APPLICATION OF P4VP POLYMER BRUSHES WITH EMBEDDED Cu NANOPARTICLES AS ANTIBACTERIAL CSE PLATFORMS

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AIM

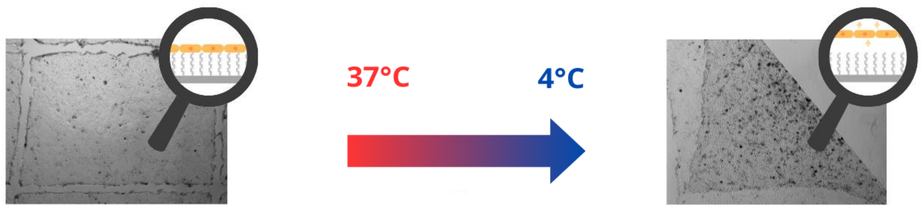

Fig. 1 Aim of the study: to produce CSE platforms for RPE cells.

Retinal diseases are the leading cause of blindness in Europe and are mainly caused by diabetic and age-related dysfunctions. One of the most promising approaches to restore retinal function and prevent vision loss is transplantation of tissue-engineered retinal pigment epithelium (RPE) cell sheets. Such cell sheets can be prepared using cell sheet engineering (CSE) technology. In this technique, cell detatchment from the substrate can be triggered by various stimuli such as temperature, instead of using proteolytic enzymes which disrupt cell monolayer.

In CSE cell sheets are prepared with the help of materials with high biocompatibility and controllable properties. We explored the potential of using poly (4-vinylpyridine) (P4VP) polymer brush coatings covered with Cu nanoparticles (P4VP&Cu) as platforms for cell sheet engineering, using differentiated RPE cell line, ARPE-19. Produced smart coatings, have unique properties: thermo-responsiveness, high biocompatibility and also antibiocidal activity thanks to Cu nanoparticles. With those characteristics, produced substrates match the requirements for extensive biomedical applications.

SUBSTRATE CHARACTERISATION

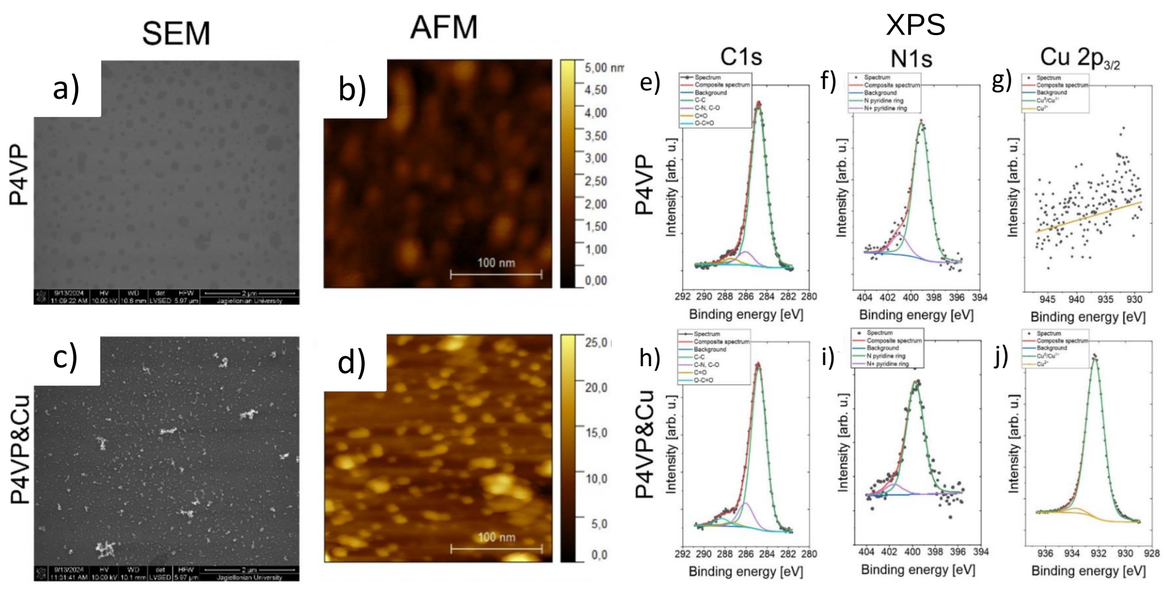

Fig. 2 Scanning electron microscopy (SEM) (a,c), atomic force microscopy (AFM) (b, d) visualization and X-ray photoelectron spectroscopy (XPS) spectra (e-j) of the coatings.

