.

References:

[1] van Helvert, S.; et al. *Nat. Cell Biol.* **2018**, *20*, 8-20.
[2] Jayawardena, I.; et al. *Mater. Adv.* **2023**, *4*, 669-682.