ABSTRACT

Hydrogels are three-dimensional, cross-linked polymer chain networks. Currently, hydrogels are being intensively developed, one of which is for wound healing. Wound healing is a complex, dynamic, and interactive process. There is still a need for efficacious, effective, and safe wound healing with active ingredients such as nanomaterials and plant extracts. These active ingredients have antibacterial, anti-inflammatory activities, and can increase the proliferation of normal fibroblast cells. In this study, graphene oxide (GO), titanium dioxide (TiO_2) doped with sulphur (S), and binahong leaf extract (ACS) were used as wound-healing active ingredients to be formulated into carrageenan and polyvinyl alcohol (PVA)-based hydrogels. The research stages carried out were GO synthesis, TiO_2-S synthesis, and extraction of binahong leaves with several solvents using the ultrasonication maceration method. FTIR, XRD, SEM-EDX, and UV-DRS analyses were used to study the characteristics of TiO_2-S synthesis results. GO was successfully synthesised using the Hummer method as shown by FTIR and XRD analyses. Binahong leaf extract was analysed using LC-HRMS to determine the compounds contained therein. The in vitro analysis carried out included proliferation and migration tests of NIH-3T3 fibroblast cells, as well as antibacterial activity tests against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. In-vitro analysis of NIH-3T3 fibroblast cell proliferation activity and NIH-3T3 fibroblast cell migration test showed that nanoparticles and binahong extract with 70% ethanol solvent used had cell proliferation activity. In binahong extract did not show antibacterial activity, but TiO_2-S nanoparticles and GO formulated into hydrogels showed better antibacterial activity under visible light conditions than dark conditions. TiO_2-S, GO, and 70% ethanol extract of binahong leaves have potential as active ingredients in wound healing hydrogels. FTIR, SEM-EDX Mapping cross-section, and TGA analyses were performed to study the morphology, heat resistance, and functional groups present in the hydrogels. The prepared hydrogel has good tensile strength, a suitable swelling degree, and can produce a good moist environment for effective wound exudate management as it has an ideal vapour transfer rate.

Keyword: hydrogel, carrageenan, graphene oxide, TiO_2-S, binahong extract, wound healing, proliferation, fibroblast cells, antibacteria