THERMORESPONSIVENESS

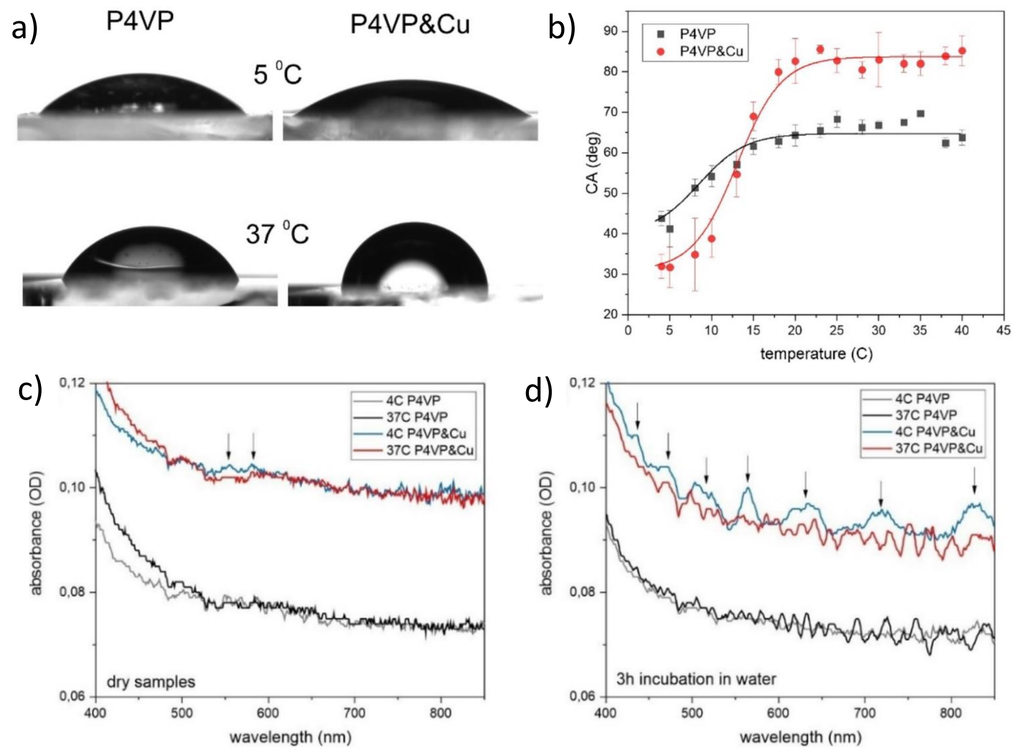

Fig. 3 Teperature impact on contact angles (a, b) and absorbance spectra (c, d) of the coatings.

PROTEIN ADSORPTION

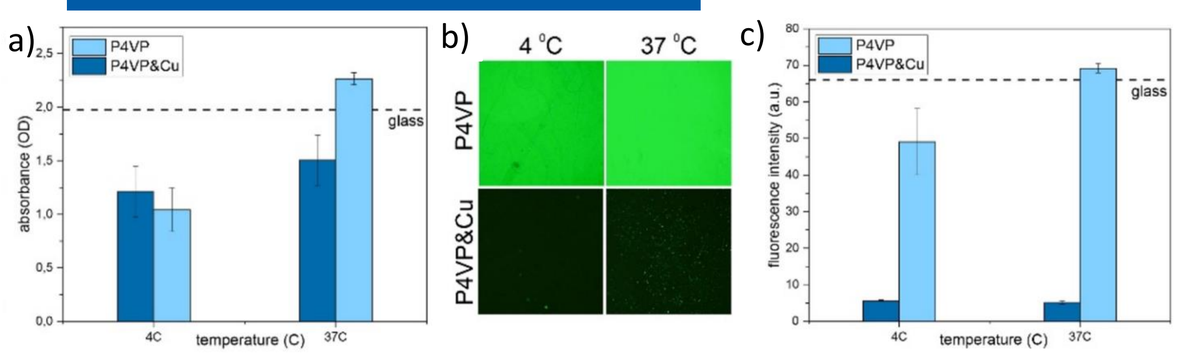

Fig. 4 Temperature dependent protein adsorption recorded with colorimetric assay (a) and fluorescence microscopy (b, c).

