Developing Cellulose Nanocomposite Hydrogel as a Value-Added Product From Biomass Waste for Wound Dressing

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The general increase in demand for biofuels and the use of bio-based materials increases the pressure on agriculture to produce biomass. As a result, huge amount of biomass waste is generated which is underutilized and limited to few selected applications like burning or healing purposes. To successfully improve and monetize the current situation, an alternate solution to this is to extract the cellulose, produce cellulose nanofibers and turn into a valuable product. However, their use in wound healing is limited. Therefore, this study aims to utilize cellulose nanofiber hydrogels to develop wound dressing using metallic nanoparticles such as silver (Ag) and copper (Cu). Cellulose microfibers were extracted from energy cane bagasse using nitric acid digestion. The nanocomposites were prepared by hydrothermal process. Super absorbent hydrogels were prepared from cellulose microfibers and chitosan. Antimicrobial wound dressings were prepared by combining AgNPs and CuNPs with super absorbent hydrogel. Antimicrobial hydrogels were characterized by using high resolution digital microscope and antimicrobial activity on E. coli (ATCC 25922) was evaluated by the visible cell colony count method. Hydrogels containing AgNPs showed significant E. coli reduction (7.85 log10 CFU/mL) than CuNPs (6.41 log10 CFU/mL). Zone of inhibition of wound dressings showed that AgNPs (dry and wet) were strongly effective (19.4 and 7.8 mm) compared to CuNPs and commercial, respectively. The results of this study show that AgNPs (dry and wet) are potential source for wound dressing with enhanced and effective antimicrobial activity.

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