Effect of Tyrosol Functionalized Gold Nanocomposite on Biofilm Milieu and Wound Healing

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Abstract

Candidiasis, a fungal infection caused by opportunistic pathogen Candida which range from superficial to deep invasive manifestations, and is of significant concern in immunocompromised individuals [1]. Moreover, the fungal infections provide conditioned space to bacterial pathogens for colonization and results in mixed/ polymicrobial surface adhered community called polymicrobial biofilm. These communities are particularly responsible for emergence of multidrug-resistant strains. Thus, posed formidable challenges for clinicians in effectively managing these infections using conventional antimicrobial therapies. Hence, we synthesized chitosan mediated gold nanocomposite of tyrosol, for their efficacy against *Candida albicans, Staphylococcus aureus, Pseudomonas aeruginosa* and their mixed communities. Compared to tyrosol alone, Chi-TY-AuNP's nanocomposite demonstrated excellent inhibition potential on both planktonic and sessile growth of *C. albicans, S. aureus, P. aeruginosa, C. albicans + S. aureus, and C. albicans + P. aeruginosa* at lower concentrations. At the highest concentration tested (20 µg/mL), the drug conjugated nanoparticle has eradicated nearly 70% of the mature/ old polymicrobial biofilm structure while completely inhibited the construction of community. To ensure the suitability of the Chi-TY-AuNP's in treatment of non-healing wounds in diabetic patients, the cytocompatibility and wound healing was also undertaken [2].

Chi-TY-AuNP's treatment revealed good cytocompatibility and decreased ROS levels in NIH-3T3 cell lines. Developed 1% and 2% (w/w) Chi-TY-AuNP's-Carbopol®934 formulations exhibited excellent rheological properties suitable for topical applications, supported by the nontoxic nature of developed gels in the dermal toxicity study in experimental rats. Findings of *in-vivo* wound healing study conclusively demonstrated the re-epithelialization of the wounded tissues with no residual scar. Increased collagen and fibroblast depositions, normal cellular integrity and neoangiogenesis were evident by the H&E and Masson's trichrome stained histopathological micrographs of the treated animal's skin tissues. The wound-healing effect mediated by Chi-TY-AuNP's-Carbopol®934 can be attributed to the additive antimicrobial and anti-inflammatory effects of tyrosol and chitosan in lipid peroxidation and oxidative damage minimizing activity [2]. Also, tyrosol being a polyphenolic compound, may act as a regulator at multiple phases of the wound healing process via preventing inflammation and secondary infection and augmenting collagen synthesis [3]. Collectively, *in-vivo* wound healing study demonstrated the reepithelialization of the wounded tissues and increased proliferation of fibroblast cells, collagen fibers and neoangiogenesis [2,4].

References

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Figures

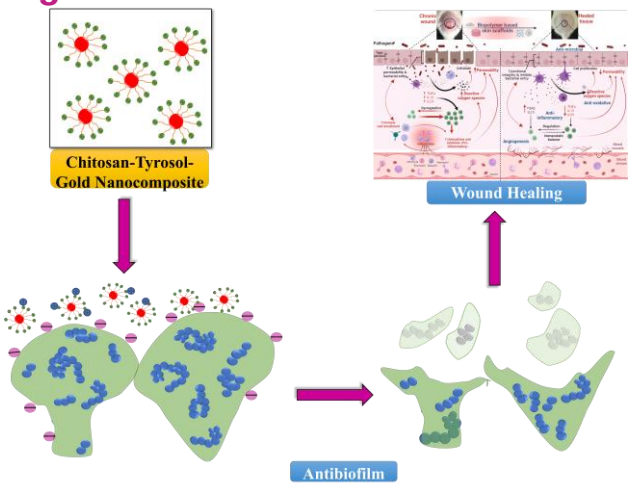

Figure 1. Chi-TY-AuNP's mediated Antibiofilm and Wound Healing activity.