CELL SHEET PRODUCTION

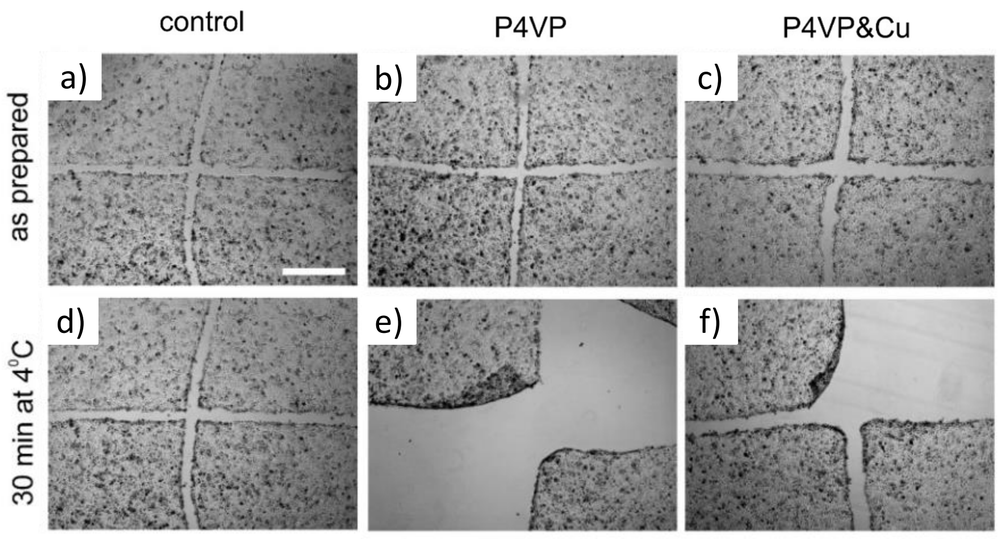

Fig. 5 Temperature dependent detachment of differentiated ARPE-19 cell monolayers from the coatings. Scale bar: 500 µm.

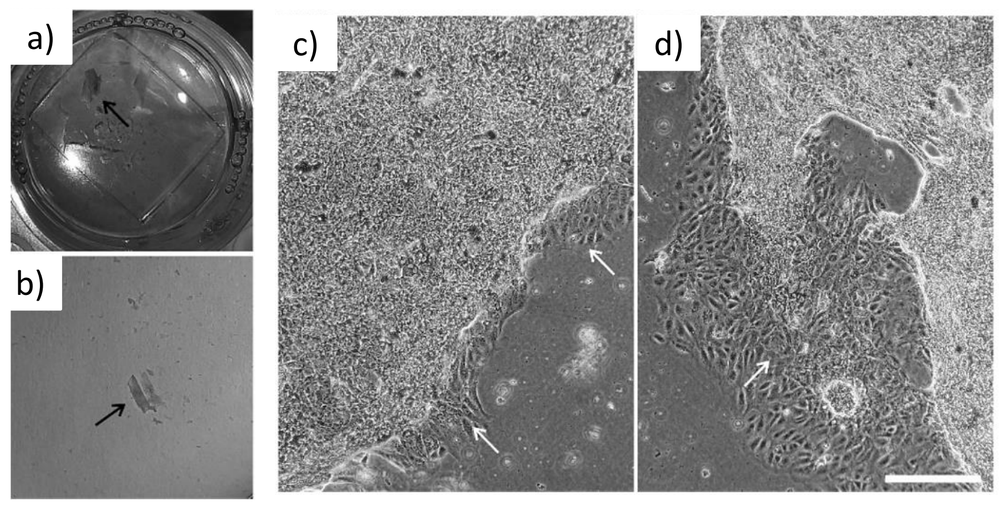

Fig. 6 Detached sheet of differentiated ARPE-19 cells (a) was transferred to a Petri dish (b) and cultured for 3 days (c-d). Scale: 200 µm (c, d).

