Development of Antimicrobial and Conductive Crosslink Film Scaffolds Effective in Nerve Damage Healing

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Given that one in every 100 people worldwide suffers from peripheral nerve injuries due to accidents, surgical complications, and various diseases, and because current treatment methods are inadequate, developing innovative biomaterials in this field is vital. Cross-linked film scaffolds are a good idea for nerve damage treatment because they create an EMC-like environment with adjustable properties such as flexibility, biocompatibility, antimicrobial activity, and conductivity. The film scaffolds were synthesized primarily using NaAlg and GelMA. Subsequently, to impart conductivity and biocompatibility to these cross-linked film scaffolds, melanin was isolated from dragon fruit for the first time in the literature and its characterization was performed. Similarly, silver nanoparticles were synthesized from the waste peel of the same dragon fruit using the green synthesis method, also for the first time in the literature. All cross-linked film scaffolds were successfully cross-linked. Morphological analyses, conductivity tests, antioxidant activity tests, antimicrobial activity tests, protein adsorption tests of the film scaffolds, and in vitro analyses were successfully performed on all cross-linked film scaffolds. The superior properties of the cross-linked film scaffolds obtained as a result of these tests were once again confirmed. Our results show that our cross-linked film scaffolds, consisting of NaAlg, melanin, Ag NP, and GelMA, are the first to combine the properties required in a hydrogel for use in nerve tissue regeneration, such as conductivity, antimicrobial activity, antioxidant activity, flexibility and strength, and biocompatibility, in a single cross-linked film scaffold. Therefore, it is unique and promising.

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