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DESIGN OF MODULAR PLATFORMS CARRYING *PSEUDOMONAS AERUGINOSA* OUTER MEMBRANE VESICLES AND CUO NANOPARTICLES FOR TOPICAL ANTITUMOR THERAPY

Background. Topical application of therapeutic nanostructures requires a biocompatible carrier that prevents degradation and ensures sustained localised release. Bacterial cellulose (BC) serves as an ideal matrix due to its exceptional purity, mechanical strength, and a three-dimensional network of nanopores and channels available for loading of therapeutic cargoes. **Aim.** To functionalize BC by developing modular materials for topical treatment of malignant skin tumours and to promote tissue regeneration. To achieve this, the BC matrix was loaded with distinct therapeutic cargoes: outer membrane vesicles (OMVs) of *Pseudomonas aeruginosa* (Pae) ATCC 10145; synthesised CuO nanoparticles (NPs); and a combined OMV-NP complex. **Methods and Results.** Pae OMVs were isolated via ultracentrifugation, and transmission electron microscopy confirmed the predominant vesicle size. In the THP-1 monocytic leukaemia cell line, qRT-PCR analysis revealed that OMVs transcriptionally activated three regulated cell death pathways: apoptosis, pyroptosis, and necroptosis. This induced a pro-inflammatory microenvironment in tumour cells, indicating the potential of OMVs to stimulate an antitumor immune response and reprogram the tumour microenvironment. Concurrently, CuO NPs demonstrated therapeutic properties, including cytotoxicity against the THP-1 cell line, biofilm suppression in pathogenic bacteria to accelerate wound healing. Both OMVs and NPs were successfully immobilised in the BC matrix via passive diffusion, which was confirmed using confocal laser scanning microscopy (for OMVs) and high-angle annular dark-field scanning transmission electron microscopy combined with electron energy loss spectroscopy (for elemental mapping of CuO). Future research will prioritise investigating the nano- and picometer-scale interactions between these therapeutic agents within the complex module and their effects on skin healing. **Conclusions.** Immunogenic OMVs and CuO NPs were successfully immobilised within the BC matrix, minimising systemic toxicity and enabling targeted in situ treatment.

Keywords: bacterial cellulose; vesicles; CuO nanoparticles.

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