ANTIBACTERIAL PROPERTIES

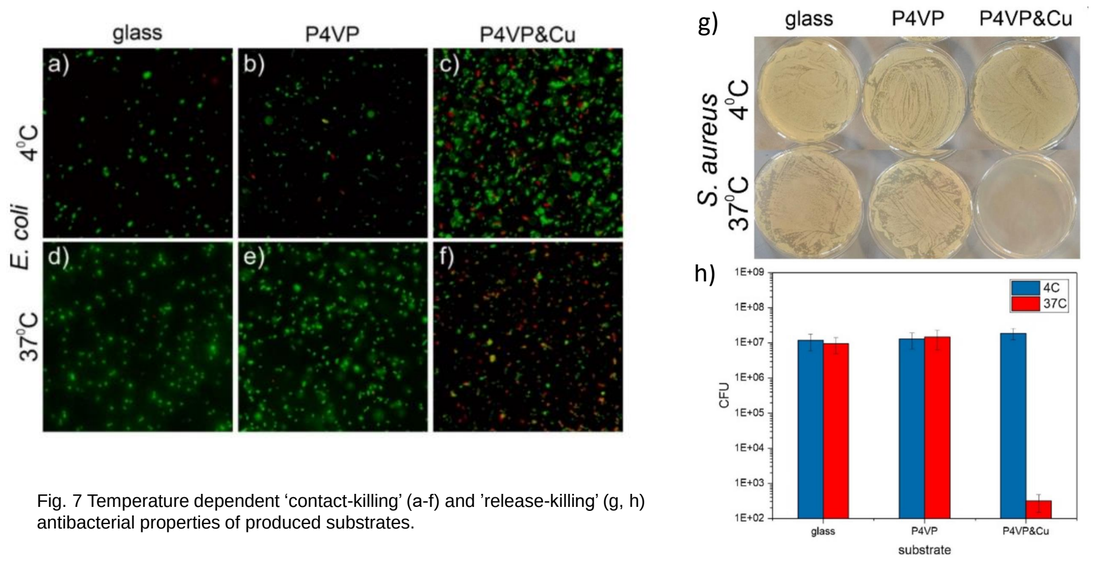

Fig. 7 Temperature dependent 'contact-killing' (a-f) and 'release-killing' (g, h) antibacterial properties of produced substrates.

CELL VIABILITY

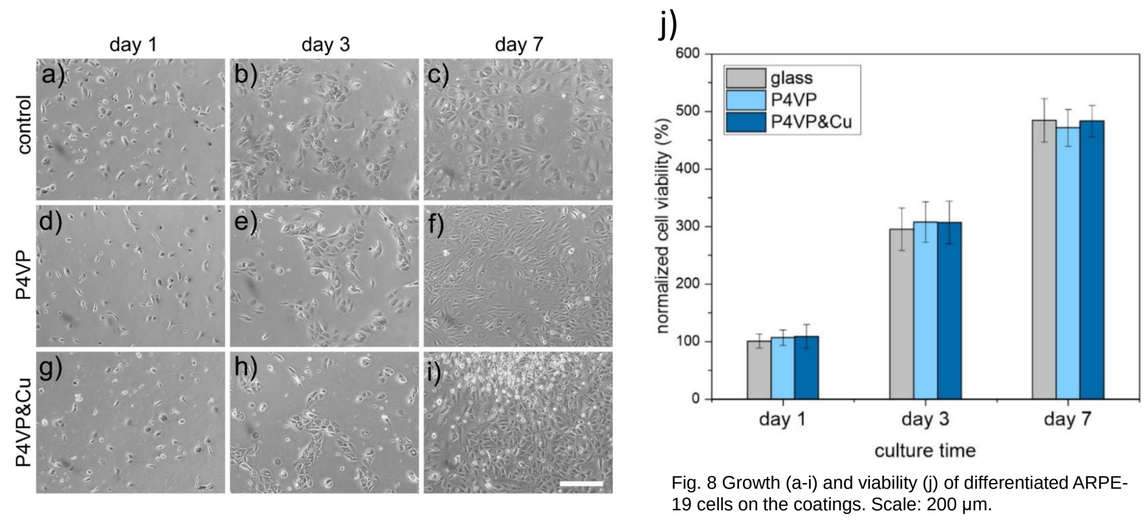

Fig. 8 Growth (a-i) and viability (j) of differentiated ARPE-19 cells on the coatings. Scale: 200 µm.

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